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Inhalation toxicity of non-nicotine e-cigarette constituents: risk assessments, scoping review and evidence map

February 2022

NHMRC

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Executive summary

Background and objectives

Electronic cigarettes (also known as e-cigarettes, e-cigs, electronic nicotine delivery systems, electronic non-nicotine delivery systems, alternative nicotine delivery systems, personal vaporisers, e-hookahs, vape pens or vapes) are electronic devices that heat a liquid (or e-liquid) to produce an aerosol to inhale (known as vaping) [1]. The evidence on e-cigarettes is constantly evolving. E-cigarettes are relatively new products and most of the direct evidence on e-cigarettes is limited to short-term studies. Indirect evidence, such as studies that examine the long-term health effects of substances used in e-liquids, such as formaldehyde, can be useful to obtain a complete picture of the safety and potential long-term impacts of e-cigarette use.

The e-liquids are commonly made by combining flavouring chemical mixtures in a solvent mixture [2]. E-cigarette e-liquids can contain nicotine, but have been reported to also contain flavourings and harmful substances such as heavy metals, volatile organic compounds and cancer-causing chemicals [3] [4]. Recent reports have found over 200 unique ingredients (constituents) used in e-liquids [5] [6] [3]. These reports [5] [3] have also found that the known chemicals currently used in e-cigarettes are also used for other purposes, such as food processing, medicines and in the manufacture of other consumer goods. These chemicals have most likely undergone toxicological risk assessments. However, these risk assessments may not be comprehensive and risks to health via inhalation is not commonly addressed in food or medicine assessments [7] [8].

Given the established evidence on the safety and health impacts of nicotine and the wide range of non-nicotine substances in e-liquids and potentially inhaled via e-cigarettes, this report will consist of two components:

1. **A summary of the toxicological risk assessments of each chemical currently known to be used in e-cigarettes.**

Objectives: (i) to examine the toxicological risk assessments and identify the health risks of chemicals known to be currently used in e-cigarettes and (ii) to identify if any of the known chemicals are permitted to be used (in Australia) for consumption via food and/or medicine and whether they have been assessed for inhalation toxicity.

2. **A scoping review to ascertain the extent, range, and nature of the evidence available on toxicology associated with the inhalation of e-liquids.**

Objective: to examine the extent (that is, size), range (variety) and characteristics of the evidence published since 2019 on the inhalation toxicity of e-liquids used in electronic nicotine delivery systems and electronic non-nicotine delivery systems and highlight key research gaps.

Methods

Toxicology assessments

The 2019 Australian Industrial Chemical Introduction Scheme (AICIS) report on non-nicotine liquids for e-cigarette devices [5] was used to identify chemicals that are currently known to be used in e-cigarettes. Chemical names and associated Chemical Abstract Service (CAS) numbers were run through the Evaluation Prioritisation Tool (EPT) developed by AICIS, which captures assessment data nationally and internationally. Data on health risks was extracted from the EPT and pulled into Microsoft Excel. Additional analysis, such as Quantitative Structure Activity Relationship (QSAR), was not within the scope of this report.

To determine if the identified chemicals are permitted for use in food and medicines in Australia, the chemical names were cross-checked by one author with entries in Food Standards Australia New Zealand's (FSANZ) *Schedule 15 - Substances that may be used as food additive* of the Australia New Zealand Foods Standards Code [9] and Therapeutic Goods Administration's (TGA) *Australian Register of Therapeutic Goods and Permissible Ingredients* [10].

Toxicology assessment data and permitted uses were analysed using descriptive statistics.

Scoping review

The scoping review was conducted according to the Joanna Briggs Institute guidelines [11] and reported in accordance with the PRISMA extension for Scoping Reviews [12]. The scoping review protocol was published on FigShare [https://figshare.com/articles/journal_contribution/NHMRC_E-cigarette_toxicology_scoping_review_protocol_pdf/18131045].

Studies were included if they were peer reviewed and published from 2019 onwards. Cochrane Central, MEDLINE (via Ovid), Embase (via Ovid), PsycInfo and CINAHL were searched on 20th July 2021. No further supplementary searches (such as searching reference lists) were conducted. Scientific literature was managed using EndNote (X9.2; United States of America) referencing software. The following data was extracted from the screened, scientific literature in to Microsoft Excel: study reference (title, authors, journal, year); study type based on labels used in the primary studies (e.g. experimental, cohort); exposure (e.g. e-liquids, individual chemicals); comparator (e.g. exposure vs. no exposure); outcome of interest (e.g. respiratory sensitisation, acute toxicity via inhalation); modifying factors (where data was available; e.g. type of device, frequency and duration of use).

A risk of bias assessment was not conducted. Data was analysed using descriptive statistics. A characteristics of studies table was developed as well as an evidence map examining the number of studies by exposure and outcome type.

Key findings

Toxicology assessments

According to toxicological assessment data, the majority of ingredients (chemicals) known to be used in e-cigarettes were associated with at least one or more health risk or suspected health risk (68.5%; n=253/369), including known or suspected acute toxicity (n=39), known or suspected carcinogen (n=82), known or suspected skin irritant (n=53), known or suspected skin sensitiser (n=114), and known to be harmful if swallowed (including fatal if swallowed; n=57).

Of the chemicals known to be used in e-cigarettes, we identified 1 chemical permitted to be used in food in Australia by FSANZ and 4 chemicals classed as permissible ingredients for use in medicine by TGA that are considered harmful to inhale.

Toxicological assessment data has an important role in identifying potential risks and identifying appropriate uses and handling for chemicals [13]. Whilst toxicological data was available for some of the chemicals, the comprehensiveness of this data, particularly for inhalation toxicity, is unclear as chemicals have not been assessed for this use (inhalation), but for other uses such as the manufacture of other consumer goods and ingestion as a component of food or medicine [14]. A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity (88.6%; n=327/369). It is important to note that the absence of data does not necessarily equal the absence of hazard.

Scoping review

After screening, 89 studies were included in the scoping review component of this report. Considerable variability in outcome of interest, study design and methodology was identified. The majority of included studies were experimental studies (65.2%; n=58/89 excluding randomised trials involving humans), however the type of experimental study (e.g. animal cell-based, biochemical) varied. Of the remaining study designs, just under a fifth were systematic reviews (19.1%; n=17/89). Cytotoxicity was the most common outcome of interest examined (n=24/89), followed by general toxicity (n=16/89), pulmonary toxicity (n=6/89) and cardiotoxicity (n=6/89).

A number of the included studies examined e-cigarettes or e-liquids as a whole rather than specific constituents (12 of 89 studies examined individual constituents). The evidence on the differential health impacts of a specific flavour, solvent or humectant could not be determined. The evidence on the differential health impacts of nicotine-containing or nicotine-free e-cigarettes or e-liquids could also not be determined. It was common for studies not to specify whether the exposure (e.g. e-cigarette, e-aerosol, e-liquid) was a commercial device or e-liquid, whether it was a specific flavour, or whether or not it contained nicotine. Long-term data on inhalation toxicity of e-cigarettes (both nicotine-containing and non-nicotine-containing) remains limited.

Time and resource constraints meant it was not feasible to conduct a systematic review of all identified e-liquid constituents.

Conclusions

In line with other published literature, this report found that where data was available, the majority of chemicals currently known to be used in e-cigarettes are associated with health risks, based on toxicological assessments. A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity and it cannot be concluded that absence of toxicological assessment data equates to absence of harm. Considerable variability in the outcomes of interest, exposure, study design and methodology was identified through the scoping review. Further research is required. Standardised methods for evaluating e-liquids are required, including specifications on device type, base liquid, concentration, coil/heating temperature and puff size. Such standardisation would lessen the many complexities of assessing toxicological health risks of inhaling non-nicotine e-cigarette constituents.

Background

Electronic cigarettes (also known as e-cigarettes, e-cigs, electronic nicotine delivery systems (ENDS), electronic non-nicotine delivery systems (ENNDS), alternative nicotine delivery systems, personal vaporisers, e-hookahs, vape pens or vapes) are electronic devices that heat a liquid (or e-liquid) to produce aerosols to inhale (known as vaping) [1]. There is continuing debate as to whether e-cigarettes have a role in smoking cessation and their potential to reduce or increase individual and population-level harm [1]. The 2019 National Drug Strategy Household Survey report showed that fewer Australians are smoking tobacco daily, while the use of e-cigarettes is increasing. In Australia between 2016 and 2019 the proportion of smokers aged 14 years and over who currently use e-cigarettes rose from 4.4% to 9.7% and lifetime use rose from 31% to 39% [15]. An increase was also seen in non-smokers; between 2016 and 2019 the proportion of non-smokers aged 14 years and over who currently use e-cigarettes rose from 0.6% to 1.4% and lifetime use rose from 4.9% to 6.9% [15]. More than half (54%) of people who tried e-cigarettes did so out of curiosity [15].

The liquids in e-cigarettes are commonly made by combining flavouring chemical mixtures in a solvent mixture [2]. These e-liquids can contain nicotine, even if labelled “nicotine free” [16] [17] [18] and have been reported to also contain flavourings and harmful substances such as heavy metals, volatile organic compounds and cancer-causing chemicals [3] [4]. Recent reports have found over 200 unique ingredients (constituents) used in e-liquids [5] [6] [3]. In a recent report [19], the World Health Organization (WHO) identified gaps in the research base regarding the toxicants of Heated Tobacco Products (HTP), including e-cigarettes, and the effects on humans. These gaps include the need for more rigorous assessments of HTP emissions, including how they are absorbed in cells, harmful exposures and impact on health outcomes [19]. In Australia, there is limited publicly available information on the composition of e-liquids. These ingredients however are of interest due to concerns around chemical exposure, with many of the constituents (chemicals) posing harm to human health in certain situations [5]. There is evidence of e-cigarette use causing short term adverse health effects, however the long-term effects on human health from using e-cigarettes are unknown [5]. In comparison to studies on nicotine containing e-cigarette liquids, there is limited data available on the health implications of inhaling nicotine-free liquids [5].

Reports [5] [3] have found that the known chemicals currently used in e-cigarettes are also used for other purposes, such as food processing, medicines and in the manufacture of other consumer goods. These chemicals have most likely undergone toxicological risk assessments. However, these risk assessments may not be comprehensive and risks to health via inhalation is not commonly addressed in food or medicine assessments [7] [8]. Numerous international agencies undertake toxicological risk assessments or chemical evaluations to identify potential health and environmental risks of a variety of chemicals. These assessments provide information and recommendations about how to manage the risks of these chemicals and substances.

The Australian Government continues to take a precautionary approach to e-cigarette regulation and policy, taking into consideration the context of existing approaches taken to reduce tobacco smoking and the risks e-cigarettes pose to population health, such as disrupting the decline of tobacco smoking in Australia [2]. Currently, non-nicotine containing e-cigarette liquids are legally sold in Australia and the ingredients are regulated as industrial chemicals for purposes other than use in e-cigarettes [5]. Human health and environmental risk assessments of these industrial chemicals are undertaken by the Australian Industrial Chemicals Introduction Scheme (AICIS), which publishes recommendations for safe use. Nicotine-containing e-liquids and certain nicotine-containing devices are not legally available to be imported, possessed or sold in Australia without a prescription from a medical practitioner and are regulated by the Therapeutic Goods Administration (TGA) under the Poisons Standard [5] [20]. Although it is illegal to sell e-liquids that contain nicotine outside of a pharmacy in Australia, incorrect and inaccurate labelling, such as undisclosed chemical ingredients, means consumers can unknowingly be inhaling nicotine [21].

Several reports and reviews have examined toxicity of e-cigarettes (e-liquids) [3] [22] [5]. These reports have been conducted recently, with the most recent literature search identifying scientific papers published up to April 2019 in the *Non-nicotine liquids for e-cigarette devices in Australia: chemistry and health concerns* report [5].

Objectives

Given the wide range of non-nicotine substances potentially inhaled and reported gaps in the research, this report will consist of two components:

1. A summary of the toxicological risk assessments of each chemical currently known to be used in e-cigarettes.
2. A scoping review to ascertain the extent, range, and nature of the evidence available on toxicology associated with the inhalation of e-liquids.

For the first component, the primary objective is to examine the toxicological risk assessments and identify the health risks of chemicals known to be currently used in e-cigarettes and secondly to identify if any of the known chemicals are permitted to be used (in Australia) for consumption via food and/or medicine and whether they have been assessed for inhalation toxicity. For the second component the objective of the scoping review is to examine the extent (that is, size), range (variety), and characteristics of the evidence published since 2019 on the inhalation toxicity of e-liquids used in electronic nicotine delivery systems and electronic non-nicotine delivery systems and highlight key research gaps.

Toxicology assessment

Background and objectives

Numerous international agencies undertake toxicological risk assessments or chemical evaluations to identify potential health and environmental risks of a variety of chemicals. Agenices include: the Australian Industrial Chemicals Information Scheme, the European Chemicals Agency, the National Institute of Technology and Evaluation (Japan) and the United States Environmental Protection Agency. These assessments provide information and recommendations about to how manage the risks of chemicals and may be used to inform policies and regulations around permitted use of these substances. Recent reports have found over 200 unique ingredients (constituents) used in e-liquids [5] [6] [3]. These reports indicate that a number of the known chemicals currently used in e-liquids are also used for other purposes, such as in food processing, medicines and in the manufacture of other consumer goods. These chemicals have most likely undergone toxicological risk assessments. However, these risk assessments may not be comprehensive and risks to health via inhalation is commonly not addressed in food or medicine assessments [7] [8].

The primary objective is to examine the toxicological risk assessments and identify the health risks of chemicals known to be currently used in e-cigarettes and secondly to identify if any of the known chemicals are permitted to be used (in Australia) for consumption via food and/or medicine and whether they have been assessed for inhalation toxicity.

Methods

The 2019 AICIS report on non-nicotine liquids for e-cigarette devices [5] was used to identify chemicals that are currently known to be used in e-cigarettes. Chemical names were extracted into Microsoft Excel (2016; United States of America). For each chemical, one author (BC) identified and extracted the Chemical Abstract Service (CAS) Registry Number using the AICIS Industrial Chemicals Inventory online database (https://www.industrialchemicals.gov.au/search-inventory).

Chemical names and associated CAS numbers were run through the Evaluation Prioritisation Tool (EPT) developed by AICIS. The EPT can scan and extract toxicology assessment data across the AICIS database (https://www.industrialchemicals.gov.au/chemical-information/search-assessments) and equivalent international regulatory agency databases (**Appendix A**). For the identified chemicals currently known to be in e-cigarettes, the EPT scanned chemical name and CAS number and collated the following information:

- permitted use(s) in Australia as an industrial chemical (including restrictions or bans)
- international permitted uses (including where a chemical may be banned or have restricted uses)
- alternate chemical name(s)
- chemical family, AICIS assessments (references to assessment)
- international assessments (references to assessment)
- existing classification in Australia (health risk(s), including suspected health risk(s))
- international classification (health risk(s), including suspected health risk(s))
- endocrine disruption concerns.

The EPT dataset did not distinguish where data on a chemical was not available because a toxicological assessment had not been completed or due to the chemical not being identified as a hazard/risk to health. Cross-referencing of EPT data with Globally Harmonized System of Classification and Labelling of Chemicals (GHS) classification data from the latest Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) reports indicate that that for most of the chemicals examined (n=349/369) there is no data available on repeat dose inhalation toxicity. As such, the authors have assumed that unavailable data from the EPT dataset is unlikely to represent that the chemicals identified are not a hazard or risk if inhaled. For reporting accuracy, a dash "-" was used to report where information was not available from the EPT dataset.

Where data was available, data on health risks were extracted from the EPT and imported into Microsoft Excel. Two authors (BC, MC) independently extracted a sample of the data (n=10 chemicals). The extracts were then reviewed and compared. There was 83% agreement between the authors; discrepancies were resolved through consensus. When extracting the health concerns, the information was only pulled from national and international assessments and classifications, and endocrine disruption concerns that had been finalised, those still in draft or under review were excluded. When the Australian Classification was missing, but the chemical referred to the *Non-nicotine liquids for e-cigarette devices in Australia: chemistry and health concerns* report [5], the report was searched for any relevant health information to include in the spreadsheet. All health concerns were captured, those that were 'suspected' or 'potential' health concerns were recorded. Additional analysis, such as Quantitative Structure Activity Relationship (QSAR), was not within the scope of this report.

To determine if the identified chemicals are permitted for use in food and medicines in Australia, the chemical names were cross-checked by one author (TC) with entries in Food Standards Australia New Zealand's (FSANZ) *Schedule 15 - Substances that may be used as food additive* of the Australia New Zealand Foods Standards Code [9] and TGA's *Australian Register of Therapeutic Goods and Permissible Ingredients* [10]. If an exact chemical name match could not be identified, alternate chemical names for the same chemical were cross-checked. Indirect matches (those with a similar chemical name but did not match word-for-word) were reviewed by a second author (LA). Discrepancies between the two authors were reviewed and a final decision made by a third author (MC). Permitted uses were recorded using Microsoft Excel.

Toxicology assessment data and permitted uses were analysed using descriptive statistics.

Results

There were 369 chemicals identified as currently being used in e-cigarettes or in e-liquids according to the National Industrial Chemical Notification and Assessment Scheme (NICNAS) 2019 report. The toxicology assessments were reviewed for each of the identified chemicals. A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity (88.6%; n=327/369). As seen in **Figure 1**, of the chemicals that had data available, 42 were assessed to be harmful to inhale and 8 assessed as being a respiratory sensitiser (n=1) or suspected respiratory sensitiser (n=7), in addition to being associated with other health risks or suspected health risks. Approximately one third of the chemicals (n=116) had no toxicological assessment data available on health risks or suspected health risks.

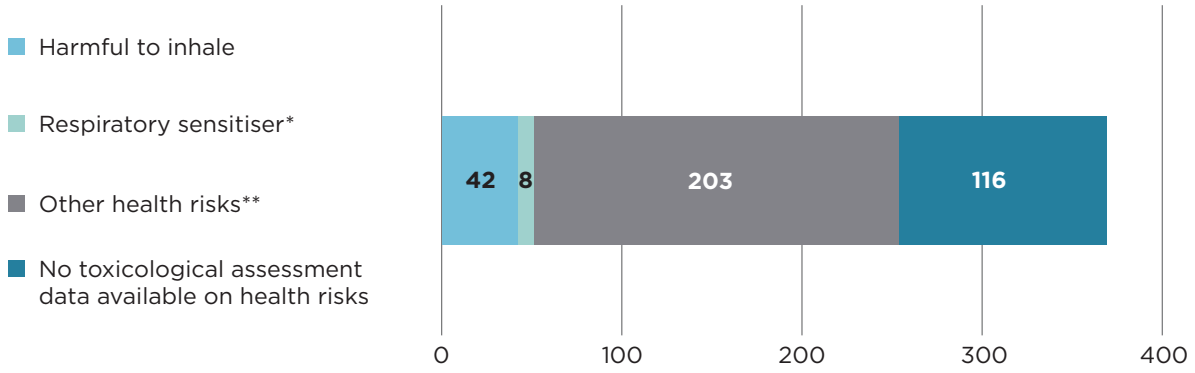

Figure 1: Summary of health risks of 369 chemicals based on data from toxicological assessments

*Includes suspected respiratory sensitisers. **Includes suspected health risks.

Based on the toxicological assessments, 68.5% (n=253/369) of chemicals examined were associated with at least one or more health risk or suspected health risk, including known or suspected acute toxicity (n=39), known or suspected carcinogen (n=82), known or suspected skin irritant (n=53), known or suspected skin sensitiser (n=114), and known to be harmful if swallowed (including fatal if swallowed; n=57). A detailed summary of health risks (including suspected health risks) for each chemical can be found at **Appendix C**.

The toxicological assessments had several variations of 'harmful to inhale'. Of the 42 chemicals known to be harmful to inhale, 11 were classified as 'fatal if inhaled', 9 classified as 'may be fatal if inhaled', 3 classified as 'causes irreversible lung damage' when inhaled and 2 classified as 'causes damage to organs through prolonged or repeated exposure' via inhalation (**Figure 2**).

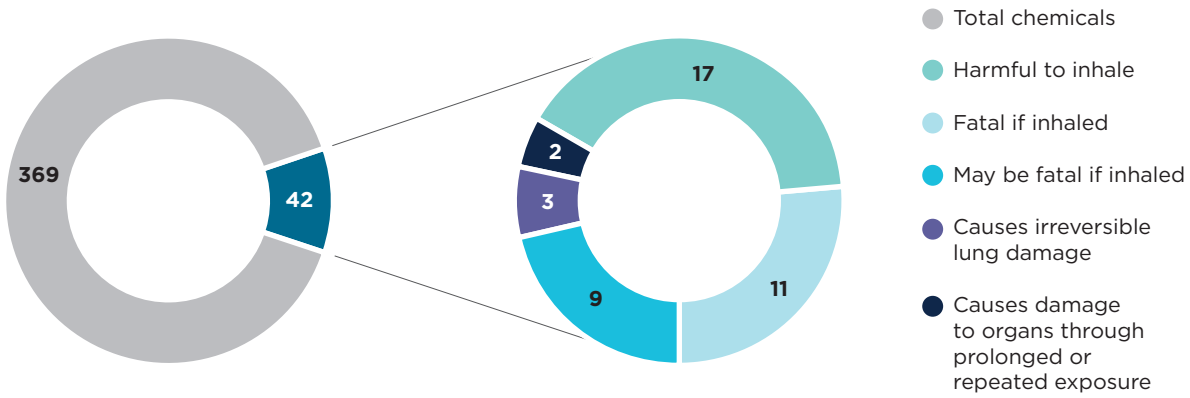

Figure 2: Detailed classification of chemicals known to be harmful to inhale

Of the 369 chemicals examined, 22 were identified as permitted to be used in food in Australia by FSANZ and 36 were classed as permissible ingredients for use in medicine by TGA (**Appendix C**). For the chemicals permitted to be used in food in Australia, 77.7% (n=16/22) were associated with at least one health risk or suspected health risk. Based on toxicological assessments, benzyl alcohol (CAS number: 100-51-6) is harmful to inhale, harmful if swallowed, a suspected respiratory sensitiser, causes eye irritation and causes acute toxicity, despite being permitted for use in food. No other chemicals permitted for use in food by FSANZ were found to be harmful to inhale. Four chemicals classed as permissible ingredients for use in medicine by TGA where found to be harmful to inhale: acetoin, acetylpropionyl (2,3-Pentanedione), arsenic and alpha-pinene. Overall, 75% (n=27/36) of chemicals classed as permissible ingredients for use in medicine by TGA were associated with health risks or suspected health risks (**Appendix C**).

Discussion

According to toxicological assessment data, the majority of ingredients (chemicals) known to be used in e-cigarettes were associated with at least one or more health risk or suspected health risk (68.5%; n=253/369). There is a small group with identified respiratory hazards where this known hazard is not relevant to e-cigarettes. This applies to substances such as alpha-pinene, beta-pinene, ethylbenzene, toluene, n-hexane, cyclohexane, xylene, which are classified under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as aspiration hazards [23]. For these, if the liquid is swallowed, its low viscosity and high vapour pressure leads to stomach contents being regurgitated and potentially inhaled [23]. This is not a relevant scenario for e-cigarette liquids in their normal use.

A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity (88.6%; n=327/369). A limitation of this research is that the authors assumed that unavailable data from the EPT dataset is unlikely to represent that the chemicals identified are not a hazard or risk if inhaled. That said, this assumption was informed by cross-referencing the EPT dataset with GHS classification data from the latest REACH reports. Classification data from the REACH reports indicated that that for most of the chemicals examined (n=349/369) there is no data available on repeat dose inhalation toxicity. It is important to note that absence of toxicological assessment data does not mean that chemicals are free of harm, but an indication where further information is required to make an assessment. Toxicological assessment data has an important role in identifying potential risks and suggesting mitigation strategies, such as dosage or concentrations in which a chemical can be safely consumed and identifying appropriate uses and handling for chemicals [13]. Whilst toxicological data was available for some of the chemicals, the comprehensiveness of this data, particularly for inhalation toxicity is unclear as chemicals have not been assessed for this use (inhalation), but for other uses such as the manufacture of other consumer goods and ingestion as a component of food or medicine [14]. The concern with these chemicals being used in e-cigarettes is that e-liquid composition is unregulated and although some chemicals are permitted to be used in foods, medicines or fragrances, they may not be suitable for use in e-cigarettes [24] [3] [25]. Of the chemicals known to be used in e-cigarettes, we identified 1 chemical permitted to be used in food in Australia by FSANZ and 4 chemicals classed as a permissible ingredients for use in medicine by TGA that are considered harmful to inhale. This is important to consider given the current use of these chemicals in e-liquids and that these chemicals are inhaled via e-cigarettes.

Although toxicological assessment data provides an indication of potential harms of the use of these constituents in e-cigarettes, a limitation of this type of data is that it assesses health risks on an individual chemical basis. E-liquids used in e-cigarettes are a mixture of many chemicals from flavours, to solvents and humectants [5] [6] [3]. Reactions between ingredients can occur, leading to the formation of other chemicals, such as aldehydes [26] [27] [28]. Recent reports [5] [19] have highlighted the complexities in trying to ascertain the health implications of inhaling e-liquids. Complexities include that e-liquids vary in constituent composition, vary in dosage and concentration of these constituents, the composition of e-liquids does not necessarily equate to the reaction products found in emissions, and how chemicals are heated and delivered through e-cigarette devices varies and has changed since the conception of e-cigarettes [3] [5] [22]. Emissions from e-cigarette devices contain carbonyl compounds formed as reaction products of the e-cigarette liquid used [5] [3] [22]. E-cigarette emissions also contain contaminants mostly derived from the e-cigarette liquid but also from the device. The contaminants identified are metals, volatile organic compounds, phthalates, pesticides and tobacco-specific nitrosamines [5].

A limitation of this report is that it examined chemicals identified in the NICNAS 2019 report. Although there is some overlap with the chemicals from the NICNAS 2019 report and those identified by the Scientific Committee on Health, Environmental and Emerging Risks (SHEER), neither report is an exhaustive list of all chemicals used in e-cigarettes on a global scale. The use of secondary data from toxicological assessments is not without its limitations. Although risk assessments are reviewed regularly, evidence used to inform the current risk assessments may be out-of-date at the time of this project or have changed since data extraction was conducted. Additionally, criteria to determine what a health risk is may vary depending on the regulatory body undertaking the assessment. There were large gaps in the available data and for some chemicals the available data was not comprehensive, particularly for inhalation toxicity. It is important to note that the absence of data does not necessarily equal the absence of hazard. That said, risk assessments typically consider information from many national and international sources, including studies commissioned by industry, information from other regulatory bodies, general scientific literature and grey literature [14] [29].

Conclusion

In line with other published literature this report found that, where data was available, the majority of chemicals currently known to be used in e-cigarettes are associated with health risks, based on toxicological assessments. A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity and it cannot be concluded that absence of toxicological assessment data equates to absence of harm. Although some of the chemicals were identified to be permitted for use in food and medicine in Australia, a number were found to be harmful when inhaled. This is important to consider given the current use of these chemicals in e-cigarettes.

Scoping review

Background and objectives

The liquids in e-cigarettes are commonly made by combining flavouring chemical mixtures in a solvent mixture [2]. These e-liquids can contain nicotine, even if labelled "nicotine free" [18] [17] [16], and have been reported to also contain flavourings and harmful substances such as heavy metals, volatile organic compounds and cancer-causing chemicals [3] [4]. Recent reports have found over 200 unique ingredients (constituents) used in e-liquids [5] [6] [3]. In a recent report [19], the World Health Organization identified gaps in the research base regarding the toxicants of HTPs, including e-cigarettes, and the effects on humans. These gaps include the need for more rigorous assessments of HTP emissions, including how they are absorbed in cells, harmful exposures and impact on health outcomes [19]. In Australia, there is limited publicly available information on the composition of e-liquids. These ingredients however are of interest due to concerns around chemical exposure, with many of the constituents (chemicals) posing harm to human health in certain situations [5].

Several reports and reviews have examined toxicity of e-cigarettes (e-liquids) [3] [22] [5]. These reports have been conducted recently, with the most recent literature search identifying scientific papers published up to April 2019 in the *Non-nicotine liquids for e-cigarette devices in Australia: chemistry and health concerns* report [5]. The objective of the scoping review is to examine the extent (that is, size), range (variety) and characteristics of the evidence published since April 2019 on the inhalation toxicity of e-liquids used in electronic nicotine delivery systems and electronic non-nicotine delivery systems and highlight key research gaps.

Methods

The scoping review was conducted according to the Joanna-Briggs Institute guidelines [11] and reported in accordance with the PRISMA extension for Scoping Reviews [12]. The scoping review protocol was published on FigShare [https://figshare.com/articles/journal_contribution/NHMRC_E-cigarette_toxicology_scoping_review_protocol_pdf/18131045].

Research question

Since April 2019, what evidence is available on the inhalation toxicity of e-liquids (chemical constituents) currently known to be used in ENDS or ENNDS?

Specifically;

1. extent: number of studies in total and for each outcome of interest
2. range: type of study designs in total and for each outcome
3. characteristics: research questions addressed by studies.

Eligibility criteria

Population

All human populations were included regardless of age, sex, gender, ethnicity or other characteristic. Priority sub-groups included in the scoping review were as follows: non-smoking populations (never-smokers of e-cigarettes or combustible tobacco products), children and youth, Aboriginal and Torres Strait Islander communities and current smokers (e-cigarette users, users of traditional combustible tobacco products and dual users).

Exposure

The following exposures were included as a part of the scoping review:

- e-liquids delivered in the form used in an ENDS/ENNDS (i.e. the combination of chemicals in an e-liquid, such as pineapple flavour, which will include a combination of the base ingredient/vehicle and multiple chemicals used to flavour)
- e-aerosols and emissions
- inhalation of individual chemicals or by-products including:
  - individual chemical constituents of e-liquids (e.g. specific base ingredients/vehicles such as propylene glycol, glycerol; specific chemicals used in flavouring such as Vanillin, Geranyl butyrate)
  - by-products of heating the e-liquid (e.g. formaldehyde)
  - aerosols (particulates)
  - contaminants such as metals.

The following exposures were excluded from the scoping review:

- e-liquids delivered in the form used in heated tobacco products
- second- or third-hand exposure (passive exposure) to e-liquids or individual chemicals
- cannabis and tetrahydrocannabinol.

Comparators

The following comparators were included as a part of the scoping review:

- exposure versus no exposure
- e-liquids with nicotine versus without nicotine
- different concentrations of individual chemicals and/or e-liquids.

Outcomes

As per the protocol, the following outcomes were included from the scoping review:

- toxicity (including acute toxicity)
- respiratory sensitisation
- adverse physiological or biological effects, including poisonings, allergic reactions, biomarkers and surrogate outcomes
- outcome measurement methods: determined as a part of the scoping review process.

As per the protocol, the following outcomes were excluded from the scoping review:

- knowledge, attitudes, behaviours and perceptions regarding ENDS/ENNDS
- uptake of ENDS/ENNDS
- roles of ENDS/ENNDS in cessation of traditional combustible cigarettes
- chronic health outcomes such as cardiovascular disease, cancer, chronic lung disease
- toxicant identification and quantification without any examination of toxicity.

Types of studies

Several reports and reviews have examined toxicity of e-cigarettes (e-liquids) [3] [22] [5]. These reports have been conducted recently, with the most recent literature search identifying scientific papers published up to April 2019 in the *Non-nicotine liquids for e-cigarette devices in Australia: chemistry and health concerns* report [5]. As such the following peer-reviewed literature published from April 2019 was included in the scoping review.

The following study types were included as a part of the scoping review:

- randomised controlled trials (including individual, cluster and cross-over trials)
- non-randomised trials
- Mendelian randomisation studies
- prospective cohort studies
- retrospective cohort studies and nested case control studies.

Other study designs that were considered included uncontrolled trials, cross-sectional studies, case control studies, before-and-after studies, *in vitro* studies and systematic reviews.

In line with the protocol, animal and in vitro studies were included as studies in humans were limited. The included animal studies were those that had a control group. *In vitro* studies with human cell-lines and animal cell lines were included.

The following study types were excluded from the scoping review:

Literature review, case series, case studies, conference papers, editorials (opinion pieces), modelling studies, letters, commentary papers and study protocols were not considered. Animal studies without a control group were not considered. Due to time constraints, studies published in languages other than English were also not considered. Literature published prior to April 2019 was not included in this review as it was captured in a number of previously published reviews.

Search methods

A sample search strategy can be found at **Appendix B**. The search strategy was run through Cochrane Central, MEDLINE (via Ovid), Embase (via Ovid), PsycInfo and CINAHL on 20th July 2021. Only papers published after April 2019 were reviewed. No further supplementary searches (such as searching reference lists) were conducted. Search results were managed using EndNote (X9.2; United States of America) referencing software.

Data screening

Titles and abstracts of a sample of studies (n=10 studies) were independently screened by two authors (BC, MC) for inclusion. Screened studies were reviewed and compared. There was 60% agreement between the two authors; discrepancies were resolved through consensus. The remaining included studies were screened by one author (MC) using Rayyan (2016) [30]. The results of the search and screening process are presented in a PRISMA flow diagram (**Figure 3**).

Data extraction, categorisation and coding

After studies had been selected for full-text review, two authors (BC, MC) independently extracted the following data from a sample of included studies (n=10 studies) in Microsoft Excel:

- study reference (title, authors, journal, year)
- study type based on labels used in the primary studies (e.g. experimental, cohort)
  - randomised controlled trials in humans were classified separately to experimental studies
  - experimental studies included animal-based, cell-based (*in vitro*), biochemical, and mixed methods (combination of animal and/or cell and/or biochemical)
- exposures (e.g. e-liquids, individual chemicals)
- comparators (e.g. exposure vs. no exposure)
- outcome of interests (e.g. respiratory sensitisation, acute toxicity via inhalation)
- modifying factors (where data was available; e.g. type of device, frequency and duration of use).

Data extracted from studies was reviewed and compared, discrepancies were resolved through consensus. The process was completed to refine the extraction process, develop guidance and ensure consistent extraction of data. The remaining included studies were extracted by one author (MC) in to Microsoft Excel.

We planned to include any toxicity outcome. For the review, all outcomes, including type of toxicity were extracted and reported verbatim from included studies by one author (MC):

- cardiorespiratory toxicity
- cardiorespiratory toxicity
- cytotoxicity
- genotoxicity
- developmental toxicity
- embryotoxicity
- angiogenesis
- carcinogenic potential
- neurotoxicity
- pulmonary function and toxicity
- reproductive toxicity
- toxicant identification and quantification
- vascular function
- acute toxicity.

Where no specific type of toxicity was reported in an included study, the outcome was categorised as 'general toxicity'. Exposure categories were extracted and reported verbatim from individual studies by one author (MC). It was evident from the data extracted that exposures could be further grouped in to high-level exposure categories, determined by consistent themes appearing in the data. One author (MC) coded the exposures into the following high-level exposure categories: e-aerosol, e-cigarette cartridge/re-fill, e-cigarette extract, e-cigarette vapour, e-cigarettes, e-hookah, e-liquid, ENDS, ENDS and ENNDS, and individual chemical constituents. During the data extraction process it was identified that the population groups and exposure types of included studies varied substantially. Consequently outcome measures were not extracted as they were unlikely to be of benefit to the review.

Data synthesis

A risk of bias assessment was not conducted. Data was analysed using descriptive statistics. A characteristics of studies table was developed (**Appendix E**) as well as an evidence map examining the number of studies by exposure (all levels of coding) and outcome type (verbatim coding of outcomes) (**Figure 5**).

Results

The searches of the five bibliographic databases identified 1221 records, of which 479 were removed as they were identified as a duplicate (n=462), in a language other than English (n=16) or not published within the specified time period (n=1). A total of 742 articles were screened and assessed for inclusion. After excluding studies for study design (n=109), outcome type (n=421) or exposure type (n=123) (**Appendix D**), 89 remained and were included in the review (**Figure 3**).

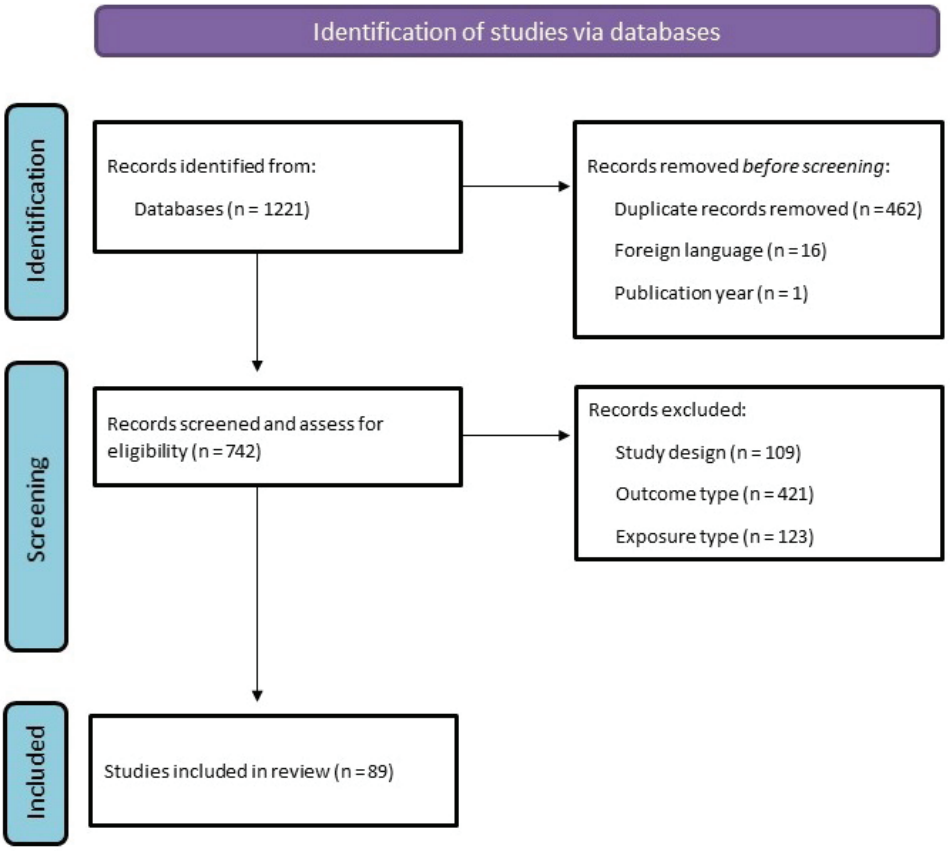

Figure 3: PRISMA Flow Diagram

As seen in **Figure 4**, the majority of the studies included were experimental studies (65.2%; n=58/89 excluding randomised trials involving humans). However, the type of experimental studies varied. Excluding experimental mixed-method designs (n=5), the majority of the experimental studies were cell-based studies (73.6%; n=39/53), followed by animal-based studies (26.4%; n=14/53). Systematic reviews made up 19.1% of studies included (n=17/89). Seven prospective cohort studies and five randomised control trials were included. Only one clinical trial and one cross-sectional study were included.

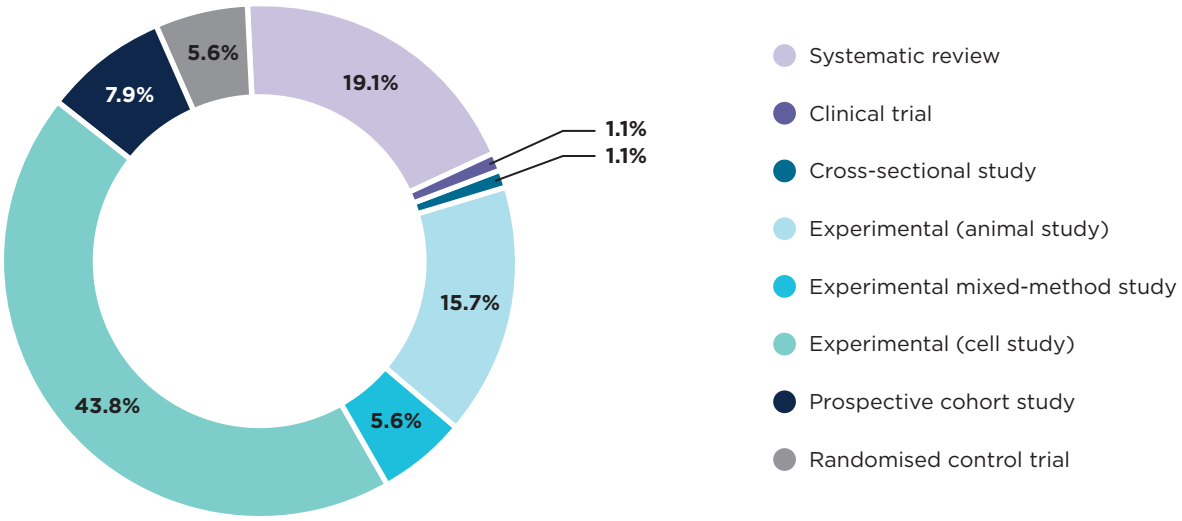

Figure 4: Distribution of included papers by study type

Studies were highly variable in terms of both study design and the PECO questions addressed. Variability was observed for outcome of interest, exposure, study population (including animal and cell type) and methodology. As seen in **Figure 5**, it was common for studies not to specify whether the exposure (e.g. e-cigarette, e-aerosol, e-liquid) was a commercial device or e-liquid, whether it was a specific flavour or whether or not it contained nicotine. Most studies examined e-liquids or e-aerosols as a whole rather than the toxicological impacts of individual chemicals (**Figure 5**).

Cytotoxicity was the most common outcome of interest examined across all 89 studies (**Figure 5**). Majority of the studies examining cytotoxicity were mainly cell-based experimental studies (n=21). General toxicity was the second most common outcome of interest (n=16), followed by pulmonary toxicity (n=6) and cardiotoxicity (n=6). A number of studies found evidence that toxicity was related to oxidative stress or endothelial cell dysfunction (**Appendix E**).

Outcome and exposure types examined varied by study population. For example, e-cigarettes (unspecified nicotine content, device types or flavour) was the most commonly examined exposure in studies with a human population group (excluding systematic reviews). This was in contrast to experimental cell-based and animal studies, where e-cigarettes was the least common exposure examined. E-aerosols (n=13/39), e-liquids (n=12/39) and individual constituents (n=7/39) were the most common exposures examined in experimental cell-based studies (**Appendix E**). Half of the animal studies (n=7/14) examined e-aerosols or e-vapour as the exposure type. Other than 1 systematic review, developmental toxicity was exclusively examined by animal-based experimental studies. Typical outcomes examined by studies with a human population included cardiotoxicity, pulmonary toxicity or changes in biomarkers of exposure (**Appendix E**).

Exposure groups			Biomarkers of exposure among dual users	Biomarkers of exposure to tobacco-related toxicants in e-cig users	Carcinogenic potential	Cardiorespiratory toxicity	Cardiorespiratory toxicity; Pulmonary toxicity	Cardiotoxicity	Changes to levels of tobacco-related biomarkers when switching to e-cigarettes	Cytotoxicity	Cytotoxicity; Genotoxicity	Developmental toxicity	Embryotoxicity; Angiogenesis	General toxicity	Genotoxicity	Genotoxicity; Carcinogenic potential	Genotoxicity; Cytotoxicity	Neurotoxicity	Oral health impact	Pulmonary function	Pulmonary toxicity	Reproductive toxicity	Toxicant identification & quantification	Toxicant identification & quantification; Biomarkers of exposure to tobacco-related toxicants in e-cig users	Toxicant identification & quantification; Cytotoxicity	Toxicant identification & quantification; General toxicity	Vascular function; Acute toxicity; Pulmonary function
			Outcome groups																								
	E-aerosol	E-aerosol — condensate													1												
		E-aerosol — flavoured								1				2													
		E-aerosol — flavoured; E-aerosol — third generation device								1																	
		E-aerosol — fourth generation device								1																	
		E-aerosol — third generation device								1																	
		E-aerosol — vitamin E acetate																			1						
		E-aerosol (unspecified)			1					4		1		2	1						1		1				
		E-aerosols containing nicotine and flavour				1																					
	E-cigarette cartridge/re-fill	E-cigarette cartridge/re-fill								2				2													
	E-cigarette extract	E-cigarette extract						1																			
	E-cigarette vapour	E-cigarette vapour										3		2				1		1		1			1		
		E-cigarette vapour (nicotine); E-cigarette vapour (nicotine-free)								1																	
	E-cigarettes	E-cigarettes — 50% propylene glycol; 50% vegetable glycerin					1	1																			
		E-cigarettes (unspecified)	2	1	1	2		2	3					5					1								
	E-hookah	E-hookah — vapour												1													
		E-hookah (unspecified)								1																	
	E-liquid	E-liquid — flavoured								3			1		1		1				2						
		E-liquid — flavoured; e-concentrate (flavoured)																					1				
		E-liquid — flavoured; E-liquid — base								1																	
		E-liquid (nicotine); E-liquid (nicotine-free)									1																
		E-liquid (unspecified)								1		1											1				
		E-liquid (unspecified); E-aerosol (unspecified)												2													
	ENDS	ENDS — flavoured						1																			
		ENDS (unspecified)								2											1						
	ENDS; ENNDS	ENDS (unspecified); ENNDS (unspecified)																									1
	Individual chemical constituents	Individual chemical constituents (unspecified)														1											
		Individual constituents — benzaldehyde, vanillin, ethyl vanillin, and their corresponding propylene glycol acetyls								1																	
		Individual constituents — cinnamaldehyde						1																			
		Individual constituents — diacetyl								1																	
		Individual constituents — diacetyl; 2,3-pentanedione								1																	
		Individual constituents — formaldehyde; acrolein																					1				
		Individual constituents — menthol								1																	
		Individual constituents — metal/metalloid																						1			
		Individual constituents — propylene glycol; glycerol								1		1															
		Individual constituents — propylene glycol; glycerol; E-cigarette cartridge/re-fill																								1	
		Individual constituents — vitamin E acetate																			1						

Figure 5: Evidence map of number of studies by exposure and outcome type

Discussion

The majority of the included studies examined e-cigarettes or e-liquids as a whole rather than specific ingredients (constituents) (12 of 89 studies examined individual constituents). The evidence on the differential health impacts of a specific flavour, solvent, humectants or nicotine-containing or nicotine-free e-cigarettes or e-liquids could not be determined from the included studies (**Figure 5**). Only a few studies compared toxicant emissions or biomarkers of non-nicotine containing e-cigarettes to nicotine-containing e-cigarettes or combustible tobacco cigarettes. Long-term data on inhalation toxicity of e-cigarettes (both nicotine-containing and non-nicotine-containing) remain limited.

Considerable variability in the outcomes of interest, population, exposure, study design and methodology was identified through the scoping review. E-cigarettes (unspecified nicotine content, device types or flavour) was the most commonly examined exposure in studies with a human population group (excluding systematic reviews). This was in contrast to experimental cell-based and animal studies, where e-cigarettes was the least common exposure examined. E-aerosols, e-liquids and individual constituents were the most common exposures examined in experimental cell-based studies (**Appendix E**). Other than 1 systematic review, developmental toxicity was exclusively examined by animal-based experimental studies. Typical outcomes examined by studies with a human population included cardiotoxicity, pulmonary toxicity or changes in biomarkers of exposure (**Appendix E**). The variability in the outcomes of interest, population, exposure, study design and methodology makes it difficult to get clear, consistent evidence on the toxicology of e-cigarettes and potential harms to users. Standardised methods for toxicant identification and quantification should be strongly encouraged and used, especially for experimental designs. Specific to e-cigarettes, in addition to using existing guidance on inhalation toxicity [31], standard protocols which include guidance on device type, base liquid, concentration, coil/heating temperature and puff size is needed. Standardised methodologies will aid in the future synthesis of evidence and examination of the potential inhalation toxicity of e-cigarettes.

It is important to note that due to the information collated and the methodological approach taken, no statement on the health risks of chemicals currently known to be used in e-cigarettes can be made. Time and resource constraints meant it was not feasible to conduct a systematic review of all identified e-liquid constituents. Additionally, a risk of bias assessment was not undertaken. Quality of studies remain unclear at this stage and key findings identified should be interpreted carefully.

Conclusion

Considerable variability in the outcomes of interest, exposure, study design and methodology was identified through the scoping review. Further research is required. Standardised methods for evaluating e-liquids are required, including specifications on device type, base liquid, concentration, coil/heating temperature and puff size. Such standardisation would the many complexities of assessing toxicological health risks of inhaling non-nicotine e-cigarette constituents.

Discussion and conclusions

According to toxicological assessment data, the majority of ingredients (chemicals) known to be used in e-cigarettes were associated with at least one or more health risk or suspected health risk (68.5%; n=253/369). For example, diacetyl and acetylpropionylare known to cause irreversible lung damage following repeated inhalation exposure and have carcinogenic potential [32]. Diacetyl and acetylpropionyl are found in both e-cigarettes and tobacco cigarettes in different concentrations. Diacetyl and acetylpropionyl, are prohibited ingredients in nicotine vaping products in Australia [33]. However, they are likely to be widely used in non-nicotine e-cigarette products across Australia [32].

There is a small group of chemicals with identified respiratory hazards where this known hazard is not relevant to e-cigarettes. This applies to substances such as alpha-pinene, beta-pinene, ethylbenzene, toluene, n-hexane, cyclohexane, xylene, which are classified under GHS as aspiration hazards [23]. For these, if the liquid is swallowed, its low viscosity and high vapour pressure leads to stomach contents being regurgitated and potentially inhaled [23]. This is not a relevant scenario for e-cigarette liquids in their normal use.

A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity (88.6%; n=327/369). A limitation of this research is that the authors assumed that unavailable data from the EPT dataset is unlikely to represent that the chemicals identified are not a hazard or risk if inhaled. That said, this assumption was informed by cross-referencing the EPT dataset with GHS classification data from the latest REACH reports. Classification data from the REACH reports indicated that that for most of the chemicals examined (n=349/369) there is no data available on repeat dose inhalation toxicity. It is important to note that absence of toxicological assessment data does not mean that chemicals are free of harm, but an indication where further information is required to make an assessment.

Toxicology assessment data has an important role in identifying potential risks and suggesting mitigation strategies, such as dosage or concentrations in which a chemical can be safely consumed and identifying appropriate uses and handling for chemicals [13]. Whilst toxicological data was available for some of the chemicals, the comprehensiveness of this data, particularly for inhalation toxicity is unclear. Chemicals have not been assessed for inhalation, but for other uses such as the manufacture of other consumer goods and ingestion as a component of food or medicine [14]. E-liquid composition is currenlty unregulated and although some chemicals are permitted to be used in foods, medicines or fragrances, they may not be suitable for use in e-cigarettes [24] [3] [25]. Of the chemicals known to be used in e-cigarettes, we identified 1 chemical permitted to be used in food in Australia by FSANZ and 4 chemicals classed as permissible ingredients for use in medicine by TGA that are considered harmful to inhale.

Although toxicological assessment data provides an indication of potential harms of the use of these constituents in e-cigarettes, a limitation of this type of data is that it assesses health risks on an individual chemical basis. E-liquids used in e-cigarettes are a mixture of many chemicals including; flavours, solvents and humectants [5] [6] [3]. Reactions between ingredients can occur leading to the formation of other chemicals, such as aldehydes [26] [27] [28]. Recent reports [5] [19] have highlighted the complexities in trying to ascertain the health implications of inhaling e-liquids. Complexities include that e-liquids vary in constituent composition, dosage and concentration of these constituents. The composition of e-liquids does not necessarily equate to the reaction products found in emissions. How chemicals are heated and delivered through e-cigarette devices varies and has changed since the conception of e-cigarettes [3] [5] [22].

Emissions from e-cigarette devices contain carbonyl compounds formed as reaction products of the e-cigarette liquid used [5] [3] [22]. E-cigarette emissions also contain contaminants mostly derived from the e-cigarette liquid but also from the device. The contaminants identified are metals, volatile organic compounds, phthalates, pesticides and tobacco-specific nitrosamines [5]. E-cigarette use increases airborne particulate matter in indoor environments [34], meaning that individuals may passively inhale e-cigarette emissions. Passive exposure was not within scope of this study, however, the World Health Organisation has warned that exposure to any level of particulate matter may be harmful and that levels of exposure should be minimised [35].

The vast majority of the included studies in the scoping review examined e-cigarettes or e-liquids as a whole rather than specific ingredients (constituents) (12 of 89 studies examined individual constituents). The evidence on the differential health impacts of a specific flavour, solvent, humectants or nicotine-containing or nicotine-free e-cigarettes or e-liquids could not be determined (**Figure 5**). Only a few studies compared toxicant emissions or biomarkers of non-nicotine containing e-cigarettes to nicotine-containing e-cigarettes or combustible tobacco cigarettes. Long-term data on inhalation toxicity of e-cigarettes (both nicotine-containing and non-nicotine-containing) remain limited.

Considerable variability in the outcomes of interest, population, exposure, study design and methodology was identified through the scoping review. E-cigarettes (unspecified nicotine content, device types or flavour) was the most commonly examined exposure in studies with a human population group (excluding systematic reviews). This was in contrast to experimental cell-based and animal studies, where e-cigarettes was the least common exposure examined. E-aerosols, e-liquids and individual constituents were the most common exposures examined in experimental cell-based studies (**Appendix E**). Other than 1 systematic review, developmental toxicity was exclusively examined by animal-based experimental studies. Typical outcomes examined by studies with a human population included cardiotoxicity, pulmonary toxicity or changes in biomarkers of exposure (**Appendix E**). The variability in the outcomes of interest, population, exposure, study design and methodology makes it difficult to get clear, consistent evidence on the toxicology of e-cigarettes and potential harms to users. Standardised methods for toxicant identification and quantification should be strongly encouraged and used, especially for experimental designs. Specific to e-cigarettes, in addition to using existing guidance on inhalation toxicity [31], standard protocols which include guidance on device type, base liquid, concentration, coil/heating temperature and puff size is needed. Standardised methodologies will aid in the future synthesis of evidence and examination of the potential inhalation toxicity of e-cigarettes.

It is important to note that due to the information collated and the methodological approach taken (scoping review), no statement on the health risks of chemicals currently known to be used in e-cigarettes can be made. Time and resource constraints meant it was not feasible to conduct a systematic review of all identified e-liquid constituents. Additionally, a risk of bias assessment was not undertaken. Quality of studies remain unclear at this stage and key findings identified should be interpreted carefully. A limitation of this report is that it examined chemicals identified in the NICNAS 2019 report. Although there is some overlap with the chemicals from the NICNAS 2019 report and those identified by the Scientific Committee on Health, Environmental and Emerging Risks (SHEER), neither report is an exhaustive list of all chemicals used in e-cigarettes on a global scale. The use of secondary data from toxicological assessments is not without its limitations. Although risk assessments are reviewed regularly, evidence used to inform the current risk assessments may be out-of-date at the time of this project or have changed since data extraction was conducted. Additionally, criteria to determine what a health risk is may vary depending on the regulatory body undertaking the assessment. There were large gaps in the available data and for some chemicals the available data was not comprehensive, particularly for inhalation toxicity. It is important to note that the absence of data does not necessarily equal the absence of hazard. Risk assessments typically consider information from many national and international sources, including studies commissioned by industry, information from other regulatory bodies, general scientific literature and grey literature [14] [29].

Combining a scoping review with toxicological assessments provided a holistic overview of the current evidence base, identified important gaps in research including current inconsistencies and provided some considerations for manufacturers and regulatory bodies on current chemicals used in e-cigarettes.

Conclusion

In line with other published literature, this report found that the majority of chemicals currently known to be used in e-cigarettes are associated with health risks, based on toxicological assessments. A large proportion of chemicals examined did not have toxicological assessment data available on inhalation toxicity. It cannot be concluded that absence of toxicological assessment data equates to absence of harm. Although some of the chemicals were identified to be permitted for use in food and medicine in Australia, a number were found to be harmful when inhaled. This is important to consider given the current use of these chemicals in e-liquids and that these chemicals are inhaled via e-cigarettes. Considerable variability in the outcomes of interest, exposure, study design and methodology was identified through the scoping review. Further research is required. Standardised methods for evaluating e-liquids are required, including specifications on device type, base liquid, concentration, coil/heating temperature and puff size. Such standardisation would the many complexities of assessing toxicological health risks of inhaling non-nicotine e-cigarette constituents.

References

[1] E. Greenhalgh and M. Scollo, In Depth 18B: Electronic cigarettes (e-cigarettes). Tobacco in Australia: facts and issues., Melbourne: Cancer Council Australia, 2018.

[2] Australian Government Department of Health, "Policy and regulatory approach to electronic cigarettes (e-cigarettes) in Australia," 28 November 2019. [Online]. Available: https://www.health.gov.au/sites/default/files/documents/2019/12/policy-and-regulatory-approach-to-electronic-cigarettes-e-cigarettes-in-australia-principles-that-underpin-the-current-policy-and-regulatory-approach-to-electronic-cigarettes-e-cigarettes-in-australia.pdf.

[3] National Academics of Sciences, Engineering, and Medicine, "Public Health Consequences of E-Cigarettes," The National Academic Press, Washington, DC, 2018.

[4] World Health Organization (WHO), "Electronic Nicotine Delivery Systems and Electronic," WHO Framework Convention on Tobacco Control, Geneva, 2016.

[5] National Industrial Chemicals Notification and Assessment Scheme, "Non-nicotine liquids for e-cigarette devices in Australia: chemistry and health concerns," 2 October 2019. [Online]. Available: https://www.industrialchemicals.gov.au/sites/default/files/2020-08/Non-nicotine%20liquids%20for%20e-cigarette%20devices%20in%20Australia%20chemistry%20and%20health%20concerns%20%5BPDF%201.21%20MB%5D.pdf.

[6] E. J. Z. Krusemann, A. Havermans, J. L. A. Pennings, K. de Graaf, S. Boesveldt and R. T. Talhout, "Comprehensive overview of common e-liquid ingredients and how they can be used to predict an e-liquid's flavour category," *Tobacco Control,* pp. 185-191, 2021.

[7] World Health Organization (WHO), "Environmental Health Criteria 240 "Principle and methods for the risk assessment of chemicals in food; Chapter 6 Dietary Exposure Assessment of Chemicals in Food"," [Online]. Available: https://www.who.int/publications/i/item/9789241572408. [Accessed 12 January 2022].

[8] United Nations, "Globally harmonized system of classification and labelling chemicals (GHS)," [Online]. Available: https://unece.org/DAM/trans/danger/publi/ghs/ghs_rev07/English/ST_SG_AC10_30_Rev7e.pdf. [Accessed 12 January 2022].

[9] Food Standards Australia and New Zealand, "Australia New Zealand Food Standards Code - Schedule 15 - Substances that may be used as food additives," 7 September 2021. [Online]. Available: https://www.legislation.gov.au/Details/F2021C00607.

[10] Theapeutic Goods Administration , "Theapeutic Goods (Permissable Ingredients) Determination (No. 1) 2021," 7 September 2021. [Online]. Available: https://www.legislation.gov.au/Details/F2021L00157.

[11] M. Peters, C. Godfrey, P. McInerney, Z. Munn, A. Tricco and H. Khalil, "Chapter 11: Scoping Reviews (2020 version). In: Aromataris E, Munn Z (Editors), JBI Manaul for Evidence Synthesis, JBI, 2020".

[12] A. A. Tricco, E. Lillie, W. Zarin, K. K. O'Brien, H. Colquhoun, D. Levac, D. Moher, M. D. Peters, T. Horsley, L. Weeks, S. Hempel, E. A. Akl, C. Chang, J. McGowan, L. Stewart, L. Hartling, A. Aldcroft, M. G. Wilson, C. Garritty, S. Lewin, C. M. Godfrey, M. T. Macdonald, E. V. Langlois, K. Soares-Weiser, J. Moriarty, T. Clifford, O. Tuncalp and S. E. Straus, "PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation," *Annals of Internal Medicine,* vol. 169, no. 7, pp. 467-473, 2018.

[13] Australian Industrial Chemicals Introduction Scheme, "Who are we and what do we do," 7 September 2021. [Online]. Available: https://www.industrialchemicals.gov.au/about-us/who-we-are-and-what-we-do.

[14] Australian Industrial Chemicals Introduction Scheme, "How and why we assess risk," [Online]. Available: https://www.industrialchemicals.gov.au/about-us/how-and-why-we-assess-risk. [Accessed 9 September 2021].

[15] Australian Institute of Health and Welfare, "National Drug Strategy Household Survey 2019," 16 July 2020. [Online]. Available: https://www.aihw.gov.au/reports/illicit-use-of-drugs/national-drug-strategy-household-survey-2019/contents/summary.

[16] E. Omaiye, I. Cordova, B. Davis and P. Talbot, "Counterfeit Electronic Cigarette Products with Mislabeled Nicotine Concentrations," *Tob Regul Sci,* vol. 3, no. 3, pp. 347-357, 2017.

[17] B. Raymond, K. Collette-Merrill, R. Harrison, S. Jarvis and R. Rasmussen, "The Nicotine Content of a Sample of E-cigarette Liquid Manufactured in the United States," *J Addict Med,* vol. 12, no. 2, pp. 127-131, 2018.

[18] E. Chivers, M. Janka, P. Franklin, B. Mullins and A. Larcombe, "Nicotine and other potentially harmful compounds in "nicotine-free" e-cigarette liquids in Australia," *Med J Aust,* vol. 210, no. 3, pp. 127-128, 2019.

[19] WHO Study Group on Tobacco Product Regulation, "Report on the scientific basis of tobacco product regulation: eighth report of a WHO study group," 4 May 2021. [Online]. Available: https://www.who.int/publications/i/item/9789240022720.

[20] Therapeutic Goods Administration, "Nicotine vaping products: Information for pharmacists," 5 October 2021. [Online]. Available: https://www.tga.gov.au/nicotine-vaping-products-information-pharmacists. [Accessed 22 October 2021].

[21] E. Chivers, M. Janka, P. Franklin, B. Mullins and A. Larcombe, "Nicotine and other potentially harmful compounds in "nicotine-free" e-cigarette liquids in Australia," *The Medical Journal of Australia,* pp. 127-128, 2019.

[22] Scientific Committee on Health, Environmental and Emerging Risks (SHEER), "Scientific Opinion on electronic cigarettes, 23 September 2020".

[23] Globally Harmonized System of Classification and Labelling of Chemicals (GHS), "Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Seventh Edition," 2017. [Online]. Available: https://unece.org/ghs-rev7-2017. [Accessed 10 January 2022].

[24] J. M. Bhatt, M. Ramphul and A. Bush, "An update on controversies in e-cigarettes," *Paediatric Respiratory Reviews,* vol. 36, pp. 75-86, 2020.

[25] A. Larcombe, S. Allard, P. Pringle, R. Mead-Hunter, N. Anderson and B. Mullins, "Chemical analysis of fresh and aged Australian e-cigarette liquids," *Medical Journal of Australia,* 2021.

[26] A. Khlystov and V. Samburova, "Flavoring Compounds Dominate Toxic Aldehyde Production during E-Cigarette Vaping," *Environmental Science and Technology,* vol. 50, pp. 13080-13085, 2016.

[27] S. Vreeke, D. H. Peyton and R. M. Strongin, "Triacetin Enhances Levels of Acrolein, Formaldehyde Hemiacetals, and Acetaldehyde in Electronic Cigarette Aerosols," *ACS Omega,* vol. 3, no. 7, pp. 7165-7170, 2018.

[28] H. C. Erythropel, S. V. Jabba, T. M. DeWinter, M. Mendizabal, P. T. Anastas, S. E. Jordt and J. B. Zimmerman, "Formation of flavorant-propylene glycol adducts with novel toxicological properties in chemically unstable e-cigarette liquids.," *Nicotine Tobacco Research,* vol. 21, no. 9, pp. 1248-1258, 2019.

[29] European Chemicals Agency (ECHA), "Guidance on Information Requirements and Chemical Safety Assessment," [Online]. Available: https://echa.europa.eu/guidance-documents/guidance-on-information-requirements-and-chemical-safety-assessment. [Accessed 9 September 2021].

[30] M. Ouzzani, H. Hammady, Z. Fedorowicz and A. Elmagarmid, "Rayyan — a web and mobile app for systematic reviews," 2016. [Online]. Available: https://rayyan.ai/. [Accessed 22 July 2021].

[31] Organisation for Economic Co-operation and Development (OECD), "Guidance Document on Inhaltion Toxicity Studies: Series on Testing and Assessment (No.39; Second Edition)," OECD Environment, Health and Safety Publications, 2018.

[32] Australian Industrial Chemical Introduction Scheme, "Acetylpropionyl and diacetyl: Evaluation statement," Australia, 2022.

[33] Therapeutic Goods Administration, "icotine vaping products and vaping devices: Guidance for the Therapeutic Goods (Standard for Nicotine Vaping Products) (TGO 110) Order 2021 and related matters.," Australia, 2021.

[34] E. Banks, A. Yazidjoglou, S. Brown, M. Nguyen, M. Martin, K. Beckwith, A. Daluwatta, S. Campbell and G. Joshy, "Electronic cigarettes and health outcomes: systematic review of global evidence.," Australian National University, 2022.

[35] World Health Organisation, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: global update 2005: summary of risk assessment," Occupational Environmental Health Team, 2006.

[36] Y. Akiyama and N. Sherwood, "Systematic review of biomarker findings from clinical studies of electronic cigarettes," *Toxicology Reports,* vol. 27, no. 8, pp. 282-294, 2021.

[37] H. Dai and A. S. Khan, "A Longitudinal Study of Exposure to Tobacco-Related Toxicants and Subsequent Respiratory Symptoms Among U.S. Adults with Varying E-Cigarette Use Status," *Nicotine Tobacco Research,* vol. 22, no. Supp1, pp. S61-S69, 2020.

[38] M. McEwan, N. Gale, J. Ebajemito, O. M. Camacho, G. Hardie, C. J. Proctor and J. Murphy, "A randomized controlled study in healthy participants to explore the exposure continuum when smokers switch to a tobacco heating product or e-cigarette relative to cessation," *Toxicology Report,* vol. 8, pp. 994-1001, 2021.

Appendices

Appendix A: National and international databases scanned by the AICIS Evaluation Prioritisation Tool

Table 1: List of national and international databases scanned by the AICIS Evaluation Prioritisation Tool

List of national and international databases scanned by the AICIS Evaluation Prioritisation Tool
Safework Australia Hazardous Chemicals Information System (HCIS)
European Commission database for information on cosmetic substances and ingredients (COSING)
Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation registered substances
European Chemicals Agency (ECHA) Substances of Very High Concern (SVHC) for Authorisation
ECHA opinion on tattoo and PMU inks
European Union (EU) Annex VI CLP Harmonised Classifications
Safe Work Australia workplace exposure standards (WES) Reviews
International Agency for Research on Cancer (IARC)
United States National Toxicology Program (NTP) Report on Carcinogens (RoC)
International Chemical Secretariat (ChemSec) Substitute It Now (SIN) List
Malaysia Department of Occupational Safety and Health GHS classifications
NICNAS e-cigarettes report
NICNAS premanent make-up (PMU) inks report
NICNAS tattoo inks report
Swedish Chemicals Agency (KEMI) PRIO database
Japan National Institute of Technology and Evaluation (NITE) GHS classifications
OECD Portal on Per and Poly Fluorinated Chemicals
NICNAS IMAP assessment data
International Fragrance Association (IFRA) transparency list
OECD Existing Chemicals Assessments (SIAR/SIAM/CoCAM)
US Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs)
ATSDR Substance Priority List
EU REACH Regulation Annex III inventory of substances
ECHA Biocidal Active Substances
NICNAS Priority Existing Chemical (PEC) assessments
NICNAS Other Assessments
NICNAS New Chemicals Assessment Data

Table 1 continued

List of national and international databases scanned by the AICIS Evaluation Prioritisation Tool
American Cleaning Institute (ACI) Cleaning Product Ingredient Safety Initiative (CPISI)
US Interstate Chemicals Clearinghouse (IC2) High Priority Chemicals Data System (HPCDS)
Hair Dye Substance Database (HDSD)
Safe Work Australia HCIS – Exposure Standards
REACH Authorisation List (REACH Annex XIV)
Canada Chemicals Management Plan Phase 3 (CMP3)
US EPA Safer Choice (Safer Chemicals Ingredients List)
REACH Registry of harmonised GHS classification CLH intentions until outcome
US EPA Chemical Data Reporting 2016
US EPA Chemical Data Reporting 2012
US EPA Toxic Substances Control Act (TSCA) Low-Priority Substances
US EPA TSCA High-Priority substances undergoing risk evaluations
Canada Domestic Substance List (DSL) 2017 Inventory Update
COSMOS Database of cosmetic -related chemicals
USEPA Integrated Risk Information System (IRIS) Assessments
ECHA Community Rolling Action Plan (CoRAP)
ECHA Nanoform Registry
The Endocrine Disruptor (ED) Lists (European)
Canada Significant New Activity (SNAc)
Japan Chemical Substances Control Law (CSCL) Class I and II Specified Chemical Substances
Consumer Product Information Database (CPID)
Global Automotive Declarable Substance List (GADSL)
REACH Registered substances – reported use information
REACH Restricted Substances (REACH Annex XVII)
REACH Regulatory Management Option Analysis (RMOA) List
REACH Mapping exercise – Plastic additives initiative
REACH Public activities coordination tool (PACT)
NICNAS Call for Information data
NICNAS 2006 High Volume Industrial Chemicals List (HVICL)
The Poisons Standard (the SUSMP) listings [extracted from Galleria Chemica]
United Nations (UN) International Narcotics Control Board (INCB) “Red List” of drug precursors
EU Endocrine Disruptors Strategy categorisation database
USEPA Toxic Substances Control Act (TSCA) Chemical Substance Inventory
Canada New Substances Risk Assessment Summaries
NICNAS Excluded Use chemicals with nominated Industrial Uses
US EPA CompTox Chemicals Dashboard List of Androgen Receptor Chemicals
US EPA CompTox Chemicals Dashboard List of Color Index dyes

Table 1 continued

List of national and international databases scanned by the AICIS Evaluation Prioritisation Tool
Substances in Products in the Nordic Countries (SPIN) database
Canada CMP Petroleum Sector Stream Approach
Canada CMP Substance Grouping Initiative
Scientific Committee on Consumer Safety (SCCS) Opinions on health and safety risks source
Cosmetic Ingredient Review (CIR) reports
Use Information via Galleria Chemica
NICNAS Assessment of genotoxicity and carcinogenicity concerns of monocyclic aromatic amine metabolites of azo dyes
US EPA Pesticide Registration - Index of chemical names & pesticide chemical codes [Galleria Chemica]
US National Institue of Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs) [Galleria Chemica]
Australian Inventory of Industrial Chemicals (AIICS) regulatory obligations
Canadian Cosmetic Ingredient Hotlist of Restricted and Prohibited chemicals
Montreal Protocol on Substances that Deplete the Ozone Layer
Kyoto Protocol to limit and reduce greenhouse gas emissions
Stockholm Convention on Persistent Organic Pollutants (POPs)
Rotterdam Convention on hazardous chemicals
United Nations Environment Programme (UNEP) scientific knowledge on endocrine disrupting chemicals
Canada Toxic Substances List - Schedule 1 chemicals
Ozone Protection and Synthetic Greenhouse Gas (OPSGG) Management Act 1989
AICIS Evaluation Statements

Appendix B: Sample search strategy for scoping review

Sample search strategy used for the scoping review component of the e-cigarette toxicology report. The search strategy was run through Cochrane Central, MEDLINE (via Ovid), Embase (via Ovid), PsycInfo and CINAHL.

Table 2: Sample search strategy

#	Search Statement	Results	Annotation
1	exp electronic nicotine delivery systems/	12932	
2	exp vaping/	5275	
3	exp electronic cigarette/	14768	
4	(e-cig* or ecig*).mp.	15285	
5	electr* cigar*.mp.	15021	
6	(e-nicotine* or enicotine*).mp.	18	
7	electr* nicotine*.mp.	7364	
8	(vape or vaper or vapers or vaping).mp.	8166	
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	21949	
10	(adverse* adj2 (effect* or reaction* or event*)).ti,ab.	1131606	
11	'side effect*'.ti,ab.	684748	
12	exp *Drug-Related Side Effects/	263101	
13	exp *adverse drug reaction/	263101	
14	exp *Drug Hypersensitivity/	57840	
15	exp *drug safety/	52800	
16	exp *Safety/	168439	
17	exp *toxicology/	57524	
18	exp *drug toxicity/	134711	
19	exp *Toxicity/	274460	
20	exp *sensitization/	23304	
21	(safe* or toxic*).ti.	784931	
22	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21	2835191	
23	9 and 22	1694	
24	remove duplicates from 23	1034	
25	limit 24 to yr="2019 -Current"	505	
26	("Conference Abstract" or editorial or letter or comment).pt,sh.	8020114	
27	25 not 26	392	e-cig safety/tox
28	systematic review.pt,sh.	466046	
29	9 and 28	362	
30	remove duplicates from 29	295	
31	limit 30 to yr="2019 -Current"	182	
32	31 not 26	151	ecig systematic reviews
33	27 or 32	524	
34	remove duplicates from 33	523	

Appendix C: Toxicological assessment data for chemicals identified as being use in e-cigarettes

The EPT dataset did not distinguish where data on a chemical was not available because a toxicological assessment had not been completed or due to the chemical not being identified as a hazard/risk to health. As such, a dash "-" was used to report where information was not available.

Table 3: Summary of health risks for chemicals known to be currently used in e-cigarettes based on toxicological assessment data

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethyl maltol | ETHYL HYDROXYPYRONE | 2-ethyl-3-hydroxy-4-pyrone | 4H-Pyran-4-one, 2-ethyl-3-hydroxy- | 4H-PYRAN-4-ONE,2ETHYL-3-HYDROXY- | 2-Ethyl-3-hydroxy-4H-pyran-4-one | 2-Ethylpyromeconic acid	4940-11-8	-	-	Respiratory irritation Cytotoxicity	May be used as food additive (tabletop sweetener)	-
4-Acetylanisole | Acetanisole | METHOXYACETOPHENONE | 4'-methoxyacetophenone | Ethanone, 1-(4-methoxyphenyl)- | 1-(4-METHOXYPHENYL)ETHANON	100-06-1	-	-	-	-	Permitted for use only: (a) in topical medicines for dermal application; and (b) in oral medicines in combination with other permitted ingredients as part of a flavour proprietary excipient formulation. When used in a flavour, the total flavour proprietary excipient formulation in a medicine must be no more than 5%.

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Benzene, ethyl-; Ethylbenzene | ethyl benzene (R1) | Ethylbenzene | Benzene, ethyl | Benzene, ethyl- | Ethylbenzene | HYDROCARBONS LIQUID AROMATIC | HYDROCARBONS, LIQUID | ETHYLBENZEN | ETYLBENZEN | Ethylbenzol | Phenylethane	100-41-4	Yes (may be fatal)	-	• Causes serious eye irritation • Causes skin irritation • May be fatal if swallowed • May cause damage to organs through prolonged or repeated exposure • Possibly Carcinogenic • Developmental • Hepatic • Urinary • Acute Toxicity • Aspiration Hazard	-	-
Styrene; Benzene, ethenyl- | Styrene | styrene (R1) | Benzene, ethenyl- | Styrene | Styrene, monomer ;Phenylethylene; Vinyl benzene; |STYREN | Styrene, monomer | Ethenyl benzene | Phenylethylene | Styrene monomer | Styrol | Vinyl benzene	100-42-5	Yes	-	• Possibly carcinogenic • Neurological • Suspected of damaging the unborn child • Causes damage to the hearing organs through prolonged or repeated exposure • Causes skin irritation • Causes serious eye irritation • Suspected of causing genetic defects • May cause respiratory irritation • May cause drowsiness or dizziness • Acute Toxicity • Low dose endocrine disruption • Hematologic • Hepatic • Nervous	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
benzyl alcohol | Benzenemethanol | BENZYLALKOHOL | BENZENMETANOL | alpha-Hydroxytoluene | Phenylmethanol | 2,6-Octadien-1-ol, 3,7-dimethyl-, 1-acetate, (2E)- | 2,6-Octadien-1-ol,3,7-dimethyl-,acetate, (E)- | Acetic acid geraniol ester | Geranyl acetate | trans-3,7-Dimethyl-2,6-octadien-1-yl acetate	100-51-6	Yes	Suspected	• Harmful if swallowed • Causes serious eye irritation • Acute Toxicity	May be used as food additive (flavouring)	-
benzaldehyde | BENZALDEHYD	100-52-7	Yes	-	• Harmful if swallowed • Gastrointestinal • Urinary • Acute Toxicity	-	-
α,α-Dimethylphenethyl butyrate | alpha,alpha-Dimethylphenethyl butyrate | DIMETHYL PHENETHYL BUTYRATE | a,a-dimethylphenethyl butyrate | Butanoic acid, 1,1-dimethyl-2-phenylethyl ester | DIMETYL-2-FENYLETYLBUTANAT, 1,1- | Benzyldimethylcarbinyl butyrate	10094-34-5	-	-	Suspected skin sensitiser	-	-
Benzene, (2,2-dimethoxyethyl)- | Phenylacetaldehyde dimethyl acetal | 1,1-dimethoxy-2-phenylethane | 1,1-DIMETHOXY-2-PHENYLETHAN | BENZEN,(2,2-DIMETHOXYETHYL)- | Phenylacetaldehyde dimethyl acetal	101-48-4	-	-	• Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Octanal, 2-(phenylmethylene)- | α-Hexyl-cinnamaldehyde | 2-Benzylideneoctanal | alpha-Hexylcinnamaldehyde | HEXYL CINNAMAL | 2 -Benzylideneoctanal | a-hexylcinnamaldehyde | HEXYL CINNAMALDEHYDE | ALPHA.-HEXYLKANELALDEHYD | OKTANAL,2-(FENYLMETYLEN)- | .alpha.-Hexylcinnamaldehyde alpha-Hexylzimtaldehyd | Octanal, 2-(phenylmethylene)-	101-86-0	-	-	• Causes skin irritation • Suspected skin sensitiser	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Ethyl phenylacetate | Benzeneacetic acid, ethyl ester	101-97-3	-	-	-	-	-
Glycerol 1,2-diacetate | 1,2,3-propanetriol, 1,2-diacetate | 1,2-DIACETIN	102-62-5	-	-	-	-	-
Methyl cinnamate | 2-Propenoic acid, 3-phenyl-, methyl ester | PROPENOIC 2- ACIID, 3-PHENYL-, METHYLESTER	103-26-4	-	-	-	-	-
Ethyl cinnamate | 2-Propenoic acid, 3-phenyl-, ethyl ester | FENYL-2-PROPENSYREETYLESTER, 3-	103-36-6	-	-	-	-	-
Benzyl cinnamate | 2-Propenoic acid, 3-phenyl-, phenylmethyl ester | PROPENOIC ACID, 3-PHENYL-, PHENYLMETHYL ESTER | Cinnamic acid, benzyl ester	103-41-3	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1-Naphthalenol, 1,2,3,4,4a,5,8,8a-octahydro-2,2,6,8-tetramethyl- | OCTAHYDRO-TETRAMETHYL-1-NAPHTHALENOL | (1R,4aS,8R,8aS)-2,2,6,8-tetramethyl-1,2,3,4,4a,5,8,8a-octahydronaphthalen-1-ol | NAPHTHALENOL, 1-, 1,2,3,4,4A,5,8,8A-OCTAHYDRO-2,2,6,8-TETRAMETHYL	103614-86-4	-	-	-	-	-
4-Anisyl acetate | p-Anisyl acetate | p-methoxybenzyl acetate | Benzenemethanol, 4-methoxy-, 1-acetate | ANISYL ACETATE | BENZENEMETHANOL, 4-METHOXY-, ACETATE | | Anisyl acetate	104-21-2	-	-	-	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Anethol | Anethole | Benzene, 1-methoxy-4-(1-propen-1-yl)- | 1-METHOXY-4-(1-PROPENYL) BENZEN | Benzene, 1-methoxy-4-(1-propenyl)- | BENZEN, 1-METOKSY-4-(1-PROPENYL)- | 1-Methoxy-4-propenylbenzene | Anise Camphor | p-Propenylanisole | Anisole, p-propenyl- | p-Methoxypropenylbenzene	104-46-1	-	-	• Suspected carcinogen • Suspected skin sensitiser	-	Permitted for use only in combination with other permitted ingredients as a flavour. If used in a flavour the total flavour concentration in a medicine must be no more than 5%.
ɣ-Octalactone | gamma-Octalactone | Octan-4-olide | 2(3H)-Furanone, 5-butyldihydro-	104-50-7	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Propenal, 3-phenyl- | Cinnamaldehyde | CINNAMAL | 2 -Propenal, 3-phenyl- | Cinnamaldehyde/3-phenyl-propen-2-al(Cinnamic aldehyde) | ACROLEIN | 3-PHENYL-2-PROPENAL | Sinnamaldehydi | PROPENAL,2-, 3-FENYL- | | trans-Cinnamaldehyde	104-55-2	-	-	• Harmful in contact with skin • Causes skin irritation • Causes serious eye irritation • May cause an allergic skin reaction • May cause respiratory irritation	-	-
ɣ-Nonalactone | gamma-Nonalactone | Nonan-4-olide | 2(3H)-Furanone, dihydro-5-pentyl- | Dihydro-5-pentyl-2(3H)-furanone | FURANON, DIHYDRO-5-PENTYL-2(3H)- | gamma-n-Amylbutyrolactone | gamma.-Nonalactone	104-61-0	-	-	-	-	-
ɣ-Undecalactone | 5-Heptyloxolan-2-one | gamma-Undecalactone | Undecan-4-olide | 2(3H)-Furanone, 5-heptyldihydro- | FURANON, 5-HEPTYLDIHYDRO-2(3H)- | 5-Heptyldihydro-2(3H)-furanone | gamma-n-Heptylbutyrolactone | 4-Hydroxyundecanoic acid lactone | Aldehyde C-14 | gamma.-n-Heptylbutyrolactone | Peach lactone | (RS)-. gamma.-Undecalactone | Undecanoic acid, 4-hydroxy-,.gamma.-lactone	104-67-6	-	-	-	-	-
p-Tolualdehyde | p-Tolylaldehyde | 4-METHYLBENZALDEHYDE | Benzaldehyde, 4-methyl- | TOLUALDEHYDE, P- | 4-METHYLBENZALDEHYD | p-Formyltoluene	104-87-0	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Benzenemethanol, 4-methoxy- | Anise alcohol | Anisyl alcohol | 4 -Methoxybenzyl alcohol | 4-METHOXYBENZYLALKOHOL	105-13-5	-	-	• Harmful if swallowed • Causes serious eye irritation • May cause an allergic skin reaction	-	-
ɣ-Heptalactone | gamma-Heptalactone | Heptan-4-olide | 2(3H)-Furanone, dihydro-5-propyl-	105-21-5	-	-	-	-	-
ethyl propionate | Ethyl propanoate | Propanoic acid, ethyl ester | OMEGA-3-ACID ETHYL ESTERS | ETHYLPROPIONAT | ETYLPROPANAT | Ethyl ester propanoic acid | Ethyl propiomate	105-37-3	-	-	• Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Diethyl malonate | Propanedioic acid, 1,3-diethyl ester | DIETHYLMALONAT | Dietyylimalonaatti | MALONSYREDIETYLESTER	105-53-3	-	-	-	-	-
Ethyl butyrate | Ethyl butanoate | Butanoic acid, ethyl ester | ETHYLBUTYRAT | ETYLBUTYRAT (C6H12O2) | Ethyl ester butanoic acid	105-54-4	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1,1-diethoxyethane; acetal | Acetal | 1,1-Diethoxyethane | ACETALDEHYDE DIETHYL ACETAL | Ethane, 1,1-diethoxy- | 1,1-diethoxyethane; acetal | 1,1-DIETHOXYETHAN | DIETOKSYETAN, 1,1- | Acetal	105-57-7	-	-	• Causes serious eye irritation • Causes skin irritation • Suspected skin sensitiser • Suspected toxic for reproduction	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Geranyl acetate | 2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (E)- | 2,6-Octadien-1-ol, 3,7-dimethyl-, 1-acetate, (2E)- | OKTADIEN-1-OL,3,7-DIMETYL-,ACETAT,(E),2,6- | Citronellyl acetate	105-87-3	-	-	-	-	-
Geranyl propionate | 2,6-Octadien-1-ol, 3,7-dimethyl-, propanoate, (E)- | 2,6-Octadien-1-ol, 3,7-dimethyl-, 1-propanoate, (2E)- | PROPANOATE,2,6-OCTADIEN-OL, 3,7-DIMETHYL-,	105-90-8	-	-	Suspected skin sensitiser	-	-
Citronellol | 6-Octen-1-ol, 3,7-dimethyl- | dl-Citronellol | Citronellol /+ - 3,7-dimethyloct-6-en-1-ol | OKTEN-1-OL,3,7-DIMETYL, 6- | 3,7-Dimethyl-6-octen-1-ol | (.+-.)-.beta.-Citronellol | Cephrol | .beta.-Citronellol | (+-). Beta.-Citronellol | 6-Octen-1-ol, 3,7-dimethyl-, (3S)- | 6-Octen-1-ol, 3,7-dimethyl-, (S)- | L-Citronellol | (S)-(-)-beta-Citronellol	106-22-9	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Isoamyl butyrate | Isopentyl butyrate | Butanoic acid, 3-methylbutyl ester | 3-methylbutyl butyrate | 3-METHYLBUTYLBUTYRAT | BUTANOIC ACID , 3-METHYLBUTYL ESTER	106-27-4	-	-	Suspected skin sensitiser	-	-
Geranyl butyrate | Butanoic acid, 3,7-dimethyl-2,6-octadienyl ester, (E)- | Butanoic acid, (2E)-3,7-dimethyl-2,6-octadien-1-yl ester | BUTANOIC ACID, 3,7-DIMETHYL-2,6-OCTA-DIENYL ESTER (E-)	106-29-6	-	-	Suspected skin sensitiser	-	-
Ethyl heptanoate | Heptanoic acid, ethyl ester | Ethyl enantate | OMEGA-3-ACID ETHYL ESTERS | HEPTANOIC ACID , ETHYL ESTER	106-30-9	-	-	Suspected skin sensitiser	-	-
Ethyl caprylate | Octanoic acid, ethyl ester | Ethyl octanoate | OMEGA-3-ACID ETHYL ESTERS | Caprylic acid ethyl ester | Ethyl n-octanoate	106-32-1	-	-	Suspected skin sensitiser	-	-
p-cresol [1] ; o-cresol [2]; p-cresol [3]; mix-cresol [4]; Phenol, 4-methyl-; p-cresol; o-cresol; mix-cresol | p-cresol | Phenol, 4-methyl- | CRESOL, PARA- | Methylphenol | CRESOLS | PHENOLS | 4-Methylphenol | p-cresol [3] | KRESOL, p- | p-Cresol | p-Hydroxytoluene | p-Methylphenol | para-Cresol | 4-Cresol | p-Cresylic acid | 1-Hydroxy-4-methylbenzene | 4-Hydroxytoluene | 4-Methyl phenol	106-44-5	-	-	• Suspected carcinogenic, mutagenic, reprotoxic (CMR) • Low dose endocrine disruptor • Toxic if swallowed • Toxic in contact with skin • Causes severe skin burns and eye damage • Acute Toxicity (dermal and oral) • Skin corrosion	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Glyceryl 1-monoacetate | 2,3-dihydroxypropyl acetate | 2,3-DIHYDROXYPROPYLACETAT	106-61-6	-	-	• Suspected mutage • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Methyl hexanoate | Hexanoic acid, methyl ester | METHYL CAPROATE	106-70-7	-	-	-	-	-
Melonal | 2,6-Dimethyl-5-heptenal | DIMETHYL HEPTENAL | DIMETHYLHEPTENAL | 2,6-dimethylhept-5-enal | 5-Heptenal, 2,6-dimethyl- | HEPTENAL, 2,6-DIMETHYL-5-	106-72-9	-	-	• Suspected carcinoge • Suspected skin sensitiser	-	-
Methyl heptanoate | Heptanoic acid, methyl ester	106-73-0	-	-	Suspected skin sensitiser	-	-
1,3-butadiene; buta-1,3-diene | Buta-1,3-diene | 1,3-Butadiene | BUTADIENE | Buta -1,3-diene, see also entries 464-611 | 1,3-Butadiene (h) | Butadiene, 1,3 - | 1,3 Butadiene | 1,3-butadiene; buta-1,3-diene | BUTA-1,3-DIEN | 1,3-butadiene buta-1,3-diene | BUTADIEN, 1,3- | Biethylene | Bivinyl | Divinyl | Erythrene | Vinylethylene	106-99-0	-	-	• Carcinogenic • May cause genetic defects • Suspected of damaging fertility • Suspected of damaging the unborn child • Mutagenic	-	-
acrolein; prop-2-enal; acrylaldehyde | acrolein (R1); acrylaldehyde; prop-2-enal | Acrolein | 2-Propenal | Acrylaldehyde | ACRYLALDEHYD | acrolein prop-2-enal acrylaldehyde | 2-Propen-1-one | Acquinite | Acrylic aldehyde | Allyl aldehyde | Prop-2-en-1-al | Propenal	107-02-8	Yes (fatal)	-	• Causes severe skin burns and eye damage • Fatal if swallowed • Toxic in contact with skin • Carcinogenic • Acute Toxicity (inhalation and dermal) • Skin corrosion	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
allyl alcohol; 2-Propen-1-ol | Allyl alcohol | 2-Propen-1-ol | ALLYLALKOHOL | PROPEN-1-OL, 2- | 1-Propenol-3 | 2-Propene-1-ol | Vinyl carbinol | AA | Allylic alcohol | Propenol | 1-Propen-3-ol | 2-Propenol	107-18-6	Yes (fatal)	-	• Hepatic • Urinary • Toxic if swallowed • Fatal in contact with skin • Causes serious eye irritation • Causes skin irritation • May cause damage to organs through prolonged or repeated exposure • May cause respiratory irritation • Acute Toxicity	-	-
ethanediol; ethylene glycol; 1,2-Ethanediol | Ethylene glycol | 1,2-Ethanediol | Ethane-1,2-diol | Ethylene glycol (ethane-1,2-diol) | ETHYLENGLYCOL | ethanediol ethylene glycol | ETANDIOL, 1,2- | Monoethyleneglycol-Y| MONOETILENOGLICOL GI | 1,2-Dihydroxyethane | Glycol alcohol | Monoethylene glycol	107-21-1	-	-	• Urinary • Harmful if swallowed • May cause respiratory irritation • Carcinogenic • Endocrine disruption • Mutagenic • Toxic for reproduction	-	-
Glyoxal | Ethanedial | | ETANDIAL | Biformyl | Diformyl | Oxaldehyde	107-22-2	Yes	-	• Harmful if swallowed • Suspected of causing genetic defects • Causes serious eye irritation • May cause allergic skin reaction • Causes skin irritation • Mutagenic • Acute toxicity • Skin sensitisation	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Acetylpyrrole | Methyl 2-pyrrolyl ketone | 1-(1H-pyrrol-2-yl)ethan-1-one | Ethanone, 1-(1H-pyrrol-2-yl)-	1072-83-9	-	-	• Suspected carcinogen • Suspected mutagen	-	-
ɣ-Valerolactone | 2(3H)-Furanone, dihydro-5-methyl- | gamma-Valerolactone | 4-hydroxy pentanoic acid	108-29-2	-	-	• Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
m-cresol |o-cresol |p-cresol | mix-cresol | Phenol, 3-methyl- | Methylphenol | CRESOLS | PHENOLS | KRESOL, m- | Cresol (all isomers) | 1-Hydroxy-3-methylbenzene | 3-Cresol | 3-Methylphenol meta-Cresol | m-Cresylic acid | 3-Hydroxytoluene | 3-Methyl phenol	108-39-4	-	-	• Nervous • Toxic if swallowed • Toxic in contact with skin • Causes severe skin burns and eye damage • Acute Toxicity (dermal and oral) • Skin corrosion	-	-
2,6-Dimethylpyridine | 2,6-Dimethylpyridine; 2,6-Lutidine | Pyridine, 2,6-dimethyl- | 2,6-DIMETHYLPYRIDIN	108-48-5	-	-	• Suspected acutely toxic via the inhalation route • Suspected carcinogen	-	-
Ethyl isovalerate | Butanoic acid, 3-methyl-, ethyl ester | EHTYL ISOVALERATE	108-64-5	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Toluene | Benzene, methyl- | toluene; methylbenzene | HYDROCARBONS LIQUID AROMATIC | HYDROCARBONS, LIQUID | TOLUEN | Toluol | Methyl benzene | Methyl benzol | Phenyl methane	108-88-3	Yes (may be fatal)	-	• Carcinogenic • Mutagenic • Toxic for reproduction • Nervous • Urinary • Neurological • Immunological • Causes skin irritation • May cause damage to organs through prolonged or repeated exposure • May damage fertility or the unborn child • May cause drowsiness or dizziness • May be fatal if swallowed • Aspiration Toxicity	-	-
Phenol |carbolic acid |monohydroxybenzene | phenylalcohol | Phenol | phenol carbolic acid monohydroxybenzene phenylalcohol | FENOL | Hydroxybenzene | Monohydroxybenzene | Phenyl alcohol | Phenyl hydroxide	108-95-2	Yes	-	• Suspected mutagenic • Suspected of causing genetic defects • Toxic if swallowed • Toxic in contact with skin • May cause damage to organs through prolonged or repeated exposure • Causes severe skin burns and eye damage • Acute Toxicity (inhalation, dermal and oral) • Skin corrosion	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Methylpyrazine | Pyrazine, methyl- | Pyrazine, 2-methyl-	109-08-0	-	-	-	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Butyl isovalerate | Butanoic acid, 3-methyl-, butyl ester | BUTYL-3-METYLBUTANAT	109-19-3	-	-	Suspected skin sensitiser	-	-
Isobutyl acetate| Acetic acid, 2-methylpropyl ester | Isobutyle acetate | 2-Methylpropyl acetate | Acetic acid, 2-methylpropyl ester | ISOBUTYLACETAT | METYLPROPYLACETAT, 2- | Butyl acetate | Acetic acid, isobutyl ester | Isobutyl ester of acetic acid | 2-Methylpropyl ester of acetic acid | beta-Methylpropyl ethanoate	110-19-0	-	-	• May cause drowsiness or dizziness • Repeated exposure may cause skin dryness and cracking	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
n-hexane | Hexane | HEXAN | HEKSAN, n- | Diethylmethylmethane | Diisopropyl | 2,2-Dimethylbutane | 2,3-Dimethylbutane | Isohexane | 2-Methylpentane | 3-Methylpentane | Hexyl hydride | normal-Hexane	110-54-3	Yes (may be fatal)	-	• Nervous • Causes skin irritation • Suspected of damaging fertility/Reproductive • May cause drowsiness or dizziness • May cause damage to organs through prolonged or repeated exposure • May be fatal if swallowed • Aspiration toxicity • Low dose endocrine disruption	-	-
Pentanal | Valeraldehyde | 1-Pentanal | n-Valeraldehyde | Amyl aldehyde | Valeral | Valeric aldehyde	110-62-3	Yes	-	• Causes skin irritation • May cause respiratory irritation • May cause an allergic skin reaction • Causes serious eye irritatiion	-	-
Propyl isocyanate | Propane, 1-isocyanato-	110-78-1	-	-	• Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	-	-
cyclohexane | CYCLOHEXAN | CYKLOHEKSAN | Hexahydrobenzene | Hexamethylene | Hexanaphthene | Benzene hexahydride	110-82-7	Yes (may be fatal)	-	• May be fatal if swallowed • Causes skin irritation • May cause drowsiness or dizziness • Aspiration toxicity	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
pyridine | PYRIDIN | Azabenzene | Azine	110-86-1	Yes	-	• Hepatic • Possibly carcinogenic • Harmful if swallowed • Harmful in contact with skin • Causes severe skin burns and eye damage • May cause damage to organs through prolonged or repeated exposure • Acute toxicity (inhalation, dermal and oral)	-	-
Methylheptenone | 6-Methyl-5-hepten-2-one | Hept-5-en-2-one, 6-methyl- | 6-methylhept-5-en-2-one | 5-Hepten-2-one, 6-methyl- | HEPTEN-2-ONE, 6-METHYL-5- | Methyl isohexenyl ketone | 6-Methyl-5-hepten-2-one	110-93-0	-	-	-	-	-
Butyl hexadecanoate | BUTYL PALMITATE | Hexadecanoic acid, butyl ester	111-06-8	-	-	Suspected skin sensitiser	-	-
Folione | 2-Octynoic acid, methyl ester | Methyl 2-octynoate | Methyl 2 -Octynoate | Methyl oct-2-ynoate | Methyl heptine carbonate	111-12-6	-	-	• Suspected skin irritant • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
1-Hexanol | hexan-1-ol | Hexyl alcohol | HEXANOL (C6) | HEKSANOL, 1- | n-Hexanol | Hexanol, branched and linear | n-Hexyl alcohol	111-27-3	-	-	• Harmful if swallowed • Causes serious eye irritation • Causes skin irritation • Acute toxicity	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2,2' -oxybisethanol | diethylene glycol | Ethanol, 2,2'-oxybis- | 2,2' -oxydiethanol Diethylene glycol (DEG) | diethylene glycol esterified | Diethylene glycol ester of disproportionated rosin | Disproportionated rosin | diethylene glycol ester | Rosin | urea | formaldehyde condensate | 2,2'-oxydiethanol | 2,2'-Oxybis[ethanol] | Ethanol, 2,2'-oxybis- | 2,2' -oxybisethanol diethylene glycol | DIETYLENGLYKOL | 2,2'-Oxybis[ethanol]	111-46-6	-	-	• Suspected carcinogenic, mutagenic, reprotoxic (CMR) • Harmful if swallowed • Acute toxicity	-	Only for use in topical medicines for dermal application and not to be included in medicines intended for use The concentration in the medicine must be no more than 5%.in the eye.
Glutaric acid, dimethyl ester | Pentanedioic acid, dimethyl ester | Pentanedioic acid, 1,5-dimethyl ester | DIMETHYL GLUTARATE | PENTANDISYREDIMETHYLESTER | Dimetyyliglutaraatti | DIMETYLPENTANDIOAT	1119-40-0	-	-	Potential endocrine disruptor	-	-
3-Ethenylpyridine	1121-55-7	-	-	-	-	-
Decyl acetate | Acetic acid, decyl ester | DECYLACETAT | EDDIKSYRE, DECYL ESTER	112-17-4	-	-	Suspected skin sensitiser	-	-
2-Acetylpyridine | Ethanone, 1-(2-pyridinyl)- | 2-ACETYLPYRIDIN	1122-62-9	-	-	-	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Triethylene glycol | Ethanol, 2,2'-[1,2-ethanediylbis(oxy)]bis- | Triethyleneglycol | 2,2'-(ethylenedioxy) diethanol | Ethanol, 2,2'-[1,2-ethanediylbis(oxy)] bis- | 2,2'-(ETHYLENDIOXY)DIETHANOL | Etyleenidioksi)dietanoli | TRIETYLENGLYKOL | Ethanol, 2,2'-(1,2-ethanediylbis(oxy)bis-	112-27-6	-	-	-	-	-
n-Decanal | 1-Decanal | Decanal | Decaldehyde | DEKANAL | Aldehyde C10 | Capric aldehyde | Decyl aldehyde | Aldehyde C-10 | n-Decyl aldehyde	112-31-2	-	-	-	-	-
2-(2-butoxyethoxy)ethanol | diethylene glycol monobutyl ether | butyl carbitol | Diethylene glycol mono butyl ether [2-(2-buthoxyethoxy) ethanol]| 2-(2-butoxyethoxy)ethanol | Ethanol, 2-(2-butoxyethoxy)- | Diethylene glycol monobutyl ether | BUTOXYDIGLYCOL | Diethylene glycol monobutyl ether (DEGBE) | Ethanol, 2-(butoxyethoxy)- | Diethylene glycol mono-N-butyl ether | 2-(2-butoxyethoxy) ethanol (DEGBE) | 2-(2-butoxyethoxy) ethanol | BUTYLDIGLYCOL | 2-(2-butoxyethoxy)ethanol diethylene glycol monobutyl ether | BUTOKSYETOKSY) ETANOL, 2-(2- | Diethylene glycol monobutyl ether | Diglycol monobutyl ether | Ethanol, 2,2'-oxybis-, monobutyl ether | O-Butyl diethylene glycol	112-34-5	-	-	Causes serious eye irritation	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Diethyl carbitol | Diethylene glycol diethyl ether | DIETHOXYDIGLYCOL | Bis(2-ethoxyethyl) ether | Ethane, 1,1'-oxybis[2-ethoxy- | DIETHYLENE GLYCOL | DIETHYLENGLYCOLDIETHYLETHER | bis((2-ethoxyethyl) ether	112-36-7	-	-	-	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Methyl hexadecanoate | Hexadecanoic acid, methyl ester | METHYL PALMITATE | HEXADECANSYRE METHYLESTER | Palmitic acid, methyl ester	112-39-0	-	-	-	-	-
Dodecane | n-Dodecane | DODECAN | Dodekaani	112-40-3	-	-	-	-	-
2,3,5,6-Tetramethylpyrazine | TETRAMETHYLPYRAZINE | Pyrazine, 2,3,5,6-tetramethyl- | Pyrazine, tetramethyl-	1124-11-4	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen	-	Permitted for use only in combination with other permitted ingredients as a flavour. If used in a flavour the total flavour concentration in a medicine must be no more than 5%.
1,2-bis(2-methoxyethoxy)ethane | triethylene glycol dimethyl ether | triglyme | Methyltriglyme | 2,5,8,11-Tetraoxadodecane | Triethylene glycol dimethyl ether | 2,5,8,11-Tetraoxadodecane | 1,2 -Bis(2-methoxyethoxy)ethane | 1,2-bis(2-methoxyethoxy)ethane (TEGDME; triglyme)	112-49-2	-	-	• May damage unborn child • Suspected of damaging fertility • Toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethoxytriglycol | Triethylene glycol, monoethyl ether | 2-(2-(2-ethoxyethoxy) ethoxy)ethanol | Ethanol, 2-[2-(2-ethoxyethoxy)ethoxy]- | Triethylene glycol monoethyl ether | ETANOL,2-(2-(2-ETOKSYETOKSY) ETOKSYL)- | 3,6,9-Trioxaundecan-1-ol | Triethylene glycol ethyl ether	112-50-5	-	-	-	-	-
1-Dodecanol | Dodecan-1-ol | Lauryl alcohol | Dodekan-1-oli | LAURYLALKOHOL | 1-Hydroxydodecane | Alcohol, C12 | Dodecyl alcohol	112-53-8	-	-	-	-	Permitted for use only: (a) in topical medicines for dermal application; and (b) in oral medicines in combination with other permitted ingredients as part of a flavour proprietary excipient formulation. When used in a flavour, the total flavour proprietary excipient formulation in a medicine must be no more than 5%.
Tetraethylene glycol | Ethanol, 2,2'-[oxybis(2,1-ethanediyloxy)]bis- | 3,6,9-trioxaundecane-1,11-diol | Ethanol, 2,2'-[oxybis(2,1-ethanediyloxy)]bis- | POLYOXYETHYLENE(MW 200) | TETRAETHYLENGLYCOL | ETANOL,2,2'-(OXYBIS(2,1-ETANDIYLOXY))BIS- | alpha-Hydro-omega-hydroxypoly(oxy-1,2-ethanediyl) | Glycols, polyethylene	112-60-7	-	-	-	Yes May be used as food additive (processed meat, poultry and game products in whole cuts or pieces)	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Methyl octadecanoate | Octadecanoic acid, methyl ester | METHYL STEARATE | Stearic acid, methyl ester	112-61-8	-	-	-	-	-
Lauryl acetate | Acetic acid, dodecyl ester | Dodecyl acetate	112-66-3	-	-	Suspected skin sensitiser	-	-
Caryophyllene oxide | [1R-(1R*,4R*,6R*,10S*)]-4,12,12-trimethyl-9-methylene-5-oxatricyclo[8.2.0.04,6]dodecane | 5-Oxatricyclo[8.2.0.04,6]dodecane, 4,12,12-trimethyl-9-methylene-, [1R-(1R,4R,6R,10S)]- | BETA-CARYOPHYLLENE OXIDE | 5-Oxatricyclo[8.2.0.04,6]dodecane, 4,12,12-trimethyl-9-methylene-, (1R,4R,6R,10S)- | 5-OXATRICYCLO(8.2.0.04,6)DODECANE, 4,12,12-TRIMETHYL-9-METHYLENE-, (1R-(1R*,4R*,6R*,10S*))- | Caryophyllene oxide	1139-30-6	-	Suspected	• Suspected bioaccumulative • Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
1,6-Octadien-3-ol, 3,7-dimethyl-, acetate | Linalyl acetate | Linalylacetate | 1,6-Octadien-3-ol, 3,7-dimethyl-, 3-acetate | 3,7-DIMETHYL-1,6-OCTADIEN-3-YLACETAT | OKTADIEN-3-OL,3,7-DIMETYL-,ACETAT, 1,6 | Linalool acetate	115-95-7	-	-	• Causes skin irritation • May cause an allergic reaction	-	-
Hydroxyacetone | 2-Propanone, 1-hydroxy- | 1-HYDROXY-2-PROPANON	116-09-6	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester | bis(2-ethylhexyl) phthalate | di-(2-ethylhexyl) phthalate | Diethylhexyl phthalate (DEHP) | 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester | Phthalic acid, bis(2-ethylhexyl) ester | Bis(2-ethylhexyl) 1,2-benzenedicarboxylate | Bis(2-ethylhexyl) o-phthalate | Di-2-ethylhexyl-phthalate | Ethylhexyl phthalate | Dioctyl phthalate | Di(isooctyl) phthalate | Octyl phthalate | Di-sec-octyl phthalate| 1,2-bis(2-ethylhexyl) ester | Di(2-ethylhexyl) phthalate bis(2-ethylhexyl) phthalate; di-(2-ethylhexyl) phthalate; DEHP | Di-(2-ethylhexyl) phthalate | Bis(2-ethylhexyl) benzene-1,2-dicarboxylate | DI(2-ETHYLHEXYL)PHTHALAT | bis(2-ethylhexyl) phthalate di-(2-ethylhexyl) phthalate | BENZENDIKARBOKSYLSYRE 1,2-, BIS(2-ETYLHEKSYL)ESTER | Bis(n-octyl) phthalate | Dioctyl o-benzenedicarboxylate | Dioctyl phthalate (DOP)| Benzenedicarboxylic acid, dioctyl ester | Phthalic acid dioctyl ester | 1,2-Benzenedicarboxylic acid, dioctyl ester | 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) | 2-Ethylhexyl phthalate | bis-(2-Ethylhexyl) phthalate	117-81-7	-	-	• Possibly carcinogenic • Hepatic • May cause cancer • May damage fertility • May damage the unborn child • Low dose endocrine disruption	-	-
Benzoic acid, 2-hydroxy-, phenylmethyl ester | Benzyl salicylate | BENZYLSALICYLAT | BENZOSYRE,2-HYDROKSY, FENYLMETYL ESTER	118-58-1	-	-	• Causes serious eye irritation • May cause an allergic reaction • Low dose endocrine disruption	May be used as food additive (preparations of food additives)	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethyl salicylate | Benzoic acid, 2-hydroxy-, ethyl ester	118-61-6	-	-	• Suspected acutely toxic via the oral route • Suspected mutagen • Suspected skin irritant • Suspected toxic for reproduction	-	-
Maltol | 3-hydroxy-2-methyl-4-pyrone | 4H-Pyran-4-one, 3-hydroxy-2-methyl- | PYRAN-4-ONE, 3-HYDROXY-2-METHYL-4H- | 2-Methyl-3-hydroxypyran-4-one | 3-Hydroxy-2-methyl-.gamma.-pyrone | Veltol	118-71-8	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	May be used as food additive (tabletop sweetener)	-
Methyl salicylate | Benzoic acid, 2-hydroxy-, methyl ester | METHYL SALICYLATE LIQUID | METHYLSALICYLAT | Metyylisalisylaatti | METYLSALICYLAT | 2-Hydroxybenzoic acid, methyl ester	119-36-8	-	-	Suspected carcinogenic, mutagenic, reprotoxic (CMR)	-	-
Methanone, diphenyl- | Benzophenone | BENZOPHENON | DIFENYLMETANON	119-61-9	-	-	• Suspected carcinogenic, mutagenic, reprotoxic (CMR) • Suspected of causing cancer • Low dose endocrine disruption	-	-
2H-1-Benzopyran-2-one, 3,4-dihydro- | 3,4-Dihydrocoumarin | Dihydrocoumarin	119-84-6	-	Suspected	• Harmful if swallowed • May cause an allergic skin reaction • Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Veratraldehyde | 3,4-Dimethoxybenzaldehyde | Benzaldehyde, 3,4-dimethoxy- | 3,4-DIMETHOXYBENZALDEHYD | BENZALDEHYD, 3,4-DIMETOKSI-	120-14-9	-	-	• Suspected toxic via the oral route • Suspected carcinogen • Respiratory irritation	-	-
Styrallyl propionate | alpha-Methylbenzyl propionate | STYRALYL PROPIONATE | 1-phenylethyl propionate | Benzenemethanol, .alpha.-methyl-, 1-propanoate | Benzenemethanol, .alpha.-methyl-, propanoate | alpha-Methylbenzyl propionate	120-45-6	-	-	Suspected skin sensitiser	-	-
Isobutyl benzoate | Benzoic acid, 2-methylpropyl ester	120-50-3	-	-	-	-	-
benzyl benzoate | Benzoic acid, phenylmethyl ester | BENZYLBENZOAT | FENYLMETYLBENZOAT | Benylate | Benzoic acid, benzyl ester | Benzyl phenylformate	120-51-4	-	-	• Harmful if swallowed • Acute Toxicity	-	-
Piperonal | 1,3-Benzodioxole-5-carboxaldehyde | HELIOTROPINE | 1,3-Benzodioxole-5-carboxaldehyde | 3,4-(METHYLENDIOXY)BENZALDEHYD | BENZODIOKSOL-5-KARBOKSALDEHYD, 1,3- | 3,4-Dihydroxybenzaldehyde methylene ketal | 3,4-(Methylenedioxy)benzaldehyde | 5-Formyl-1,3-benzodioxole | Dioxymethylene protocatechuic aldehyde | Piperonaldehyde | Protocatechuic aldehyde methylene ether	120-57-0	-	-	-	-	-
Dimethyl terephthalate | 1,4-Benzenedicarboxylicacid,dimethylester | Dimethyl terephthalate (DMT) | 1,4-Benzenedicarboxylic acid, 1,4-dimethyl ester | DIMETHYLTEREPHTHALAT | DIMETYLTEREFTALAT	120-61-6	-	-	Urinary	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1,2-Benzenediol | pyrocatechol | 1,2-dihydroxybenzene | Catechol | o-Dihydroxybenzene | Benzene-1,2-diol | 1,2-dihydroxybenzene pyrocatechol | BENZENDIOL, 1,2- | Pyrocatechine | o-Benzenediol | o-Dihydroxybenzene | 2-Hydroxyphenol	120-80-9	-	-	• Toxic if swallowed • Toxic in contact with skin • Susptected of causing cancer • Suspected of causing genetic defects • Causes serious eye irritiation • May cause allergic skin reaction • Causes skin irritation • Acute toxicity • Mutagenic	-	-
Ethyl vanillin | 3-ethoxy-4-hydroxybenzaldehyde | Benzaldehyde, 3-ethoxy-4-hydroxy- | 3-ETHOXY-4-HYDROXYBENZALDEHYD | Bentsaldehydi, 3-etoksi-4-hydroksi- | ETOKSI-3-HYDROKSI-4-BENZALDEHYD | Ethylvanillin	121-32-4	-	-	Respiratory irritation	-	-
Vanillin | Benzaldehyde, 4-hydroxy-3-methoxy- | Bentsaldehydi, 4-hydroksi-3-metoksi- | BENZALDEHYD, 4-HYDROKSI-3-METOKSI- | 3-Methoxy-4-hydroxybenzaldehyde | 4-Hydroxy-3-methoxybenzaldehyde | m-Methoxy-p-hydroxybenzaldehyde	121-33-5	-	-	• Irritation • Cytotoxicity • Impaired cell function	-	-
4-Methyl acetophenone | p-Methylacetophenone | Ethanone, 1-(4-methylphenyl)- | METHYL(4-METHYLPHENYL)KETON | METYLFENYL)-ETANON, 1-(4- | 4'-Methylacetophenone	122-00-9	-	-	-	-	-
Benzyl propionate | Propanoic acid, phenylmethyl ester | BENSYLPROPIONAT	122-63-4	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Anisaldehyde | p-Anisaldehyde | p-Methoxybenzaldehyde | Benzaldehyde, 4-methoxy- | 4-METHOXYBENZALDEHYD | BENZALDEHYD, 4-METOKSY- | Aubepine | p-Anisic aldehyde | p-Formylanisole	123-11-5	-	-	-	-	-
Diethyl succinate | Butanedioic acid, 1,4-diethyl ester | BUTANEDIOIC ACID, DIETHYL ESTER | Butanoic acid, diethylester-	123-25-1	-	-	-	-	-
Ethyl nonanoate | Nonanoic acid, ethyl ester | ETHYL PELARGONATE | OMEGA-3-ACID ETHYL ESTERS | Ethyl nonanoate	123-29-5	-	-	Suspected skin sensitiser	-	-
2,5-Dimethylpyrazine | Pyrazine, 2,5-dimethyl-	123-32-0	-	-	• Respiratory irritation • Impaired cell function	-	-
Propanal | Propionaldehyde | Propionic aldehyde | Propylaldehyde	123-38-6	-	-	• Nervous • Causes serious eye irritation • May cause respiratory irritation • Causes skin irritation	-	-
Isopentyl alcohol | 3-Methylbutan-1-ol | Isoamyl alcohol | 1-Butanol, 3-methyl- | METYL-1-BUTANOL, 3- | Fermentation amyl alcohol | Isobutyl carbinol | 3-Methyl-1-butanol | Primary isoamyl alcohol	123-51-3	-	-	-	-	-
Ethyl caproate | Hexanoic acid, ethyl ester | Ethyl hexanoate | OMEGA-3-ACID ETHYL ESTERS	123-66-0	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction • Respiratory irritation	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Hexanoic acid, 2-propenyl ester | Allyl caproate | Allyl hexanoate | Hexanoic acid, 2-propen-1-yl ester | HEXANSYRE,2-PROPENYLESTER	123-68-2	-	-	• Toxic if swallowed • Toxic in contact with skin	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
butyraldehyde | Butanal | n-Butanal	123-72-8	-	-	-	-	-
Acetic acid, butyl ester | n-butyl acetate | Butyl acetate | BUTYLACETAT | BUTYLACETAT, n- | 1-Butanol acetate | n-Butyl ester of acetic acid | Butyl ethanoate	123-86-4	-	-	• May cause drowsiness or dizziness • Repeated exposure may cause skin dryness and cracking	-	-
isopentyl acetate | isoamyl acetate | 1-Butanol, 3-methyl-, acetate | 1-Butanol, 3-methyl-, 1-acetate | AMYL ACETATE | 3-METHYLBUTYLACETAT | METYL-1-BUTYLACETAT, 3- | Amyl acetate (iso-, n- & sec- isomers) | 3-Methylbutyl acetate	123-92-2	-	-	-	-	Only for use in: - topical medicines for dermal application; or - combination with other permitted ingredients as a flavour proprietary excipient formulation. The total flavour proprietary excipient formulation in a medicine must not be more than 5%.
Butyl octadecanoate | Octadecanoic acid, butyl ester | Butyl stearate | BUTYLSTEARAT | Stearic acid, butyl ester	123-95-5	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethyl myristate | Tetradecanoic acid, ethyl ester | OMEGA-3-ACID ETHYL ESTERS | ETHYLMYRISTAT | TETRADECANOICACID, ETHYL ESTER | Ethyl tetradecanoate | Myristic acid, ethyl ester	124-06-1	-	-	Suspected skin sensitiser	-	-
Octadecanamide | STEARAMIDE | STEARIC ACID AMIDE	124-26-5	-	-	-	-	-
3-Buten-2-one, 3-methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)- | Isomethyl-α-ionone | alpha-iso-Methylionone | ALPHA-ISOMETHYL IONONE | METHYL IONONES | 3 -Methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-3-buten-2-one | 3-methyl-4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-3-buten-2-one | alpha-Isomethylionone | BUTEN-,3-, 2-ON, 3-METYL-4-(2,6,6-TRIMETYL-2-CYCLOHEKSEN-1-YL)- | alpha-ionone, isomethyl- | Isomethyl-alpha-ionone | Methyl gamma-ionone	127-51-5	-	-	• Causes serious eye irritation • Causes skin irritation • May cause an allergic skin reaction • Suspected carcinogen • Suspected skin sensitiser	-	-
Bicyclo[3.1.1]heptane, 6,6-dimethyl-2-methylene- | β-Pinene | beta-Pinene | Pin-2(10)-ene | Pin-2(10)-eeni | PINEN, beta- | Bicyclo(3.1.1)heptane, 6,6-dimethyl-2-methylene- | (-)-(1S,5S)-beta-pinene | Bicyclo[3.1.1]heptane, 6,6-dimethyl-2-methylene-,(1S,5S)- | (S)-(-)-beta-Pinene | (S)-beta-Pinene	127-91-3	Yes (may be fatal)	-	• May be fatal if swallowed • Causes skin irritation • May cause an allergic skin reaction • Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Butylated Hydroxytoluene (BHT) | 2,6-Di-tert-butyl-p-cresol | 2,6-tert-Butyl-p-cresol | Dibutylhydroxytoluene | Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl- | PHENOLS | Di-tert-butyyli-p-kresoli | HYDROKSYTOLUEN, BUTYLERT | 2,6-Bis(1,1-dimethylethyl)-4-methylphenol | 2,6-Di-tert-butyl-4-cresol | 2,6-Di-tert-butyl-4-methylphenol | Dibutylated hydroxytoluene | 4-Methyl-2,6-di-tert-butyl phenol	128-37-0	-	-	• Carcinogen • Low dose endocrine disruption • Skin sensitiser	May be used as a food additive (edible oils and oil emulsions)	-
POLYCYCLIC AROMATIC HYDROCARBONS | Aromatic hydrocarbons, polycyclic | POLYCYCLISKE AROMATISKE HYDROCARBONER	130498-29-2	-	-	-	-	-
Xylene | Benzene, dimethyl- | Xylene (mixed isomers) | Xylene(s) | XYLENES, TOTAL | HYDROCARBONS LIQUID AROMATIC | HYDROCARBONS, LIQUID | XYLEN | Dimethylbenzene | Xylol | Xylene range aromatic solvent | Xylene range hydrocarbon solvent	1330-20-7	Yes (may be fatal)	-	• Harmful in contact with skin • May cause respiratory irritation • Causes skin irritation • May be fatal if swallowed • Acute toxicity	-	-
Methyl anthranilate | Benzoic acid, 2-amino-, methyl ester | Methyl 2-aminobenzoate | METHYL-2-AMINOBENZOAT | BENZOSYRE, 2-AMINO, METYL ESTER	134-20-3	-	-	• Suspected carcinogen • Suspected mutagen	-	-
Linalool oxide | LINALOOL DIHYDROEPOXIDE	1365-19-1	-	-	• Suspected skin irritant • Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
p-Mentha-1,8(9)-diene|Limonene | Dipentene | trans-1-Methyl-4-(1-methylvinyl)cyclohexene | Cyclohexene, 1-methyl-4-(1-methylethenyl)- | dl-Limonene (racemic) | 1,8(9)-p-Menthadiene | p-Mentha-1,8-diene (Dipentene) | 1-methyl-4-isopropenyl-1-cyclohexane | LIMONEN | dipentene limonene | DIPENTEN | 1-Methyl-4-(1-methyletheny)cyclohexene | 1-Methyl-4-isopropenyl-1-cyclohexene | 1-Methyl-4-isopropenylcyclohexene | 4-Isopropenyl-1-methyl-1-cyclohexene | alpha.-Limonene | Cajeputene | Cinen | Cyclil Decene | Cyclohexene, 4-isopropenyl-1-methyl- | .delta.-1,8-Terpodiene | DL-p-Mentha-1.8-diene | Eulimen | Kautschin | Limonen | Monocyclic terpene hydrocarbons | Nesol | p-Mentha-1,8-diene | p-Mentha-1,8-diene, dl | (+-)-alpha-Limonene | alpha-Limonene | (+-)-Dipentene | dl-Limonene | Orange flavor | d,l-Limonene | p-Mentha-1,8-diene, (.+-.)-| d-Limonene | | d-(+)-Limonene | p-Mentha-1.8-diene, (R)-(+)-| (R)-(+)-Limonene	138-86-3	-	-	• Causes skin irritation • May cause an allergic skin reaction • Skin sensitiser • Suspcected bioaccumulative • Suspected carcinogen	-	-
Benzyl acetate | Benxyl acetate | Acetic acid, phenylmethyl ester | BENZYLACETAT | Bentsyyliasetaatti | EDDIKSYRE,FENYLMETYLESTER	140-11-4	-	-	-	-	-
Phenethyl isovalerate | Butanoic acid, 3-methyl-, 2-phenylethyl ester | BUTANOIC ACID, 3-METHYL-, 2-PHENYLETHYL ESTER	140-26-1	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
4-(1,1,3,3-tetramethylbutyl)phenol | 4-tert-octylphenol | 4-(2,4,4-Trimethylpentan-2-yl)phenol | Phenol, 4-(1,1,3,3-tetramethylbutyl)- | PHENOLS | 4-tert-Octylphenol=1,1,3,3-Tetramethyl-4-butylphenol | 4-(1,1,3,3-tetramethylbutyl)phenol 4-tert-octylphenol | OCTYLPHENOL, p- | (1,1,3,3-Tetramethylbutyl)phenol | Octylphenol | Phenol, (1,1,3,3-tetramethylbutyl)- | tert-Octylphenol	140-66-9	-	-	• Causes skin irritation • Causes serious eye damage • Low dose endocrine disruption	-	-
2-Ethylhexyl fumarate | DIETHYLHEXYL FUMARATE | Bis(2-ethylhexyl) fumarate | 2-Butenedioic acid (2E)-, 1,4-bis(2-ethylhexyl) ester | 2-Butenedioic acid (E)-, bis(2-ethylhexyl) ester | OCTYL FUMARATE | BUTENEDIOIC ACID (E)-, BIS(2-ETHYLHEXYL) ESTER, 2-	141-02-6	-	-	-	-	-
Glycolaldehyde | Glycollaldehyde | Acetaldehyde, hydroxy-	141-46-8	-	-	• Suspected carcinogen • Suspected skin irritant • Suspected skin sensitiser	-	-
Acetic acid| ethyl ester |Ethyl acetate | ethyl acetate | Acetic ester | Acetic acid ethyl ester | ETHYLACETAT | ETYLACETAT | Acetic ester | Ethyl ester of acetic acid | Ethyl ethanoate	141-78-6	-	-	• May cause drowsiness or dizziness • Causes serious eye irritation • Repeated exposure may cause skin dryness and cracking	May be used as a food additive (flavouring)	-
Ethyl acetoacetate | Butanoic acid, 3-oxo-, ethyl ester | Etyyliasetoasetaatti | BUTANSYRE,3-OXO-,ETYLESTER | ETHYLACETOACETAT | Acetoacetic acid, ethyl ester	141-97-9	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
n-Hexanoic acid | Hexanoic acid | CAPROIC ACID | HEXANSYRE | Butylacetic acid | Capronic acid | n-Hexoic acid | Pentylformic acid	142-62-1	-	-	-	-	-
Hexyl acetate | Acetic acid, hexyl ester | HEXYLACETAT | EDDIKSYRE, HEKSYLESTER | Hexanol, acetate, branched and linear | Oxo hexyl acetate	142-92-7	-	-	-	-	-
Tetraethylene glycol dimethyl ether | Bis(2-(2-methoxyethoxy)ethyl)ether | 2,5,8,11,14-Pentaoxapentadecane | PENTAOXAPENTADECANE , 2,5,8,11,14 -	143-24-8	-	-	Toxic for reproduction	-	-
2,3,5-Trimethylpyrazine | TRIMETHYLPYRAZINE | Pyrazine, 2,3,5-trimethyl- | Pyrazine, trimethyl- | PYRAZINE, 2,3,5-TRIMETHYL	14667-55-1	-	-	• Suspected toxic via oral route • Suspected carcinogen	-	Permitted for use only in combination with other permitted ingredients as a flavour. If used in a flavour the total flavour concentration in a medicine must be no more than 5%.
2-sec-Butyl-cyclohexanone | 2-sec-Butylcyclohexanone | 2-sec-butylcyclohexan-1-one | Cyclohexanone, 2-(1-methylpropyl)- | BUTYLCYCLOHEXAN-1-ONE, 2-SEC- | Cyclohexanone, 2-sec-butyl-	14765-30-1	-	-	• Suspected skin sensitiser • Suspected toxic for reporoduction	-	-
Nitrate | NITRAT ION	14797-55-8	-	-	Hematologic	May be used as a food additive (soft cheeses, processed meats, fermented products)	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Menthol | Cyclohexanol, 5-methyl-2-(1-methylethyl)- | d,l-Menthol (isomer unspecified) | DL-menthol | Menthol (unspecified isomer) | 2-ISOPROPYL-5-METHYLCYCLOHEXANOL (USPEC.) | Menttooli | MENTHOL, DL- | l-Menthol | 5-Methyl-2-(1-methylethyl)cyclohexanol | Menthol racemic | (+-)-2-Isopropyl-5-methylcyclohexanol	1490-04-6	-	-	• Respiratory irritation • Cytotoxicity	-	-
p-Dimethoxybenzene | DIMETHYLHYDROQUINONE | 1,4-dimethoxybenzene | Benzene, 1,4-dimethoxy- | BENZENE, 1,4-DIMETOXY- | p-Dimethoxybenzene	150-78-7	-	-	-	-	-
Trifluralin (ISO) | Benzenamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)- | alpha,alpha,alpha-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine | a,a,a -trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine | 2,6-dinitro-N,N-dipropyl-4-trifluoromethylaniline | N,N-dipropyl-2,6-dinitro-4-trifluoromethylaniline | trifluralin (ISO) (containing < 0.5 ppm NPDA)	1582-09-8	-	-	• Hepatic • Hematologic • Suspected of causing cancer • May cause an allergic skin reaction • Skin sensitiser • Suspected bioaccumulative • Suspected mutagen • Suspected toxic for reproduction • Low dose encodrine disruption	-	-
4-Methyl-2-pentyl-1,3-dioxolane | 1,3-Dioxolane, 4-methyl-2-pentyl-	1599-49-1	-	-	• Suspected mutagen • Suspected toxic for reproduction	-	-
p-Orcacetophenone	1634-34-0	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
N-Nitrosonornicotine | N'-Nitrosonornicotine (NNN) and 4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	16543-55-8	-	-	• Suspected/Reasonably anticipated to be carcinogenic • Suspected mutagen	-	-
(E)-2-Methyl-2-pentenoic acid | 2-Pentenoic acid, 2-methyl-, (E)- | 2-Methyl-2-pentenoic acid | TRANS-2-METHYLPENT-2-ENOIC ACID | (E)-2-methylpent-2-en-1-oic acid | 2-METHYL-2-PENTENOIC ACID, TRANS- | 2-Pentenoic acid, 2-methyl-, (2E)-	16957-70-3	-	-	Suspected skin sensitiser	-	Permitted for use only in combination with other permitted ingredients as a flavour. If used in a flavour the total flavour concentration in a medicine must be no more than 5%.
Cuparene | (R)-(+)-p-(1,2,2-trimethylcyclopentyl)toluene | Benzene, 1-methyl-4-(1,2,2-trimethylcyclopentyl)-, (R)-	16982-00-6	-	-	• Suspected bioaccumulative • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
2-Phenyl-1,3-dioxan-5-ol | 1,3-Dioxan-5-ol, 2-phenyl-	1708-40-3	-	-	-	-	-
3-Hexenyl acetate | Hex-3-enyl acetate | 3-Hexen-1-ol, 1-acetate | 3-HEXEN-1-OL, ACETATE	1708-82-3	-	-	• Suspected skin sensitiser • Suspected toxic for reporduction	-	-
MDMB-FUBINACA	1715016-77-5	-	-	-	-	-
1,2-Ethanediol, 1-(hydroxymethoxy)-	1823904-91-1	-	-	-	-	-
α-Decalactone | 2(3H)-Furanone, 3-hexyldihydro- | 3-Hexyldihydrofuran-2(3H)-one | HEXYLDIHYDROFURANONE | ALPHA-HEXYL-GAMMA-BUTYROLACTONE	18436-37-8	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1-(2-Methoxy-1-methylethoxy)-2-propanol | 1-(2-methoxy-1-methylethoxy) propan-2-ol | 2-PROPANOL, 1-(2-METHOXY-1-METHYLETHOXY)- | DIPROPYLENGLYKOLMETYLETER	20324-32-7	-	-	Suspected toxic for reproduction	-	-
Isopentyl isobutyrate | Propanoic acid, 2-methyl-, 3-methylbutyl ester | 3-Methylbutyl 2-methylpropanoate | ISOAMYL ISOBUTYRATE	2050-01-3	-	-	-	-	-
Ethanol, 1-(hydroxymethoxy)-	206360-28-3	-	-	-	-	-
Cocal | 5-Methyl-2-phenyl-2-hexenal | 5-methyl-2-phenylhex-2-enal | Benzeneacetaldehyde, .alpha.-(3-methylbutylidene)-	21834-92-4	-	-	• Suspected carcinogen • Suspected mutagen • Suspected skin irritant • Suspected skin sensitiser	-	-
2-Acetylpyrazine | Acetylpyrazine | METHYL PYRAZINYL KETONE | Ethanone, 1-(2-pyrazinyl)- | Ethanone, 1-pyrazinyl-	22047-25-2	-	-	Respiratory irritation	-	Permitted for use only in combination with other permitted ingredients as a flavour. If used in a flavour the total flavour concentration in a medicine must be no more than 5%.
ɣ-Dodecalactone | gamma-Dodecalactone | Dihydro-5-octylfuran-2(3H)-one | 2(3H)-Furanone, dihydro-5-octyl-	2305-05-7	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Buten-1-one, 1-(2,6,6-trimethyl-1,3-cyclohexadien-1-yl)- | Damascenone | 1-(2,6,6-Trimethylcyclohexa-1,3-dienyl)-2-buten-1-one | ROSE KETONE-4 | Rose ketone -4 (see note 16) 1-(2,6,6-Trimethylcyclohexa-1,3-dien-1-yl)-2-buten-1-one | 1-(2,6,6-trimethyl-1,3-cyclohexadien-1-yl)-2-buten-1-one | 4-(2,6,6-TRIMETHYLCYCLOHEXA-1,3-DIENYL)BUT-2-EN-4-ONE | BUTEN-1-ONE, 1-(2,6,6-TRIMETHYL-1,3-CYCLOHEXADIEN-1-YL)-, 2-	23696-85-7	-	-	• May cause an allergic skin reaction • Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	-	-
2-Buten-1-one, 1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-, (Z)- | β-Damascone | (Z)-beta-1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)-2-buten-1-one | CIS-ROSE KETONE-2 | (Z)1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)-2-buten-1-one (cis-beta-Damascone) | (Z)-1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-2-buten-1-one | 4-(2,6,6-TRIMETHYLCYCLOHEX-1-ENYL)BUT-2-EN-4-ONE | 2-Buten-1-one, 1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-, (2Z)- | TRIMETHYL-1-CYCLOHEXEN-1-YL)-2-BUTEN-1-ONE, (Z)-1-(2,6,6- | beta-Damascone, (Z)-	23726-92-3	-	-	• May cause an allergic skin reaction • Suspected carcinogen • Suspected mutagen • Suspect skin sensitiser	-	-
(R)-(+)-Citronellal | (R)-3,7-dimethyloct-6-enal | 6-Octenal, 3,7-dimethyl-, (3R)- | Citronellal	2385-77-5	-	-	-	-	-
Hedione | Methyl dihydrojasmonate | METHYLDIHYDROJASMONATE | Methyl 3-oxo-2-pentylcyclopentaneacetate | Cyclopentaneacetic acid, 3-oxo-2-pentyl-, methyl ester | Sodium Tetrahydrojasmonate | 3-OXO-2-PENTYLCYCLOPENTANEDDIKESYRE, METHYL ESTER | CYCLOPENTANEDDIKSYRE, 3-OKSO-2-PENTYL-, METYL ESTER	24851-98-7	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Dipropylene glycol | Propanol, oxybis- | Dipropylene glycol (isomer unspecified) | Oxydipropanol | DIPROPYLENGLYCOL | Oksidipropanoli | DIPROPYLENGLYKOL | Propanol, oxybis | 1,1'- oxybis-2-propanol | 2-Propanol, 1,1'-oxybis- | Bis(2-hydroxypropyl) ether	25265-71-8	-	-	-	-	-
Diacetin | 1,2,3-Propanetriol, diacetate | Glycerol 1,3-di(acetate) | GLYCEROL DIACTATE | DIACETIN (USPEC.) | PROPANTRIOL, 1,2,3-, DIACETAT	25395-31-7	-	-	• Suspected mutagen • Suspected toxic for reproduction	-	-
Amyl isovalerate | Butanoic acid, 3-methyl-, pentyl ester | Pentyl isovalerate | Isoamyl isovalerate | n-Pentyl valerate | Pentanoic acid, pentyl ester	25415-62-7	-	-	Suspescted skin sensitiser	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Benzaldehyde propylene glycol acetal | BENZALDEHYDE PROPYLENEGLYCOL ACETAL | 4-methyl-2-phenyl-1,3-dioxolane | 1,3-Dioxolane, 4-methyl-2-phenyl-	2568-25-4	-	-	• Suspected acutely toxic via the oral route • Suspected mutagen	-	-
Hexyl butanoate | Butanoic acid, hexyl ester	2639-63-6	-	-	Suspected skin senitiser	-	-
Glyceryl monocaprate | Decanoic acid, monoester with 1,2,3-propanetriol | GLYCERYL CAPRATE | Decanoic acid, monoester with glycerol | Dodecanoic acid, monoester with 1,2,3-propanetriol | Glycerol monolaurate	26402-22-2	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Dicyclopentenyl alcohol | 3a,4,5,6,7,7a-hexahydro-4,7-methano-1H-indenol | 4,7-Methano-1H-indenol, 3a,4,5,6,7,7a-hexahydro-	27137-33-3	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	-
δ-Tetradecalactone | delta-Tetradecalactone | Tetrahydro-6-nonyl-2H-pyran-2-one | 2H-Pyran-2-one, tetrahydro-6-nonyl-	2721-22-4	-	-	Suspected skin sensitiser	-	-
N'-Nitrosoanatabine (NAT)	2743-90-0	-	-	-	-	-
Homocamfin	28587-71-5	-	-	-	-	-
3-Thujene | 5-isopropyl-2-methylbicyclo[3.1.0] hex-2-ene | Bicyclo[3.1.0]hex-2-ene, 2-methyl-5-(1-methylethyl)-	2867-05-2	-	-	-	-	-
chlorpyrifos| O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate | Chlorpyrifos ethyl | Chlorpyrifos (ISO) | O,O-diethyl O-(3,5,6-trichloro-2-pyridyl) thiophosphate | Chlorpyrifos | Phosphorothioic acid | O,O-diethyl O-(3,5,6-trichloro-2-pyridinyl) ester | O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate | O,O-Diethyl O-(3,5,6-trichloropyridin-2-yl) phosphorothioate	2921-88-2	-	Suspected	• Neuro • Toxic if swallowed • Suspected bioaccumulative • Suspected mutagen • Suspected skin sensitiser • Low dose endocrine disruption	-	-
ɣ-Muurolene	30021-74-0	-	-	-	-	-
decanoic acid | Capric acid | DECANOIC ACID | 1-Nonanecarboxylic acid | Caprinic acid | Decylic acid | n-Decanoic acid | Decanoic acid, sodium salt | sodium salt of capric acid	334-48-5	-	-	• Causes skin irritation • Causes serious eye irritation • Suspected skin sensitiser	-	-
p-Menthane-1,2-diol	33669-76-0	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Sabinene | Thuj-4(10)-ene | Bicyclo[3.1.0] hexane, 4-methylene-1-(1-methylethyl)- | BICYCLO(3.1.0)HEXANE, 4-METHYLENE-1-(1-METHYLETHYL)-	3387-41-5	-	-	Suspected skin sensitiser	-	-
2-Isopropyl-5-methyl-2-hexenal | ISOPROPYLMETHYLHEXENAL | 2-isopropyl-5-methylhex-2-enal | 2-Hexenal, 5-methyl-2-(1-methylethyl)-	35158-25-9	-	-	• Suspected carcinogen • Suspected skin irritant • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Neomenthol | Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1R,2R,5S)-rel- | dl-Neomenthol | (±)-neomenthol | Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1.alpha.,2.alpha.,5.beta.)-(.+-.)-	3623-51-6	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Isomenthol | Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1R,2S,5S)-rel- | (±)-isomenthol | Cyclohexanol, 5-methyl-2-(1-methylethyl)-, (1.alpha.,2.beta.,5.beta.)-(.+-.)- | DL-ISOMENTHOL	3623-52-7	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Theaspirane | TETRAMETHYL-1-OXASPIRO-6-DECENE | 2,6,10,10-tetramethyl-1-oxaspiro[4.5] dec-6-ene | 1-Oxaspiro[4.5]dec-6-ene, 2,6,10,10-tetramethyl-	36431-72-8	-	-	• Suspected bioaccumulative • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Furaneol | 4-Hydroxy-2,5-dimethyl-3(2H)-furanone | DIMETHYLHYDROXY FURANONE | 4-hydroxy-2,5-dimethylfuran-2(3H)-one | 3(2H)-Furanone, 4-hydroxy-2,5-dimethyl- | 3(2H)-FURANONE,4-HYDROXY-2,5-DIMETHYL | 4-Hydroxy-2,5-dimethyl-3-(2H) furanone | Pineapple ketone	3658-77-3	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected mutagen	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2,3-Hexanedione | METHYL PROPYL DIKETONE | Hexane-2,3-dione	3848-24-6	-	-	• Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	Permitted for use only in combination with other permitted ingredients as a flavour. If used in a flavour the total flavour concentration in a medicine must be no more than 5%.
1-Propen-1-ol	3965-44-4	-	-	-	-	-
Crotonaldehyde | 2-butenal | But-2-enal | (E) -crotonaldehyde | trans-But-2-enal; | ACROLEIN | 2-BUTENAL | b-Methyl acrolein | Crotonic aldehyde | beta-Methyl acrolein| Propylene aldehyde	4170-30-3	Yes (fatal)	-	• Toxic if swallowed • Toxic in contact with skin • Causes skin irritation • Causes serious eye damage • May cause genetic deffects • May cause respiratory irritation • May cause damage to organs through prolonged or repeated exposure • Mutagenic • Acute toxicity	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Buten-1-one, 1-(2,6,6-trimethyl-2-cyclohexen-1-yl)- | α-Damascone | alpha-1-(2,6,6-Trimethyl-2-cyclohexen-1-yl)-2-buten-1-one | ALPHA-DAMASCONE | cis -Rose ketone-1| (Z)-1-(2,6,6-Trimethyl-2-cyclohexen-1-yl)-2-buten-1-one (cis-alpha-Damascone) | Damascone, alpha- | BUTEN-1-ONE, 1-(2,6,6-TRIMETHYL-2-CYCLOHEXEN-1-YL)-, 2- | alpha-1-(2,6,6-Trimethyl-2-cyclohexen-1-yl)-2-buten-1-one	43052-87-5	-	-	• Harmful if swallowed • May cause an allergic skin reaction	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
Diacetyl (2,3-Butanedione) | Diacetyl | Butanedione | 2,3-Butanedione | BUTANDION | BUTANEDIONE, 2,3-	431-03-8	Yes (irreversible lung damage)	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser • Irritation	-	-
Difurfuryl disulfide | 2,2'-(Dithiodimethylene)-difuran | 2,2'-[dithiobis(methylene)]bisfuran | Furan, 2,2'-[dithiobis(methylene)]bis-	4437-20-1	-	-	• Suspected mutagen • Suspected skin sensitiser	-	-
3,4-Hexanedione | Hexane-3,4-dione	4437-51-8	-	-	• Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Nootkanone | Nootkatone | [4R-(4a,4aa,6ß)]-4,4a,5,6,7,8-hexahydro-4,4a-dimethyl-6-(1-methylvinyl)naphthalen-2(3H)-one | 2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4,4a-dimethyl-6-(1-methylethenyl)-, (4R,4aS,6R)- | 2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4,4a-dimethyl-6-(1-methylethenyl)-, [4R-(4.alpha.,4a.alpha.,6.beta.)]- | 2(3H)-NAPHTHALENONE, 4,4A,5,6,7,8-HEXAHYDRO-4,4A-DIMETHYL-6-(1-METHYLETHENYL)-, (4R-(4.ALPHA.,4A.ALPHA.,6.BETA.))-	4674-50-4	-	-	• Suspected bioaccumulative • Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
α-Cedrene | alpha-Cedrene | [3R-(3a,3aß,7ß,8aa)]-2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-1H-3a,7-methanoazulene | 1H-3a,7-Methanoazulene, 2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-, [3R-(3α,3aβ,7β,8aα)]- | CEDR-8-ENE | 1H-3a,7-Methanoazulene, 2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-, (3R,3aS,7S,8aS)- | 1H-3A,7-METHANOAZULENE, 2,3,4,7,8,8A-HEXAHYDRO-3,6,8,8-TETRAMETHYL-, (3R-(3.ALPHA.,3A.BETA.,7.BETA.,8A.ALPHA.))- | 1H-3a,7-Methanoazulene, 2,3,4,7,8,8a-hexahydro-3,6,8,8-tetramethyl-, [3R-(3 | 1H-3A,7-METHANOAZULENE,2,3,4,7,8,8A-HEXAHYDRO-3,6,8,8-TETRAMETHYL-,(3R-(3.ALPHA.,3A.BETA.,7.BETA.,8A.APLHA.)) | alpha-Cedrene	469-61-4	-	-	• Suspected bioaccumulative • Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1,8-Cineol | 1,3,3-Trimethyl-2-oxabicyclo[2.2.2] octane; 1,8-Epoxy-p-menthane | Eucalyptol | Cineole | 2-Oxabicyclo[2.2.2]octane, 1,3,3-trimethyl- | 1,3,3-TRIMETHYL-2-OXABICYCLO(2.2.2)OCTAN | CINEOLE, 1,8- | 1,8-Cineole | 2-Oxabicyclo(2.2.2)octane, 1,3,3-trimethyl- | p-Menthane, 1,8-epoxy-	470-82-6	-	-	-	-	-
Pentaethylene glycol | 3,6,9,12-Tetraoxatetradecane-1,14-diol | TETRAOXATETRADECANE-1,14-DIOL, 3,6,9,12-	4792-15-8	-	-	• Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
δ-Cadinene	483-76-1	-	-	-	-	-
Cadalene	483-78-3	-	-	• Suspected bioaccumulative • Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
anabasine	494-52-0	-	-	• Suspected acutely toxic via the oral route • Suspected skin irritant • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Formaldehyde | formaldehyde (R1) | formaldehyde solution | Formalin | Formic aldehyde | Methaldehyde | Formaldehyde (h) | FORMALDEHYD | Methan 21 | Methanal | Methyl aldehyde | Methylene oxide	50-00-0	Yes (fatal)	-	• Gastrointestinal • Urinary • Respiratory • carcinogenic, mutagenic, reprotoxic (CMR) • Toxic if swallowed • Toxic in contact with skin • Causes severe skin burns and eye damage • May cause an allergic skin reaction • May cause cancer by inhalation • Acute toxicity (inhalation, dermal and oral) • Skin sensitiser • Skin corrosion	-	-
Hydrocinnamic acid | 3-Phenylpropionic acid | Benzenepropanoic acid | BENZENPROPANOIC ACID	501-52-0	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	-
1,3-Propanediol | PROPANEDIOL | Propane-1,3-diol | propan-1,3-diol | 1,3-Dihydroxypropane | 1,3-Propylenediol | 1,3-Propylene glycol | 2-Deoxyglycerol | beta-Propylene glycol | omega-Propanediol | Trimethylene glycol	504-63-2	-	-	-	-	-
Sorbitol | D-Glucitol | d-Sorbitol	50-70-4	-	-	-	-	-
D-Glucose | GLUCOSE | dextrose | Glukoosi | GLYKOSE	50-99-7	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Acetoin | 3-Hydroxy-2-butanone | 2-Butanone, 3-hydroxy- | 3-HYDROXY-2-BUTANON | Acetoin	513-86-0	Yes (irreversible lung damage)	-	Irritation	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
β-Bourbonene	5208-59-3	-	-	• Suspected bioaccumulative • Suspected skin sensitiser	-	-
β-Cadinene	523-47-7	-	-	-	-	-
o-Methylbenzaldehyde | O-TOLUALDEHYDE | 2-tolualdehyde | TOLUALDEHYDE, O-	529-20-4	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Myosmine	532-12-7	-	-	-	-	-
2-Methylfuran | Furan, 2-methyl-	534-22-5	-	-	Suspected carcinogen	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Citral | 2,6-Octadienal, 3,7-dimethyl- | 3,7 -Dimethyl-2,6-octadienal | OCTADIENAL, 3,7-DIMETYL-2,6-	5392-40-5	-	-	• Causes skin irritation • May cause an allergic skin reaction • Skin sensitisation	-	Only for use in medicines in combination with other permitted ingredients as a fragrance proprietary excipient formulation. The total fragrance proprietary excipient formulation in a medicine must not be more than 1%.
Ethyl 3-hydroxybutanoate | Ethyl 3-hydroxybutyrate | Butanoic acid, 3-hydroxy-, ethyl ester	5405-41-4	-	-	Suspected toxic for reproduction	-	-
Nicotine | 3-(N-methyl-2-pyrrolidinyl)pyridine | 3-[(2S)-1-methylpyrrolidin-2- yl]pyridine | Nicotine and its salts | Pyridine, 3-[(2S)-1-methyl-2-pyrrolidinyl]- | NICOTIN | nicotine (ISO) 3-[(2S)-1-methylpyrrolidin-2-yl]pyridine | METYLPYROLLIDINO)PYRIDIN, 3-(N- | 3-(1-Methyl-2-pyrrolidinyl)pyridine | Nicotine alkaloid | Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)- | 3-(1-Methyl-2-pyrrolidyl)pyridine	54-11-5	Yes (fatal)	-	• Fatal in contact with skin • Fatal if swallowed • Acute toxicity • Suspected mutagen • Suspected toxic for reproduction	-	-
Thujon | α-Thujone | ISOPROPYL-METHYLBICYCLOHEXANONE | 1-isopropyl-4-methylbicyclo[3.1.0]hexan-3-one | Bicyclo[3.1.0]hexan-3-one, 4-methyl-1-(1-methylethyl)-, [1S-(1α,4α,5α)]- | THUJONE | Bicyclo[3.1.0]hexan-3-one, 4-methyl-1-(1-methylethyl)-, (1S,4R,5R)- | BICYCLO(3.1.0) HEXAN-3-ONE, 4-METHYL-1-(1-METHYLETHYL)-, (1S-(1.ALPHA.,4.ALPHA.,5. ALPHA.))- | Bicyclo[3.1.0]hexan-3-one, 4-methyl-1-(1-methylethyl)-, [1S-(1 | Thujone	546-80-5	-	-	• Suspected skin sensitiser • Suspected toxic for reproduction	-	Mandatory component of artemisia type chemicals

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Raspberry ketone | 4-(p-Hydroxyphenyl)-2-butanone | 4-(4-hydroxyphenyl)butan-2-one | 2-Butanone, 4-(4-hydroxyphenyl)- | BUTANONE, 4-(4-HYDROXYPHENYL)-2-	5471-51-2	-	-	-	-	-
Carane	554-59-6	-	-	-	-	-
2,3-epoxypropan-1-ol | glycidol | oxiranemethanol | Glycidol | 2,3-Epoxy-1-propanol | 2-Oxiranemethanol | EPOKSY-1-PROPANOL, 2,3- | Epoxypropyl alcohol | Glycide | Hydroxymethyl ethylene oxide | 2-Hydroxymethyl oxiran | 3-Hydroxypropylene oxide	556-52-5	Yes (fatal)	-	• Harmful if swallowed • Harmful in contact with skin • May cause cancer/ Carcinogenic • May cause genetic defects • Causes serious eye irritation • Causes skin irritation • May cause respiratory irritation • May damage fertility • Acute toxicity (inhalation, dermal and oral) • Mutagenic	-	-
octamethylcyclotetrasiloxane | Octamethylcyclotetrasiloxane (D4) | octamethylcyclotetra siloxane | Octamethyl-cyclotetrasiloxane | Cyclotetrasiloxane, octamethyl- | 2,2,4,4,6,6,8,8-Octamethylcyclotetrasiloxane | CYCLOMETHICONE | CYCLOTETRASILOXANE | Cyclotetrasiloxane, 2,2,4,4,6,6,8,8-octamethyl- | Octamethylcyclotetra- siloxane (D4) | Octamethylcyclo-tetrasiloxane (D4) | Octamethylcydotetrasiloxane | OCTAMETHYLCYCLOTETRASILOXAN | Cyclosiloxanes, di-Me | Dimethyl cyclosiloxanes | Cyclic dimethylsiloxane tetramer	556-67-2	-	-	• Bioaccumulation • Suspected of damaging fertility • Low dose endocrine disruption • Persistence (undisclosed)	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Glycerol | 1,2,3-Propanetriol | GLYCERIN | GLYCERIN, NATURAL | Glyseroli | PROPANTRIOL, 1,2,3- | Glycerin mist | Glycerine Synthetic glycerine | Vegetable Glycerin | Glycerin (anhydrous) | Glycyl alcohol | Trihydroxypropane	56-81-5	-	-	-	-	-
Glyceraldehyde | DL-glyceraldehyde | Propanal, 2,3-dihydroxy-	56-82-6	-	-	• Suspected carcinogen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
(R)-3-(pyrrolidin-2-yl)pyridine	5746-86-1	-	-	• Suspected acutely toxic via the oral route • Suspected toxic for reproduction	-	-
D-Fructose | FRUCTOSE | LEVULOSE | FRUKTOSE	57-48-7	-	-	-	-	-
Sucrose | alpha.-D-Glucopyranoside, .beta.-D-fructofuranosyl | | SATURATED SUCROSE | SACCHAROSE | Sukroosi, puhdas | SUKKER | D(+)-Sucrose | Sugar (D(+)-Sucrose) | Invert sugar | Invert syrup | alpha-D-Glucopyranoside, beta-D-fructofuranosyl- | Glucopyranoside, beta-D-fructofuranosyl, alpha-D | Sugar | Beet sugar | Cane sugar | Confectioner's sugar | Granulated sugar | Rock candy | Saccarose | Table sugar	57-50-1	-	-	-	May be used in food	-
Propylene glycol | Propane-1,2-diol (Propylene glycol) | 1,2-Propanediol | PROPYLENGLYCOL | Propaani-1,2-dioli | PROPANDIOL, 1,2- | alpha-Hydro-omega-hydroxypoly(oxy(methyl-1,2-ethanediyl)) | alpha-Hydro-omega-hydroxypoly(oxypropylene)	57-55-6	-	-	Respiratory	May be used as a food additive (unprocessed fruit and vegetables)	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
caffeine | 1H-Purine-2,6-dione, 3,7-dihydro-1,3,7-trimethyl- | BROMIDES | COFFEIN | KOFFEIN | 1,3,7-Trimethyl-2,6-dioxopurine | 1,3,7-Trimethylxanthine | 7-Methyltheophylline | Caffein	58-08-2	-	-	• Harmful if swallowed • Acute Toxicity	May be used as a food additive	-
2,3'-bipyridine	581-50-0	-	-	• Suspected mutagen • Suspected toxic for reproduction	-	-
Cyclohexene, 1-methyl-4-(1-methylethylidene)- | α-Terpinolene | Terpinolene | Terpinolene; p -Mentha-1,4(8)-diene | p-mentha-1,4(8)-diene | TERPINOLEN | Sykloheksseeni, 1-metyyli-4-(1-metyylietylideeni)- | METYL-4-(1-METYLETYLIDEN)CYKOLHEKSEN,1- | 4-Isopropylidene-1-methylcyclohexene | Isoterpinene | Terpinolene 90	586-62-9	Yes (may be fatal)	-	• May be fatal if swallowed • May cause an allergic skin reaction	-	-
Isovaleric aldehyde | 3-Methylbutanal | 3-Methylbutyraldehyde | ISOPENTANAL | Butanal, 3-methyl- | Isovaleraldehyde | Isovaleraldehydi	590-86-3	-	-	-	-	-
Lactaldehyde	598-35-6	-	-	-	-	-
Acetylpropionyl (2,3-Pentanedione) | Acetyl propionyl (2,3-Pentanedione) | Acetyl propionyl | PENTANEDIONE | Pentane-2,3-dione | 2,3-Pentanedione | Pentanedione, 2,3-	600-14-6	Yes (irreversible lung damage)	-	• Suspected mutagen • Suspected skin sensitiser • Cytotoxicity • Irritation	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Benzeneethanol | Phenethyl alcohol | beta-Phenylethyl alcohol | phenylethyl alcohol | 2-phenylethanol | Fenyylietanoli | BENZENETANOL | 2-Phenylethyl alcohol | beta-Hydroxyethylbenzene | beta-Phenethyl alcohol | beta.-Phenylethanol | Phenyl ethyl alcohol	60-12-8	-	-	• Harmful if swallowed • Causes serious eye damage	-	-
acetamide | ACETAMID	60-35-5	-	-	Suspected of causing cancer	-	-
2-Nitrothiophene | Thiophene, 2-nitro-	609-40-5	-	-	• Suspected carcinogen • Suspected mutagen	-	-
Piperonal propylene glycol acetal | 5-(4-methyl-1,3-dioxolan-2-yl)-1,3-benzodioxole | 1,3-Benzodioxole, 5-(4-methyl-1,3-dioxolan-2-yl)-	61683-99-6	-	-	Suspected carcinogen	-	-
5-Methylfurfural | METHYLFURFURAL | 2-Furancarboxaldehyde, 5-methyl-	620-02-0	-	-	• Suspected carcinogen • Suspected skin sensitiser	-	-
m-Methylbenzaldehyde | Benzaldehyde, 3-methyl- | M-TOLUALDEHYDE | TOLUALDEHYDE, M-	620-23-5	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected toxic for reproduction	-	-
1,2-Propanediol, 2-acetate	6214-01-3	-	-	-	-	-
Isovanillin | 3-hydroxy-p-anisaldehyde | Benzaldehyde, 3-hydroxy-4-methoxy-	621-59-0	-	-	Suspected carcinogen	-	-
2-Methylbutyrate | Methyl butanoate | Butanoic acid, methyl ester | Methyl butyrate | METHYLBUTYRAT	623-42-7	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-methylbutyl acetat | 2-Methylbutyl acetate | 1-Butanol, 2-methyl-, 1-acetate | AMYL ACETATE | 2-METHYLBUTYLACETAT | 2-methylbutyl acetat [4] | METYLBUTYLACETAT, 2- | Acetic acid 2-methylbutyl ester	624-41-9	-	-	• Suspected carcinogen • Suspected skin sensitiser	-	Only for use in: - topical medicines for dermal application; or - combination with other permitted ingredients as a flavour proprietary excipient formulation. The total flavour proprietary excipient formulation in a medicine must not be more than 5%.
2-Methyl-1,3-dioxane	626-68-6	-	-	-	-	-
Dimethylnitrosoamine (DMNA) | N-nitrosodimethylamine (NDMA)| Methanamine, N-methyl-N-nitroso- | N,N-Dimethylnitrosamine | Nitrosamines | Nitrosodipropylamine |2,2' -(Nitrosoimino) bisethanol | N-NITROSODIMETHYLAMINE | N-Nitrosodimethylamine |AMINES | N-NITROSODIMETHYLAMIN | N-Methyl-N-nitroso-methanamine | N-Nitroso-N,N-dimethylamine | Nitrosamines | N-Nitrosodimethylamine	62-75-9	Yes (fatal)	-	• Probably carcinogenic • Toxic if swallowed • Causes damage to organs through prolonged or repeated exposure • Suspected mutagen • Suspected skin sensitiser • Acute toxicity	-	-
Ethyl hexadecanoate | Ethyl palmitate | OMEGA-3-ACID ETHYL ESTERS | Hexadecanoic acid, ethyl ester | Palmitic acid, ethyl ester	628-97-7	-	-	Suspected skin sensitiser	-	-
Hexamethylenediol | 1,6-Hexanediol | HEXANEDIOL | Hexane-1,6-diol | HEXAMETHYLENE GLYCOL | hexan-1,6-diol | HEKSANDIOL, 1,6-	629-11-8	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Hexadecanal	629-80-1	-	-	• Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	-	-
4-Chloro-2,5-dimethoxyaniline | Benzenamine, 4-chloro-2,5-dimethoxy-	6358-64-1	-	-	-	-	-
Hexyl hexanoate | Hexanoic acid, hexyl ester	6378-65-0	-	-	Suspected skin sensitiser	-	-
Octadecanal | Stearaldehyde	638-66-4	-	-	• Suspected carcinogen • Suspected skin sensitiser	-	-
Elemol | ALPHA,ALPHA-DIMETHYL-VINYL-O-MENTHENEMETHANOL | (1S,2S,4R)-(-)-a,a-dimethyl-1-vinyl-o-menth-8-ene-4-methanol | Cyclohexanemethanol, 4-ethenyl-α,α,4-trimethyl-3-(1-methylethenyl)-, [1R-(1α,3α,4β)]- | Cyclohexanemethanol, 4-ethenyl-.alpha.,.alpha.,4-trimethyl-3-(1-methylethenyl)-, (1R,3S,4S)- | CYCLOHEXANEMETHANOL, 4-ETHENYL-.ALPHA.,.ALPHA.,4-TRIMETHYL-3-(1-METHYLETHENYL)-, (1R-(1.ALPHA.,3.ALPHA.,4.BETA.))- | CYCLOHEXANEMETHANOL, 4-ETHYL-ALFA,ALFA,4-TRIMETHYL-3-(1-METHYLETHENYL)- (1R,3S,4S)- | Elemol	639-99-6	-	-	• Suspected bioaccumulative • Suspected skin irritant • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone | Nitrosamines | N-nitrosodiethanolamine | N'-Nitrosonornicotine (NNN) and 4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	64091-91-4	-	-	• Carcinogenic* • Suspected carcinogen* (*divergent assessments) • Suspected mutagen	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
p-Anisaldehyde propylene glycol acetal | 2-(4-methoxyphenyl)-4-methyl-1,3-dioxolane	6414-32-0	-	-	Suspected mutagen	-	-
Ethanol | Ethyl alcohol | ALCOHOL DENAT | ALCOHOL | ethanol ethyl alcohol | ETANOL | Alcohol (ethyl) | EtOH | Grain alcohol | Ethanol in alcoholic beverages	64-17-5	-	-	• Carcinogenic • Causes serious eye irritation	May be used as a food additive (flavouring; colouring)	-
Formic acid | Formic acid and its sodium salt | FORMIC ACID / SODIUM FORMATE | MYRESYRE | MAURSYRE | Formic acid, zinc salt | Zinc formate | Ammonium formate | Formic acid, ammonium salt | Hydrogen carboxylic acid | Methanoic acid	64-18-6	Yes	-	• Bioaccumulation • Endocrine disruption • Other human toxicity • Persistence (undisclosed) • Harmful if swallowed • May cause respiratory irritation • Causes severe skin burns and eye damage • Skin corrosion	-	-
acetic acid | Acetic acid | EDDIKESYRE | EDDIKSYRE | Ethanoic acid | Glacial acetic acid | Methanecarboxylic acid	64-19-7	-	-	• Causes severe skin burns and eye damage • Skin corrosion • Skin irritation • Eye irritation	May be used as a food additive	-
Isoamyl isovalerate | Isoamyl isobutyrate | Butanoic acid, 3-methyl-, 3-methylbutyl ester | 3-methylbutyl isovalerate | BUTANOIC ACID, 3-METHYL-3-METHYLBUTYL-ESTHER | n-Pentyl valerate | Pentanoic acid, pentyl ester	659-70-1	-	-	-	-	-
Hexaldehyde | Hexanal | Aldehyde C6	66-25-1	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Hexenal, (E)- | Leaf aldehyde | Hexen-2-al | TRANS-2-HEXENAL | trans -2-hexenal | trans-hex-2-enal | 2-HEXENAL, TRANS- | ACROLEIN | HEKSENAL, trans-2- | (E)-2-Hexen-1-al	6728-26-3	-	-	• Harmful if swallowed • Toxic in contact with skin • May cause an allergic skin reaction • Suspected carcinogen • Suspected mutagen • Suspected skin irritant • Suspected skin sensitiser	-	-
5-Hydroxymethylfurfurol | 5-(hydroxymethyl)-2-furaldehyde | 2-Furancarboxaldehyde, 5-(hydroxymethyl)-	67-47-0	-	Suspected	• Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	-	-
methanol | methanol (R1) | METHYL ALCOHOL | | METANOL | Carbinol | Wood alcohol | Wood naphtha	67-56-1	Yes	-	• Suspected carcinogenic, mutagenic, reprotoxic (CMR) • Developmental • Nervous • Suspected CMR • Toxic in contact with skin • Toxic if swallowed • Causes damage to organs • Acute Toxicity (Inhalation, dermal and oral)	-	-
propan-2-ol | isopropyl alcohol | isopropanol | 2-Propanol | Propan-2-ol |propan-2-ol isopropyl alcohol isopropanol | PROPANOL, 2- | Dimethyl carbinol | IPA | sec-Propyl alcohol | Rubbing alcohol	67-63-0	-	-	• Causes serious eye irritation • May cause drowsiness or dizziness	May be used as a food additive (flavouring)	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Acetone | propan-2-one | propanone | 2-Propanone | acetone propan-2-one propanone | ACETON | Dimethyl ketone | Ketone propane	67-64-1	-	-	• Neuro • Urinary • Hematologic • Causes serious eye irritation • May cause drowsiness or dizziness • Repeated exposure may cause skin dryness and cracking	-	The residual solvent limit for Acetone is 50 mg per maximum recommended daily dose. The concentration in the medicine must be no more than 0.5%.
Ethylvanillin propylene glycol acetal | Ethyl vanillin propylene glycol acetal | Phenol, 2-ethoxy-4-(4-methyl-1,3-dioxolan-2-yl)-	68527-76-4	-	-	-	-	-
ɣ-Hexalactone | gamma-Hexalactone | GAMMA-CAPROLACTONE | Hexan-4-olide | 2(3H)-Furanone, 5-ethyldihydro- | GAMMA-CAPROLACTON | 2(3H)-FURANONE,5-ETHYLDIHYDRO- | 5-Ethyltetrahydro-2-furanone | 6-Caprolactone | Furanone, 5-ethyldihydro-2(3H)-	695-06-7	-	-	• Suspected mutagen • Suspected skin sensitiser	-	-
δ-Decalactone | delta-Decalactone | Decan-5-olide | 2H-Pyran-2-one, tetrahydro-6-pentyl- | delta-Decalactone	705-86-2	-	-	-	-	-
ɣ-Decalactone | gamma-Decalactone | Decan-4-olide | 2(3H)-Furanone, 5-hexyldihydro- | FURANONE, 5-HEXYLDIHYDRO-, 2(3H)- | gamma Decalactone | gamma-Hexyl-gamma-butyrolactone	706-14-9	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
δ-Undecalactone | delta-Undecalactone | 6-hexyltetrahydro-2H-pyran-2-one | 5-HYDROXYUNDECANOIC ACID LACTONE | 2H-Pyran-2-one, 6-hexyltetrahydro- | HEXYLTETRAHYDRO-2H-PYRAN-2-ONE, 6- | 5-Hydroxyundecanoic acid	710-04-3	-	-	Suspected skin sensitiser	-	-
1-Propanol | n -propanol | propan-1-ol | n-Propyl alcohol | Propyl alcohol | Propanol | propan-1-ol n-propanol | PROPANOL, n- Ethyl carbinol	71-23-8	-	-	• May cause drowsiness or dizziness • Causes serious eye damage • Repeated exposure may cause skin dryness and cracking	-	-
butan-1-ol | n-butanol | n-butyl alcohol | 1-Butanol | Butyl alcohol | Butan-1-ol | Butanol | butan-1-ol n-butanol | BUTANOL, n- | Butyl alcohol (8CA) | 1-Hydroxybutane | n-Propyl carbinol	71-36-3	-	-	• Nervous • Suspected Reprotoxic • Harmful if swallowed • May cause respiratory irritation • Causes skin irritation • Causes serious eye damage • May cause drowsiness or dizziness • Acute toxicity • Acute toxicity (oral)	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1-pentanol | Amyl alcohol | Pentan-1-ol | | PENTANOL, 1- | 1-Pentanol (9CA) | n-Pentanol | Pentyl alcohol	71-41-0	-	-	• Suspected Sensitiser • Harmful if inhaled • May cause respiratory irritation • Causes skin irritation • Acute toxicity	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
benzene | benzene (R1) | Annulene | Coal naphtha | Carbon oil | Cyclohexatriene | BENZEN | Benzol | Phenyl hydride	71-43-2	Yes (may be fatal)	-	• Immune • Carcinogenic • May cause genetic defects • Causes damage to organs through prolonged or repeated exposure • May be fatal if swallowed • Causes serious eye irritation • Causes skin irritation • Mutagenic • Aspiration toxicity	-	-
1,3-Dioxolane, 2-butyl-4-methyl- | 2-butyl-4-methyl-1,3-dioxolane	74094-60-3	-	-	Suspected mutagen	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
aluminium powder (pyrophoric) | aluminium powder (stabilised) | Aluminium | Aluminium metal | ALUMINUM | Aluminium, alkyls (NOC) | Aluminium, pyro powders | Aluminium, soluble salts | Aluminium & compounds | Aluminum powder | Aluminum (metal) | Elemental aluminum	7429-90-5	-	-	Neuro	May be used as food additive	-
Iron | IRON POWDER | IRON, ELEMENTAL | JERN | Rauta	7439-89-6	-	-	-	-	-
Lanthanum | LANTHANUM	7439-91-0	-	-	-	-	-
Lead | lead powder | Lead and its compounds | Lead, inorganic dusts & fumes | Lead and compounds (inorganic) | Lead (metallic) | Lead metal	7439-92-1	-	-	• Carcinogenic • Mutagenic • Toxic for reproduction • Suspected of causing genetic defects • May cause damage to organs through prolonged or repeated exposure • May damage the unborn child • Suspected of damaging fertility • Lactation	-	-
magnesium powder (pyrophoric) | Magnesium | MAGNESIUM POWDER	7439-95-4	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Manganese | Magnesium | Manganese tetroxide | MANGAN | Mangaani | Manganese, fume, dust & compounds | Manganese Sucrate | Colloidal manganese	7439-96-5	Yes (damage to organs through prolonged or repeated exposure)	-	• Neuro • Nervous • Causes damage to organs through prolonged or repeated exposure if swallowed or inhaled	-	-
mercury | mercury (R1) | Mercury & mercury compounds including methyl mercury | Mercury, elemental vapour | Mercury, elemental | MERCURY metallic | KVIKS | KVIKKS | Alkyl mercury compounds | Cresol mercury naphthenate | Colloidal mercury | Metallic mercury | Mercuric oxide| Phenyl mercuric acetate | Phenyl mercuric benzoate | Phenyl mercuric borate |Thimerosal | Mercury and inorganic mercury compounds	7439-97-6	Yes (fatal)	-	• Nervous • Neuro • Carcinogenic • Mutagenic • Toxic for reproduction • May damage fertility • May damage the unborn child • Causes damage to organs through prolonged or repeated exposure • Acute toxicity	-	-
Molybdenum | Molybdenum & molybdenum compounds | Molybdenum, insoluble compounds | Molybdenum, soluble compounds | MOLYBDEN | Molybdeeni |	7439-98-7	-	-	• Renal • Urinary	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
nickel | nickel powder | Nickel, soluble compounds | Nickel, metal | NIKKEL | Nickel, metal and insoluble compounds | Elemental nickel | Nickel catalyst | Nickel, metallic	7440-02-0	Yes (damage to organs through prolonged or repeated exposure)	-	• Skin sensitiser • Respiratory • Carcinogenic • Suspected of causing cancer • May cause an allergic skin reaction • Suspected of causing cancer • Causes damage to organs through prolonged or repeated exposure • May cause an allergic skin reaction	-	-
potassium | KALIUM	7440-09-7	-	-	• Causes severe skin burns and eye damage • Skin corrosion	May be used as a food additive	-
Rubidium	7440-17-7	-	-	-	-	-
Silicon | Silicon (powder, amorphous) | Ammonium hexafluorosilicate | Silicon (a) | Quartz | SILICIUM | Pii, sis | SILISIUM | Elemental silicon	7440-21-3	-	-	-	-	-
Silver | COLLOIDAL SILVER | Silver, metal | Hopea | Silver and its salts (metal, soluble compounds) | Silver (1+) | Silver cation | Silver Ion | Silver, ionic | Silver monocation | Argentum | Shell Silver | Silber	7440-22-4	-	-	Dermal	May be used as a food additive	-
sodium | NATRIUM	7440-23-5	-	-	• Causes severe skin burns and eye damage • Skin corrosion	May be used as a food additive	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Strontium | Strontium and its salts, other than nitrite	7440-24-6	-	-	Musculoskeletal	-	-
Tin | Tin, metal | Tin, oxide & inorganic compounds, except SnH4 | Tina | TINN | Metallic tin | Tin flake | Tin metal | Tin powder	7440-31-5	-	-	-	-	-
Titanium | Titanium (powder) | TITAN | Titaani | TITANIUM (TI)	7440-32-6	-	-	-	-	-
Tungsten | Tungsten, insoluble compounds | Tungsten, soluble compounds | WOLFRAM | Tungsten metal	7440-33-7	-	-	-	-	-
Antimony | Antimony & Antimony compounds | ANTIMON | Antimoni | Antimony metal | Antimony powder | Stibium	7440-36-0	-	-	• Respiratory • Metabolic • Hematologic • Hepatic	-	-
Arsenic | Arsenic and its compounds including arsenic trioxide (1327-53-3) & dimethyl arsenic acid (75-60-5) | Arsenic, Inorganic | Arsenic, elemental | ARSEN | Arsenic metal: Arsenia	7440-38-2	Yes	-	• Gastrointestinal • Dermal • Cardiovascular • Carcinogenic • Toxic if swallowed • May cause cancer • Suspected of causing genetic defects • May cause damage to organs through prolonged or repeated exposure • Acute toxicity (oral, inhalation) • Suspected mutagen	-	Only for use as an active homoeopathic ingredient. The concentration of arsenic in the medicine must be no more than 0.001%.
Barium | Barium and Compounds	7440-39-3	-	-	• Renal • Urinary	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Boron | Boron and Compounds | BOR	7440-42-8	-	-	• Developmental • Respiratory	-	-
cadmium (non-pyrophoric) | cadmium (pyrophoric) | Cadmium | Cadmium & cadmium compounds | KADMIUM | Cadmium metal: Cadmium	7440-43-9	Yes (fatal)	-	• Musculoskeletal • Renal • Carcinogenic • Urinary • Respiratory • May cause cancer • Suspected of causing genetic defects • Suspected of damaging fertility • Suspected of damaging the unborn child • Causes damage to organs through prolonged or repeated exposure • Mutagenic • Acute Toxicity (inhalation) • Acute toxicity • Reproductive	-	-
Chromium and its salts | Zinc chromates including zinc potassium chromate | chromic acid |Chromium (metal) | CHROM | Kromi | KROM | Chrome | Chromium, metallic	7440-47-3	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
cobalt | cobalt & cobalt compounds | Cobalt, metal dust & fume | Cobalt, elemental | KOBOLT | Cobalt metal with tungsten carbide | Cobalt metal without tungsten carbide	7440-48-4	Yes (fatal)	Yes	• Possibly carcinogenic • Hematological • Respiratory • Developmental • Harmful if swallowed • May cause cancer by inhalation • May cause respiratory irritation • May cause damage to organs through prolonged or repeated exposure if inhaled • May damage fertility • May cause allergy or asthma symptoms or breathing difficulties if inhaled • May cause an allergic skin reaction • Skin sensitisation	-	-
Copper | Copper flakes (coated with aliphatic acid) | Copper (metallic) | COPPER COMPOUNDS | KOBBER | Kupari | KOPPER | Copper (fume, dusts and mists) | Bronze Powder | Cathode copper | Copper powder | Copper precipitates | Copper slag-airborne | Copper slag-milled | Copper element	7440-50-8	-	-	Gastrointestinal	-	-
Germanium	7440-56-4	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
uranium | Uranium (natural), soluble & insoluble compounds | RADIOISOTOPES | URAN | Uraani | Uranium (metal)	7440-61-1	Yes (fatal)	-	• Developmental • Respiratory • Renal • Fatal if swallowed • May cause damage to organs through prolonged or repeated exposure • Acute toxicity	-	-
Vanadium	7440-62-2	-	-	• Respiratory • Hematological	-	-
Zinc |Zinc powder, pyrophoric | Zinc and Compounds | Zinc dust | Zinc metal |	7440-66-6	-	-	• Hematologic • Immune	-	-
zirconium powder (pyrophoric) | zirconium powder (nonpyrophoric) | Zirconium | Zirconium compounds | ZIRKONIUM	7440-67-7	-	-	-	-	-
calcium | Calcium carbonate | KALSIUM	7440-70-2	-	-	-	May be used as a food additive	-
Indium | Indium & compounds | Indiumi | Indium metal	7440-74-6	-	-	-	-	-
Ethyl α-methylbutyrate | Ethyl 2-methylbutyrate | Ethyl ester 2-methylbutanoic acid | Butanoic acid, 2-methyl-, ethyl ester | ETYL 2-METYLBUTYRAT	7452-79-1	-	-	-	-	-
Nonylcyclopropane	74663-85-7	-	-	Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Butyl butyryllactate | BUTYL BUTYROLACTATE | Butyl O-butyryllactate | Butanoic acid, 2-butoxy-1-methyl-2-oxoethyl ester	7492-70-8	-	-	Suspected skin sensitiser	-	-
Acetonitrile | cyanomethane | CYANIDES | ACETONITRIL | acetonitrile cyanomethane | Ethyl nitrile | Methyl cyanide	75-05-8	Yes	-	• Harmful if swallowed • Harmful in contact with skin • Causes serious eye damage • Eye irritation • Acute toxicity (Oral, inhalation and dermal)	-	-
Acetaldehyde | | ACETALDEHYD | acetaldehyde ethanal | Acetic aldehyde | Ethanal | Ethyl aldehyde	75-07-0	-	-	• Nervous • Respiratory • Possibly carcinogenic • Harmful if swallowed • Suspected of causing genetic defects • Causes serious eye irritation • May cause respiratory irritation	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Dichloromethane | methylene chloride | Methane, dichloro- | Methylene dichloride | METHYLENE CHLORIDE | Methylene chloride | DICHLORMETHAN | dichloromethane methylene chloride | DIKLORMETAN | Methane, dichloro- | Aerothene MM | Methylene dichloride | Dichloromethane	75-09-2	-	-	• Suspected of causing cancer • Suspected mutagen • Suspected reprotoxic • LD endocrine disruptor • Suspected sensitiser • Neuro • Hepatic • May cause drowziness or dizziness • Causes serious eye irritation • Causes skin irritation	-	-
Oxirane, methyl- | propylene oxide | 1,2-epoxypropane | methyloxirane | propylene oxide (R1) | Propylene oxide (1,2-Epoxypropane) | Oxirane, 2-methyl- | 1,2-epoxypropane | PROPYLENOXID | propylene oxide 1,2-epoxypropane methyloxirane | PROPYLENOKSYD, 1,2- | 1,2-Epoxy propane | Methyl ethylene oxide | Propene oxide | 1,2-Propylene oxide | Methyloxirane monomer	75-56-9	Yes	-	• Respiratory • Possibly carcinogenic • Harmful if swallowed • Harmful in contact with skin • May cause genetic defects • May cause respiratory irritation • Causes severe burns and eye damage • Acute toxicity (inhalation, dermal and oral) • Eye irritation	-	-
Tributyl aconitate | Tributyl prop-1-ene-1,2,3-tricarboxylate	7568-58-3	-	-	• Suspected mutagen • Suspected skin sensitiser	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Camphor | bornan-2-one | 1,7,7-Trimethylbicyclo[2.2.1]heptan-2-one | Camphor, synthetic | Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl- | BICYCLO(2.2.1)HEPTAN-2-ONE, 1,7,7-TRIMETHYL- | Bornan-2-oni | 1,7,7-Trimethylbicyclo(2.2.1) heptan-2-one | Camphor fractions | (1S)-Camphor | (-)-Alcanfor | Bicyclo[2.2.1] heptan-2-one, 1,7,7-trimethyl-, (1S)- | Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl-, (1S,4S)- | Camphor, (1S,4S)-(-)- | l-Camphor | S-Camphor | (+)-2-Bornanone | Bicyclo[2.2.1] heptan-2-one, 1,7,7-trimethyl-, (1R)- | Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl-, (1R,4R)- | Camphor, (1R,4R)-(+)- | (R)-Camphor | 2-Camphonone | Gum camphor | Laurel camphor	76-22-2	-	-	Irritation	-	-
3-Methyl-1,2-cyclopentanedione | 3-Methylcyclopentane-1,2-dione | 1,2-Cyclopentanedione, 3-methyl- | 2-Cyclopenten-1-one, 2-hydroxy-3-methyl- | 2-Hydroxy-3-methyl-cyclo-pent-2-en-1-one | Maple lactone	765-70-8	-	-	• Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Water | AQUA | VAND | Vesi, tislattu tai s | VANN | Moisture	7732-18-5	-	-	-	Permitted	Permitted
Ethyl mandelate	774-40-3	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
selenium | | Selenium and its compounds excluding hydrogen selenide, selenium sulfide and selenium disulphide | SELEN | Elemental selenium | Selenium alloy	7782-49-2	Yes	-	• Toxic if swallowed • May cause damage to organs through prolonged or repeated exposure • Acute toxicity (inhalation, oral)	-	-
chlorine | Active chlorine generated from chloride of ambient water by electrolysis | Active chlorine generated from hydrochloric acid by electrolysis | active chlorine generated from magnesium chloride hexahydrate and potassium chloride by electrolysis | active chlorine generated from magnesium chloride hexahydrate by electrolysis | Active chlorine generated from potassium chloride by electrolysis | active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate) and sulphamic acid | Active chlorine generated from sodium chloride by electrolysis | Active chlorine generated from sodium dichloroisocyanurate dihydrate and pentapotassium bis(peroxymonosulphate) bis(sulphate) | active chlorine generated from sodium N-chlorosulfamate | Active chlorine released from chlorine | Active chlorine released from hypochlorous acid | Active chlorine generated from seawater (sodium chloride) by electrolysis | CHLOR | KLOR | Molecular chlorine	7782-50-5	Yes	-	• Causes serious eye irritation • May cause respiratory irritation • Causes skin irritation • Acute toxicity (inhalation)	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethyl 3-methyl-3-phenylglycidate | Ethyl methylphenylglycidate | Ethyl 2,3-epoxy-3-phenylbutyrate | 2-Oxiranecarboxylic acid, 3-methyl-3-phenyl-, ethyl ester | 2-Oxiranecarboxylic acid, 3-methyl-3-phenyl-, ethyl ester | 3-methyl-3-phenyl-, ethyl ester | 3-METHYL-3-PHENYL GLYCIDIC ACID ETHYL ESTER | OXIRANECARBOXYLIC ACID, 3-METHYL-3-PHENYL-, ETHYL ESTER | OKSIRANKARBOKSYLSYRE, 3-METYL-3-FENYL-, ETYL ESTER | Aldehyde C16 | Hexadecanal | Palmitaldehyde | 2,3-Epoxy-3-phenylbutyric acid, ethyl ester of (as impurity only) | alpha-beta-Epoxy-beta-methylhydrocinnamic acid, ethyl ester of (as impurity only)) | Ethyl methylphenylglycidate (as impurity or fragrance use only))	77-83-8	-	-	-	-	-
Tributyl acetylcitrate | 1,2,3-Propanetricarboxylic acid, 2-(acetyloxy)-, tributyl ester | ACETYL TRIBUTYL CITRATE | Tributyl O-acetylcitrate | 1,2,3-Propanetricarboxylic acid, 2-(acetyloxy)-, 1,2,3-tributyl ester | Tributyl-O-Acetyl citrate | PROPANETRICARBOXYLIC ACID,2-(ACETYL-OXY)-TRIBUTYLESTER , 1,2,3- | Citric acid, tributyl ester, acetate | Citroflex A-4 | Uniplex 84	77-90-7	-	-	Endocrine disruption	-	-
Triethyl citrate | 1,2,3-Propanetricarboxylic acid, 2-hydroxy-, triethyl ester | 1,2,3-Propanetricarboxylic acid, 2-hydroxy-, 1,2,3-triethyl ester | PROPANTRIKARBOKSYLSYRE,2-HYDROKSY-, TRIETYLESTER, 1,2,3- | Citroflex 2	77-93-0	-	-	-	May be used as a food additive (flavouring)	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Tetrahydrolinalool | 3,7-dimethyloctan-3-ol | 3-Octanol, 3,7-dimethyl- | 3,7-DIMETHYL-3-OCTANOL | OKTANOL,3,7-DIMETYL, 3-	78-69-3	-	-	-	-	-
1,6-Octadien-3-ol, 3,7-dimethyl- | Linalol | Linalool | 3,7-dimethyl-1,6-octadien-3-ol |dl-linalool | linalool 3,7-dimethyl-1,6-octadien-3-ol | OKTADIEN-3-OL,3,7-DIMETYL, 1,6- | Linalool FCC synthetic | Linalyl alcohol | 1,6-Octadien-3-ol, 3,7-dimethyl-, (S)- | 1,6-Octadien-3-ol, 3,7-dimethyl-, (S)-(+)-	78-70-6	-	-	• Causes skin irritation • May cause an allergic skin reaction • Skin sensitiser	-	-
Isobutyraldehyde | 2-METHYLPROPANAL | Propanal, 2-methyl- | ISOBUTYRALDEHYD | METYLPROPANAL, 2- | Butaldehyde | Butanal | Butyraldehyde | n-Butyl aldehyde | Isobutyraldehyde	78-84-2	-	-	-	-	-
Methacrolein | 2-Methyl-2-propenal | Methacrylaldehyde | 2-Propenal, 2-methyl- | ACROLEIN	78-85-3	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected mutagen • Suspected skin irraitant • Suspected skin sensitiser • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Butanone | ethyl methyl ketone | methyl ethyl ketone (MEK) | 2-Butanone | METHYLATED SPIRIT(S) | BUTANON | butanone ethyl methyl ketone | BUTANON, 2- | 2-Oxobutane | Acetone, methyl- | Butan-2-one | Ketone, ethyl methyl | Methyl acetone	78-93-3	-	-	• Nero • Suspected reprotoxic • LD Endocrine disruption • Critical effects developmental, musculoskeletal • Causes serious eye irritation • May cause respiratory irritation • May cause drowsiness or dizziness • Repeated exposure may cause skin dryness and cracking	-	-
Methylglyoxal | Pyruvaldehyde | Propanal, 2-oxo-	78-98-8	-	-	-	-	-
methyl acetate | Acetic acid, methyl ester | METHYLACETAT | METYLACETAT | Methyl ethanoate | Methyl ester of acetic acid	79-20-9	-	-	• Causes serious eye irritation • May cause drowsiness or dizziness	-	-
3-Buten-2-one, 4-(2,5,6,6-tetramethyl-2-cyclohexen-1-yl)- | α-Irone | alpha-Irone | 5-METHYL-ALPHA-IONONE | 4-(2,5,6,6-tetramethylcyclohex-2-enyl)but-3-en-2-one | BUTEN-2-ONE, 4-(2,5,6,6-TETRAMEHTYL-2-CYCLOHEXEN-1-YL)-, CIS-, 3- | alpha-Irone	79-69-6	-	-	• Causes skin irritation • May cause an allergic skin reaction • Suspected carcinogen • Suspected skin sensitiser • Suspected mutagen	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
3-Buten-2-one, 4-(2,5,6,6-tetramethyl-1-cyclohexen-1-yl)- | β-Irone | 6-Methyl-.beta.-ionone | 5-METHYL-BETA-IONONE | 4-(2,5,6,6-tetramethyl-1-cyclohexen-1-yl)-3-buten-2-one | BETA-IRONE	79-70-9	-	-	• Causes skin irritation • May cause an allergic skin reaction • Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	-	-
Ionone | Ionone (mixed isomers) | MIXED IONONES	8013-90-9	-	-	• Causes skin irritation • May cause an allergic skin reaction • Suspected carcinogen • Suspected mutagen • Suspected skin sensitiser	-	-
α-Terpineol acetate | alpha-Terpineol acetate | A-TERPINYL ACETATE | p-menth-1-en-8-yl acetate | Terpinyl acetate | 3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, 1-acetate | 3-CYCLOHEXENE-1-METHANOL, .ALPHA.,.ALPHA.,4-TRIMETHYL-, ACETATE | 3-Cyclohexene-1-methanol, | CYCLOHEXENE-1-METHANOL,A,A,4-TRIMETHYL-,ACETAT, 3- | .alpha.-Terpineol acetate | .alpha.-Terpinyl acetate | Terpineol acetate	80-26-2	-	-	-	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Bicyclo[3.1.1]hept-2-ene, 2,6,6-trimethyl- | α-Pinene | 2,6,6-Trimethylbicyclo[3.1.1] hept-2-ene (alpha-Pinene) | alpha-Pinene | PINENE | Pin-2(3)-ene | Alpha-Pinenes | 2-PINEN | Pin-2(3)-eeni | PINEN, 2- | 2,2,6-Trimethylbicyclo(3.1.1)hept-2-ene | 2,6,6-Trimethylbicyclo(3.1.1)heptane, didehydro deriv. | 2,6,6-Trimethylbicyclo(3.1.1)hept-2-ene | 2-Pinene | alpha-(+)-Pinene | Cyclic Dexadiene | Biclo{3.1.1}hept-2-ene, 2,6,6-trimethyl- | (1S,2S)-(-)-alpha-Pinene | 2-Pinene, (1S,5S)-(-)- | Bicyclo[3.1.1]hept-2-ene,2,6,6-trimethyl-, (1S,5S)- | (S)-(-)-alpha-Pinene | (+)-Pin-2(3)-ene	80-56-8	Yes (may be fatal)	-	• Harmful if swallowed • May be fatal if swallowed • Causes skin irritation • May cause damage to organs through prolonged or repeated exposure • May cause an allergic skin reaction	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
methyl methacrylate | methyl 2-methylprop-2-enoate |methyl 2-methylpropenoate | 2-Propenoic acid, 2-methyl-, methyl ester | Methacrylate, methyl- | Methacrylic acid, methyl ester | Methyl methacrylate monomer (MMA) | methylmethacrylat | methyl methacrylate methyl 2-methylprop-2-enoate methyl 2-methylpropenoate | METYL-2-METYLPROPENOAT | Methyl ester of methacrylic acid | Methyl-2-methyl-2-propenoate	80-62-6	-	-	• Nervous • Respiratory • Causes skin irritation • Skin sensitisation • May cause respiratory irritation • May cause an allergic skin reaction	-	-
Methyl cyclopentenolone | Methylcyclopentenolone | 2-hydroxy-3-methylcyclopent-2-enone | 2-Cyclopenten-1-one, 2-hydroxy-3-methyl- | 3-METHYL-2-CYCLOPENTEN-2-OL-1-ONE | CYCLOPENTEN-1-ONE, 2-, 2-HYDROXY-3-METHYL-	80-71-7	-	-	• Suspected carcinogen • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Tetracosyl acetate	822-29-7	-	-	-	-	-
diethyl phthalate (DEP) | Diethylphthalate | 1,2-Benzenedicarboxylic acid, diethyl ester | Ethyl phthalate | Neantine | o-Benzenedicarboxylic acid diethyl ester | o-Bis(ethoxycarbonyl)benzene | Phthalate, diethyl | Phthalic acid, diethyl ester | 1,2-Benzenedicarboxylic acid, 1,2-diethyl ester | DIETHYLPHTHALAT | Dietyyliftalaatti | DIETYL-1,2-BENZENDIKARBOKSYLAT | Diethyl ester of phthalic acid	84-66-2	-	-	• Reproductive • Hepatic • LD Endocrine disruption	-	-
diisobutyl phthalate (DIBP) | 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester | diisobutyl phthalate | 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester | 1,2-Benzenedicarboxylic acid, 1,2-bis(2-methylpropyl) ester | Di-isobutyl phthalate - (1,2-Benzene- dicarboxylic acid, 1,2- bis-(2methylpropyl) ester) | Diisobutylphthatlate (1,2-Benzenedicarboxylic acid, 1,2-bis(2-methylpropyl) ester) | DIISOBUTYLPHTHALAT | DIISOBUTYLFTALAT	84-69-5	-	-	• May damage the unborn child • Suspected of damaging fertility • LD Endocrine disruption • Toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
dibutyl phthalate (DBP) | 1,2-Benzenedicarboxylic acid, dibutyl ester | Dibutyl phthalate| 1,2-Benzenedicarboxylic acid, dibutyl ester | Di-n-butyl phthalate | Phthalic acid, dibutyl ester | Bis-n-butyl phthalate | Butyl phthalate | Dibutyl o-phthalate | Di(n-butyl) 1,2-benzenedicarboxylate | n-Butyl phthalate | Phthalic acid di-n-butyl | Di-n-butyl phthalate | 1,2-Benzenedicarboxylic acid, 1,2-dibutyl ester | Dibutyl phthalate (1,2-Benzene-dicarboxylic acid, 1,2- dibutyl ester) | Dibutylphthalate (1,2-Benzenedicarboxylic acid, 1,2-dibutyl ester) | DIBUTYLPHTHALATE | Dibutyl benzene-1,2-dicarboxylate | DIBUTYLPHTHALAT | DIBUTYLFTALAT | Dibutyl-1,2-benzene-dicarboxylate	84-74-2	-	-	• May damage the unborn child • Suspected of damaging fertility • LD Endocrine disruption • Toxic for reproduction	-	-
Methyl 2-methylbutyrate | METHYL METHYLBUTYRATE | Butanoic acid, 2-methyl-, methyl ester	868-57-5	-	-	• Suspected carcinogen • Suspected skin sensitiser	-	-
2-Hydroxyethyl salicylate | Monoglycol salicylate | GLYCOL SALICYLATE | ETHYLENE GLYCOL MONOSALICYLATE | Benzoic acid, 2-hydroxy-, 2-hydroxyethyl ester	87-28-5	-	-	• Suspected acutely toxic via the oral route • Suspected skin irritant	-	-
Caryophyllene | beta-Caryophyllene | Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-, [1R-(1R,4E,9S)]-	87-44-5	-	-	• Suspected bioaccumulative • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Acetovanillin | 4-formyl-2-methoxyphenyl acetate | Benzaldehyde, 4-(acetyloxy)-3-methoxy-	881-68-5	-	Suspected	Suspected carcinogen	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Menthyl acetate | Cyclohexanol, 5-methyl-2-(1-methylethyl)-, 1-acetate, (1R,2S,5R)-rel- | Menthyl acetate (1alpha,2beta,5alpha) | CYCLOHEXANOL, 5-METHYL-2-(1-METHYLETHYL)-, ACETATE, (1.ALPHA.,2.BETA.,5.ALPHA.)-	89-48-5	-	-	-	-	-
Cyclohexanol, 5-methyl-2-(1-methylethenyl)-, [1R-(1.alpha.,2.beta.,5.alpha.)]- | (-)-Isopulegol | Isopulegol | Cyclohexanol, 5-methyl-2-(1-methylethenyl)-, (1R,2S,5R)- | SYKLOHEKSANOL, 5-METYL-2-(1-METYL-ETENYL)-, (1R-(alfa,2beta,5alfa))- | Isopulegol	89-79-2	-	-	• Suspected of causing cancer • Causes damage to organs through prolonged or repeated exposure	-	-
Cyclohexanone, 5-methyl-2-(1-methylethyl)-, (2R,5S)-rel- | Menthone | trans-p-Menthan-3-one | trans-menthone | CYCLOHEXANONE, 5-METHYL-2-(1-METHYLETHYL)-, TRANS- | SYKLOHEKSANON, 5-METYL-2-(1-METYL-ETENYL)-, trans- | dl-Menthone | p-Menthan-3-one (trans)	89-80-5	-	-	• Causes skin irritation • Suspected mutagen • Suspected skin sensitiser • Suspected toxic for reproduction	-	-
Piperitone | 6-isopropyl-3-methylcyclohex-2-enone | 2-Cyclohexen-1-one, 3-methyl-6-(1-methylethyl)-	89-81-6	-	-	-	-	-
Cyclohexanone, 5-methyl-2-(1-methylethylidene)-, (R)- | Pulegone | d-Pulegone | p-menth-4(8)-en-3-one | Cyclohexanone, 5-methyl-2-(1-methylethylidene)-, (5R)-	89-82-7	-	-	• Toxic if swallowed • Suspected carcinogen • Causes damage to organs through prolonged or repeated exposure • Suspected skin sensitiser • Suspected toxic for reproduction	-	Mandatory component of agathosma betulina

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
1-naphtol | 1-Naphthalenol | 1-naphthol | 1 -Naphthol and its salts | PHENOLS | Naphthalen-1-ol | NAFTOL, 1- | 1-Hydroxynaphthalene | alpha-Hydroxynaphthalene | Basf Ursol ERN | C.I. 76605 | C.I. Oxidation Base 33 | Durafur Developer D | Fouramine ERN | Fourrine 99 | Fourrine ERN | Furro ER | Nako TRB | Naphthalene, 1-hydroxy-	90-15-3	-	-	• Harmful if swallowed • Harmful in contact with skin • Causes serious eye damage • Causes skin irritation • May cause respiratory irritation • May cause an allergic skin reaction • Suspected mutagen • Suspected skin sensitiser • Harmonised classification for specific target organ toxicity • Suspected toxic for reproduction • Acute Toxicity • Suspected acutely toxic via the oral route	-	-
Syringol | 2,6-Dimethoxyphenol | PHENOLS | Phenol, 2,6-dimethoxy-	91-10-1	-	-	• Suspected carcinogen • Suspected skin irritant • Suspected skin sensitiser	-	Permitted for use only in combination with other permitted ingredients as a fragrance. If used in a fragrance the total fragrance concentration in a medicine must be no more than 1%.

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2H-1-Benzopyran-2-one | BENZOPYRAN-2-ON, 2H-1- | 1,2-Benzopyrone | 2-Propenoic acid, 3-(2-hydroxyphenyl)-, .delta.-lactone | 5,6-Benzo-2-pyrone | Benzo-alpha-pyrone | Cinnamic acid, o-hydroxy-, delta-lactone | cis-o-Coumarinic acid lactone | Coumarinic anhydride | Cumarin | Rattex | Tonka bean camphor	91-64-5	-	-	Toxic if swallowed	-	Permitted for use only in combination with other permitted ingredients as a fragrance. If used in a fragrance the total fragrance concentration in a medicine must be no more than 1%.
2H-1-Benzopyran-2-one, 6-methyl- | 6-Methylcoumarin | 6-METHYL COUMARIN	92-48-8	-	-	• Harmful if swallowed • Suspected carcinogen • Suspected mutagen • Suspected toxic for reproduction	-	Permitted for use only in combination with other permitted ingredients as a fragrance. If used in a fragrance the total fragrance concentration in a medicine must be no more than 1%.
trans-2-Hexenol | trans-hex-2-en-1-ol | 2-HEXEN-1-OL, TRANS- | 2-Hexen-1-ol, (2E)- | trans-2-HEXEN-1-OL | 2-Hexen-1-ol, (E)-	928-95-0	-	-	Suspected skin irritant	-	-
Leaf alcohol | cis-3-Hexenol | 3-HEXENOL | cis-hex-3-en-1-ol | 3-Hexen-1-ol, (3Z)- | CIS-3-HEXEN-1-OL | 3-HEXEN-1-OL, (Z)- | cis-3-Hexene-1-ol	928-96-1	-	-	-	-	-
Creosol | 2-Methoxy-4-methylphenol | 2-METHOXY-P-CRESOL | PHENOLS | Phenol, 2-methoxy-4-methyl- | 2-Methoxy-4-methylphenol | Cresylic acid | Tar acid oil	93-51-6	-	-	• Suspected acutely toxic via the oral route • Suspected carcinogen • Suspected mutagen • Suspected skin irraitant • Suspected skin sensitisation • Suspected toxic for reproduction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethyl benzoate | Benzoic acid, ethyl ester | Salts of benzoic acid other than esters of benzoic acid | AMMONIUM BENZOATE / BUTYL BENZOATE / CALCIUM BENZOATE / ETHYL BENZOATE / ISOBUTYL BENZOATE / ISOPROPYL BENZOATE / MAGNESIUM BENZOATE / MEA-BENZOATE / METHYL BENZOATE / PHENYL BENZOATE / POTASSIUM BENZOATE / PROPYL BENZOATE | ETHYLBENZOAT | BENZOSYRE, ETYLESTER	93-89-0	-	-	-	May be used as a food additive	-
Styrallyl acetate | alpha-Methylbenzyl acetate | METHYLBENZYL ACETATE | 1-phenylethyl acetate | Benzenemethanol, .alpha.-methyl-, 1-acetate | BENZENMETANOL,A-METYL-,ACETAT | Benzenemethanol, alpha-methyl-, 1-acetate | Benzenemethanol,.alpha.-methyl-,acetate | Methylphenyl carbinyl acetate | (.+-.)-Styrallyl acetate	93-92-5	-	-	-	-	-
Propenylguaethol | ETHOXY-PROPENYLPHENOL | 2-ethoxy-5-prop-1-enylphenol | PHENOLS | Phenol, 2-ethoxy-5-(1-propen-1-yl)- | Phenol, 2-ethoxy-5-(1-propenyl)-	94-86-0	-	-	• Suspected acutely toxic via the oral route • Suspected skin sensitisation	-	-
o-cresol | p-cresol |mix-cresol | Phenol, 2-methyl- | orthocresol | CRESOL, ORTHO- | Methylphenol | CRESOLS | PHENOLS | KRESOL, o- | Cresol (all isomers) | ortho-Cresol | 2-Cresol | o-Cresylic acid | 1-Hydroxy-2-methylbenzene | 2-Hydroxytoluene | 2-Methyl phenol	95-48-7	-	-	• Nervous • Toxic if swallowed • Toxic in contact with skin • Causes severe skin burns and eye damage • Acute toxicity (oral, dermal) • Skin corrosion	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
3,4-xylenol | 3,4-Dimethylphenol | Phenol, 3,4-dimethyl- | Dimethylphenol | PHENOLS | 3,4-DIMETHYLPHENOL	95-65-8	-	-	• Cardiovascular • Hepatic • Immune • Toxic if swallowed • Toxic in contact with skin • Causes severe skin burns and eye damage • Urinary • Acute Toxicity • Skin Corrosion	-	-
2,3-Heptanedione | Heptane-2,3-dione	96-04-8	-	-	• Suspected mutagen • Suspected skin sensitiser	-	-
Dihydroxyacetone | 1,3-dihydroxyacetone | DIHYDROXYACETONE (MONOMER) | 2-Propanone, 1,3-dihydroxy-	96-26-4	-	-	-	-	-
ɣ-Butyrolactone | gamma-Butyrolactone | 4-Hydroxybutanoic acid lactone | BUTYROLACTONE | 2(3H)-Furanone, dihydro- | gamma-Hydroxybutyrolactone | gamma butyrolactone | 4-BUTYROLACTON | Butyrolaktoni | FURANONE,DIHYDRO,2(3H)- | 4-Hydroxybutyric acid, gamma-lactone | Butyrolactone, gamma- | Dihydro-2(3H)-furanone	96-48-0	-	-	-	-	-
Phenol, 2-methoxy-4-(2-propenyl)- | Eugenol | Phenol, 2-methoxy-4-(2-propen-1-yl)- | Fenoli, 2-metoksi-4-(2-propenyyli)- | FENOL, 2-METOKSY-4-(2-PROPENYL)- | 4-Allyl-2-methoxyphenol | Phenol, 4-allyl-2-methoxy-	97-53-0	-	-	• Causes serious eye irritation • May cause an allergic skin reaction	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
Ethyl 2-methylpropanoate | Propanoic acid, 2-methyl-, ethyl ester | Ethyl isobutyrate | 2-METHYLPROPANSYREETHYLESTER	97-62-1	-	-	Suspected skin sensitiser	-	-
ethyl lactate | ethyl DL-lactate | Propanoic acid, 2-hydroxy-, ethyl ester | ETHYLLACTAT | ethyl lactate ethyl DL-lactate | ETYL-2-HYDROKSYPROPANOAT | Lactic acid, ethyl ester(S) | lactic acid, ethyl ester | Propanoic acid, 2-hydroxy-, ethyl ester	97-64-3	-	-	• May cause respiratory irritation • Causes serious eye damage • Specific organ toxicity • Suspected toxic for reproduction	-	-
furfuryl alcohol | 2-2-Furanmethanol | furfuryl alcohol (R1) | 2-Furanmethanol | 2-FURYLMETHANOL | FURANMETANOL, 2- | 2-Furancarbinol | 2-Hydroxymethylfuran	98-00-0	Yes	-	• Harmful if swallowed • Harmful in contact with skin • Causes serious eye irritation • May cause an allergic skin reaction • Suspected carcinogenic • May cause respiratory irritation • May cause damage to organs through prolonged or repeated exposure • Acute toxicity (inhalation, dermal and oral)	-	-

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
2-Furancarboxaldehyde | 2-furaldehyde | 2-FURANCARBALDEHYD | Fural | Furfuraldehyde	98-01-1	Yes	-	• Hepatic • Suspected carcinogenic • Suspected mutagenic • Toxic if contact with skin • Causes serious eye irritation • Toxic if swallowed • May cause respiratory irritation • Acute toxicity • Skin irritation	-	-
α-Terpineol | alpha-Terpineol | p-menth-1-en-8-ol | 3-Syklohekseeni-1-metanoli | MENTH-1-EN-8-OL , P- | Terpineol | 3-Cyclohexene-1-methanol,.alpha.,.alpha., 4-trimethyl- | (-)-.alpha.-Terpineol | (+-)-Alpha-Terpineol | dl-.alpha.-Terpineol | p-Menth-1-en-8-ol, (R)-(+)- | (R)-(+)-.alpha.-Terpineol | (s)-p-Menth-1-en-8-ol | Terpineol 350 | p-Menth-1-en-8-ol (S)	98-55-5	-	-	-	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.

Table 3 continued

Chemical name(s)	CAS number	Health assessment			Permitted use in Australia	
		Harmful if inhaled	May cause respiratory sensitisation	Other reported hazards	FSANZ [9]	TGA [10]
acetophenone | Ethanone, 1-phenyl- | PHENYL METHYL KETONE | ACETOPHENON | ACETOFENON | Acetylbenzene | Hypnone | 1-Phenylethanone	98-86-2	-	-	• Harmful if swallowed • Causes serious eye irritation • Acute toxicity	-	Permitted for use only in combination with other permitted ingredients as a flavour or a fragrance. If used in a flavour the total flavour concentration in a medicine must be no more than 5%. If used in a fragrance the total fragrance concentration in a medicine must be no more 1%.
carvone (ISO) |2-methyl-5-(prop-1-en-2-yl)cyclohex-2-en-1-one | Carvone | D-p-mentha-1(6),8-dien-2-one | 2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)- | Bedoukian L-Carvone | L-Carvone | 2-Cyclohexen-1-one,2-methyl-5-(1-methylethenyl)-,(5R)- | (4R)-(-)-Carvone | (-)-(5R)-Carvone | p-Mentha-6,8-dien-2-one, (R)-(-)- | (R)-(-)-Carvone | (R)-Carvone | d-Carvone	99-49-0	-	-	• May cause alergic skin reaction • Skin sensitiser • Suspected carcinogen	-	-
1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl)- | ɣ-Terpinen | p-Mentha-1,4-diene | GAMMA-TERPINENE | CYCLOHEXADIEN,1-METYL-4-(1-METYLETYL)-, 1,4- | 1-Methyl-4-isopropyl-1,4-cyclohexadiene | gamma.-Terpinene	99-85-4	Yes (may be fatal)	-	• Fatal if swallowed • Suspected bioaccumulative • Suspected skin sensitiser	-	-

Appendix D: Excluded studies from scoping review

Table 4: Excluded studies and exclusion reason

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
253 Increasing Incidence and Severity of Electronic Cigarette Burns: Two Year Experience at a Single Verified Burn Center	Komak, S. and Cross, J	Journal of Burn Care & Research	2019	40	Supp1	S105–S105	Excluded	Study design
284 Resurgence of Electronic Cigarette Explosions Despite Regulation	Day, A., McLawhorn, M.M., Prindeze, N.J., Nosanov, L.B., Moffatt, L.T. and Shupp, J.W.	Journal of Burn Care & Research	2019	40	Supp1	S119–S120	Excluded	Outcome type; study design
Briefly Noted	-	Alcoholism & Drug Abuse Weekly	2019	31	4	8–8	Excluded	Study design
E-cigarettes: Hazardous or helpful? Their efficacy as a tool for quitting regular cigarettes and their long-term safety remain concerning	-	Harvard Heart Letter	2019	29	12	5–5	Excluded	Outcome type
Electronic cigarette among health science students in Saudi Arabia	-	Annals of Thoracic Medicine	2019	14	1	56–62	Excluded	Outcome type
In Case You Haven't Heard	-	Alcoholism & Drug Abuse Weekly	2019	31	26	8–8	Excluded	Study design
Vaping + smoking = bad news	-	University of California at Berkeley Wellness Letter	2019	-	-	3–3	Excluded	Study design
Comparison of systemic exposure to toxic and/or carcinogenic volatile organic compounds (VOCs) during vaping, smoking, and abstention	Helen, G.S., Liakoni, E., Nardone, N., Addo, N., Jacob, P. and Benowitz, N.L.	Cancer Prevention Research	2019	13	2	153–162	Excluded	Duplicate

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
E-cigarettes compared with nicotine replacement therapy within the UK Stop Smoking Services: the TEC RCT	Hajek, P., Phillips-Waller, A., Przulj, D., Pesola, F., Myers Smith, K., Bisal, N., Li, J., Parrott, S.J., Sasieni, P., Dawkins, L. and Ross, L.	Health Technology Assessment	2019	-	-	1-108	Excluded	Outcome type
Moderating the Effects of Adverse Childhood Experiences to Address Inequities in Tobacco-Related Risk Behaviors	Srivastav, A., Strompolis, M., Kipp, C., Richard, C.L. and Thrasher, J.F.	Health Promotion Practice	2020	21	Supp1	139S-147S	Excluded	Outcome type
Tobacco Advertisements: What Messages Are They Sending in African American Communities?	Rosario, C. and Harris, K.E., 2020.	Health Promotion Practice	2020	21	Supp1	54S-60S	Excluded	Outcome type
Vaping is not a 'safer option' for pregnant women	-	Community Practitioner	2020	93	6	13-13	Excluded	Study design
Serum proteome and high wattage e-cigarette vaping: a randomized crossover study	Chaumont, M., Communi, D., Tagliatti, V., Colet, J.M. and Van de Borne, P.	Journal of Hypertension	2021	39	-	e167	Excluded	Duplicate
Perceived health effects of vaping among Hungarian adult e-cigarette-only and dual users: a cross-sectional internet survey	Abafalvi, L. and Penzes, M. and Urban, R. and Foley, K. L. and Kaan, R. and Kispelyi, B. and Hermann, P.	BMC Public Health	2019	19	1	302	Excluded	Outcome type
Diagnosis of EVALI: General Approach and the Role of Bronchoscopy	Aberegg, Scott K. and Maddock, Sean D. and Blagev, Denitza P. and Callahan, Sean J.	CHEST	2020	158	2	820-827	Excluded	Study design
A Single-Center, Randomized, Double-Blind, Placebo-Controlled, Two-Part, Dose-Escalation Study to Evaluate the Safety, Tolerability, Pharmacokinetic, and Pharmacodynamic Effects of KER-050 Administered to Healthy, Postmenopausal Women	Synder, B	Australia New Zealand Clinicals Trials Registry	2019	-	-	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Randomized, Double-Blind, Placebo-Controlled, Single and Multiple Ascending Dose Study to Evaluate the Safety, Tolerability and Pharmacokinetics of KER-047 Administered to Healthy Male Volunteers and Postmenopausal Female Volunteers	Synder, B	Australia New Zealand Clinicals Trials Registry	2019	-	-	-	Excluded	Exposure type
A Phase I Study to assess Safety, Tolerability, Pharmacokinetics and Pharmacodynamics of Single and Multiple Oral Ascending Doses of BioE-1115 in Healthy Adult Volunteers	Lickliter, J and Scharschmidt, BF	Australia New Zealand Clinicals Trials Registry	2019	-	-	-	Excluded	Exposure type
Safety, Tolerability, Pharmacokinetics and Pharmacodynamics of SIR1-365	Motwani, P	Australia New Zealand Clinicals Trials Registry	2019	-	-	-	Excluded	Exposure type
A Phase 1, Open-Label, Four-Period, Two-Sequence, Two-Treatment, Single Dose, Randomized, Crossover Bioequivalence Study of a Test Tablet Formulation of Ravidasvir with the Reference Tablet Formulation of Ravidasvir in Healthy Adult Volunteers Under Fasting Conditions	Ibnou Zekri Lassout, N and Ng Shi Min, S	Australia New Zealand Clinicals Trials Registry	2020	-	-	-	Excluded	Exposure type
A Phase 1, Healthy Volunteer Study to Evaluate the Effect of Differing Bonding Strengths on the Adhesion of a Patch Delivery System for Alzheimer's type Dementia	Rossi, V and Mclendon, K	Australia New Zealand Clinicals Trials Registry	2020	-	-	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
A Phase 1, Healthy Volunteer Study to Evaluate the Effect of Differing Bonding Strengths on the Adhesion of a Patch Delivery System for Alzheimer's type Dementia	Rossi, V and Mclendon, K	Australia New Zealand Clinicals Trials Registry	2020	-	-	-	Excluded	Duplicate
A randomized, double-blind, placebo-controlled investigation of the safety, tolerability and pharmacokinetics of 1% SPL7013 nasal spray in healthy volunteers when administered four times a day for 14 days (1% SPL7013 nasal spray is intended to help prevent COVID-19)	Paull, J	Australia New Zealand Clinicals Trials Registry	2020	-	-	-	Excluded	Exposure type
A Phase 1, Healthy Volunteer Study to Assess a Patch Delivery System for Alzheimer's type Dementia	Kilfoil, T and Miller, V	Australia New Zealand Clinicals Trials Registry	2020	-	-	-	Excluded	Exposure type
A Randomized, Single-Dose and Multiple Dose Dose-Ranging Safety and Pharmacokinetics Study of Tacrolimus Powder for Inhalation in Healthy Adult Subjects	Lickliter, J	Australia New Zealand Clinicals Trials Registry	2020	-	-	-	Excluded	Exposure type
HARMONY: harm reduction for Opiates, Nicotine and You	Dunlop, A	Australia New Zealand Clinicals Trials Registry	2021	-	-	-	Excluded	Outcome type
In Vitro Models, Standards, and Experimental Methods for Tobacco Products	Aghaloo, T. and Kim, J. J. and Gordon, T. and Behrsing, H. P. and Ajiboye, A. S. and Tomar, S.	Advances in Dental Research	2019	30	1	16-21	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
E-cigarette use behaviors and device characteristics of daily exclusive e-cigarette users in Maryland: Implications for product toxicity	Aherrera, A. and Aravindakshan, A. and Jarmul, S. and Olmedo, P. and Chen, R. and Cohen, J. E. and Navas-Acien, A. and Rule, A. M.	Tobacco Induced Diseases	2020	18	-	93	Excluded	Duplicate
Imitating waterpipe: Another tobacco industry attempt to create a cigarette that seems safer	Ahmad, Isra and Dutra, Lauren M.	Addictive Behaviors	2019	91	-	244-252	Excluded	Exposure type
Electronic Cigarettes Prevalence and Awareness Among Jordanian Individuals	Al-Balas, Hasan Ibrahim and Al-Balas, Mahmoud and Al-Balas, Hamzeh and Almehaiza, Sumaya and melhem, Haneen bany and Al-Balas, Bayan	Journal of Community Health	2021	46	3	587-590	Excluded	Outcome type
Severe E-Cigarette, or Vaping, Product Use Associated Lung Injury Requiring Venovenous Extracorporeal Membrane Oxygenation	Aldy, Kim and Cao, Dazhe James and McGetrick, Molly and Willcutts, David and Verbeck, Guido and De Silva, Imesha and Hsu, Stephanie	Pediatric Critical Care Medicine	2020	21	4	385-388	Excluded	Study design
Effects of electronic cigarettes on health: a systematic review of the available evidence.	Amato, L. and Cruciani, F. and Solimini, R. and Barca, A. and Pacifici, R. and Davoli, M.	Recenti Progressi in Medicina	2020	111	1	30-43	Excluded	Duplicate; foreign language
Reducing Tobacco-Related Disability in Chronic Smokers	Ambrose, J. A. and Najafi, A. and Jain, V. and Muller, J. E. and Ranka, S. and Barua, R. S.	American Journal of Medicine	2020	133	8	908-915	Excluded	Outcome type
Social Influence in the Uptake and Use of Electronic Cigarettes: A Systematic Review	Amin, Samia and Dunn, Adam G. and Laranjo, Liliana	American Journal of Preventive Medicine	2020	58	1	129-141	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Effects of e-cigarette health warnings and modified risk ad claims on adolescent e-cigarette craving and susceptibility	Andrews, J. and Mays, Darren and Netemeyer, Richard G. and Burton, Scot and Kees, Jeremy	Nicotine & Tobacco Research	2019	21	6	792-798	Excluded	Outcome type
Exploring e-cigarette policy recommendations and the role of evidence in international public health guidelines: a citation network analysis	Smith, M.J., Skivington, K., Hilton, S. and Katikireddi, S.V	The Lancet	2019	394	-	S4	Excluded	Study design
Can e-cigarettes quit smoking safely and effectively? [Chinese]	Yu Shuilian, Liang Lirong	Chinese Journal of Epidemiology	2020	41	5	799-800	Excluded	Foreign language
ACDS 32nd Annual Meeting Abstracts	-	Dermatitis. Conference: 32nd Annual Meeting of the American Contact Dermatitis Society, ACDS	2021	32	3	-	Excluded	Study design
Acute and chronic sympathomimetic effects of e-cigarette and tobacco cigarette smoking: Role of nicotine and non-nicotine constituents	Arastoo, S. and Haptonstall, K. P. and Choroomi, Y. and Moheimani R. and Nguyen, K. and Tran, E. and Gornbein, J. and Middlekauff, H. R.	American Journal of Physiology - Heart and Circulatory Physiology	2020	319	2	H262-H270	Excluded	Exposure type
Examining the temporality of vitamin E acetate in illicit THC-containing e-cigarette, or vaping, products from a public health and law enforcement response to EVALI - Utah, 2018-2020	Arons, Melissa M. and Barnes, Stephen R. and Cheng, Rita and Whittle, Kelly and Elsholz, Christopher and Bui, David and Gilley, Stephen and Maldonado, Alej and ra and LaCross, Nathan and Sage, Kylie and Lewis, Nathaniel and McCaffrey, Keegan and Green, Jordan and Duncan, Janae and Dunn, Angela C.	International Journal of Drug Policy	2021	88	-	103026	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Interventions for replacing missing teeth: alveolar ridge preservation techniques for dental implant site development	Atieh, M.A., Alsabeeha, N.H., Payne, A.G., Ali, S., Clovis Jr, M. and Esposito, M.,	Cochrane Database of Systematic Reviews	2021	4	-	-	Excluded	Outcome type
Health Professions Students Transform COVID-19 Learning Challenges into Innovation...Association of Schools Advancing Health Professions, Live Virtual Series, September 30, 2020 - March 24, 2021	Austin, Melanie	Journal of Allied Health	2021	-	-	-	Excluded	Study design
E-cigarette use and combustible tobacco cigarette smoking uptake among non-smokers, including relapse in former smokers: umbrella review, systematic review and meta-analysis	Baenziger, O.N., Ford, L., Yazidjoglou, A., Joshy, G. and Banks, E.	BMJ Open	2021	11	3	e045603	Excluded	Outcome type
Impact of tobacco control interventions on smoking initiation, cessation, and prevalence: A systematic review	Bafunno, D., Catino, A., Lamorgese, V., Del Bene, G., Longo, V., Montrone, M., Pesola, F., Pizzutilo, P., Cassiano, S., Mastrandrea, A. and Ricci, D., Petrillo, P., Varesano, N., Zacheo, A. and Galetta, D.	Journal of Thoracic Disease	2020	12	7	3844-3856	Excluded	Outcome type
Electronic Cigarette (E-Cigarette) Vapor Exposure Alters the Streptococcus pneumoniae Transcriptome in a Nicotine-Dependent Manner without Affecting Pneumococcal Virulence	Bagale, K. and Paudel, S. and Cagle, H. and Sigel, E. and Kulkarni, R.	Applied and environmental microbiology	2020	86	3	e02125-19	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Smoking Assessment and Current Smoking Status Among Adolescents in Primary Care Settings	Bailey, Steffani R. and Fankhauser, Katie and Marino, Miguel and Schmidt, Teresa and Giebultowicz, Sophia and Ezekiel-Herrera, David and Heintzman, John	Nicotine & Tobacco Research	2020	22	11	2098-2103	Excluded	Outcome type
Diffuse alveolar damage and e-cigarettes: Case report and review of literature	Bakre, S. A. and Al-Farra, T. S. and Al-Farra, S.	Respiratory Medicine Case Reports	2019	28	-	100935	Excluded	Study design
Evidence-based tobacco-control legislation on e-cigarettes is urgently needed	B and ara, Nilanga Aki and Wanniarachchi, Senara and Mehrnoush, Vahid	CMAJ	2020	192	3	E74-E74	Excluded	Outcome type
The influence of waste from electronic cigarettes, conventional cigarettes and heat-not-burn tobacco products on microorganisms	Baran, W. and Madej-Knysak, D. and Sobczak, A. and Adamek, E.	Journal of Hazardous Materials	2020	385	-	-	Excluded	Exposure type
Hypnotherapy for smoking cessation	Barnes, J. and McRobbie, H. and Dong, C. Y. and Walker, N. and Hartmann-Boyce, J.	Cochrane Database of Systematic Reviews	2019	-	6	-	Excluded	Outcome type
Use of E-Cigarettes and Self-Reported Lung Disease Among US Adults	Barrameda, Robelyn and Nguyen, Trisha and Wong, Vivian and Castro, Grettel and Rodriguez de la Vega, Pura and Lozano, Juan and Zevallos, Juan	Public Health Reports	2020	135	6	785-795	Excluded	Outcome type
An Evaluation of the Knowledge and Perceptions of Pharmacy Staff and Pre-Registration Students of E-Cigarettes Use: A Systematic Review	Barrett, Ravina and Aldamkhi, Hajar	Tobacco Use Insights	2021	14	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Alcohol use, cigarette smoking, vaping and number of sexual partners: A cross-sectional study of sexually active, ethnically diverse, inner city adolescents	Bartholomew, R., Kerry-Barnard, S., Beckley-Hoelscher, N., Phillips, R., Reid, F., Fleming, C., Lesniewska, A., Yoward, F. and Oakeshott, P.	Health Expectations: An International Journal of Public Participation in Health Care & Health Policy	2021	-	-	-	Excluded	Outcome type
E-cigarettes: informing the conversation with patients	Barton, Anna Kate Please confirm that given names and surnames/family names have been identified, correctly	Prescriber	2021	32	5	21-27	Excluded	Outcome type
Smoking Effects in Foot and Ankle Surgery: An Evidence-Based Review	Beahrs, T. R. and Reagan, J. and Bettin, C. C. and Grear, B. J. and Murphy, G. A. and Richardson, D. R.	Foot and Ankle International	2019	40	10	1226-1232	Excluded	Outcome type
Systematic Review of Electronic Cigarette Use (Vaping) and Mental Health Comorbidity among Adolescents and Young Adults	Becker, T.D., Arnold, M.K., Ro, V., Martin, L. and Rice, T.R	Nicotine and Tobacco Research	2021	23	3	415-425	Excluded	Outcome type
Examining the effectiveness of general practitioner and nurse promotion of electronic cigarettes versus standard care for smoking reduction and abstinence in hardcore smokers with smoking-related chronic disease: protocol for a randomised controlled trial	Begh, R., Coleman, T., Yardley, L., Barnes, R., Naughton, F., Gilbert, H., Ferrey, A., Madigan, C., Williams, N., Hamilton, L. and Warren, Y.	Trials	2019	20	1	1-16	Excluded	Outcome type
Nicotine Toxicity Secondary to Aftermarket Modifications to a Vaping Device	Bendel, G. S. and Hiller, H. M. and Ralston, A.	Military medicine	2021	11	-	-	Excluded	Outcome type
E-Cigarette Quality Control: Impurity and Nicotine Level Analysis in Electronic Cigarette Refill Liquids	Bennani, I., Alami Chentoufi, M., El Karbane, M., Cheikh, A. and Bouatia, M.	Scientific World Journal	2020	-	-	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Twenty-Four-Hour Cardiovascular Effects of Electronic Cigarettes Compared With Cigarette Smoking in Dual Users	Benowitz, N.L., St. Helen, G., Nardone, N., Addo, N., Zhang, J., Harvanko, A.M., Calfee, C.S. and Jacob III, P.	Journal of the American Heart Association	2020	9	23	e017317	Excluded	Exposure type
Vape Shop Owners/Managers' Opinions about FDA Regulation of E-Cigarettes	Berg, C. J. and Barker, D. C. and Sussman, S. and Getachew, B. and Pulvers, K. and Wagener, T. L. and Hayes, R. B. and Henriksen, L.	Nicotine and Tobacco Research	2021	23	3	535-542	Excluded	Outcome type
Randomised, placebo-controlled, double-blind, double-dummy, multicentre trial comparing electronic cigarettes with nicotine to varenicline and to electronic cigarettes without nicotine: the ECSMOKE trial protocol	Berlin, I., Dautzenberg, B., Lehmann, B., Palmyre, J., Liégey, E., De Rycke, Y. and Tubach, F.	BMJ open	2019	9	5	e028832	Excluded	Outcome type
Comparison of e-cigarette use characteristics between exclusive e-cigarette users and dual e-cigarette and conventional cigarette users: an on-line survey in France.	Berlin, I., Nalpas, B., Targhetta, R. and Perney, P.	Addiction	2019	114	12	2247-2251	Excluded	Outcome type
Reduced-risk warnings versus the US FDA-mandated addiction warning: The effects of e-cigarette warning variations on health risk perceptions	Berry, Christopher and Burton, Scot	Nicotine & Tobacco Research	2019	21	7	979-984	Excluded	Outcome type
What every dentist needs to know about electronic cigarettes	Bestman, Eugene G. and Brooks, John K. and Mostoufi, Behzad and Bashirelahi, Nasir	General Dentistry	2021	69	3	31-36	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
A randomized trial comparing the acute coronary, systemic, and environmental effects of electronic vaping cigarettes versus heat-not-burn cigarettes in smokers of combustible cigarettes undergoing invasive coronary assessment: rationale and design of the SUR-VAPES 3 trial	Biondi-Zoccai, G., Carnevale, R., Vitali, M., Tritapepe, L., Martinelli, O., Macrina, F., Bullen, C., Peruzzi, M., Cavarretta, E., Marullo, A.G. and Abbate, A	Minerva cardioangiologica	2020	-	-	-	Excluded	Outcome type
Use of electronic nicotine delivery systems (ENDS) in lesbian, gay, bisexual, transgender and queer persons: Implications for public health nursing	Blackwell, C.W. and López Castillo, H.	Public Health Nursing	2020	37	4	569-580	Excluded	Outcome type
The Role of the School Nurse in Creating a Vape-Free School	Blume, Lisa Frey and Lines, Shannon	NASN School Nurse	2020	35	3	166-172	Excluded	Outcome type
Preconception lifestyle advice for people with infertility	Boedt, T., Vanhove, A.C., Vercoe, M.A., Matthys, C., Dancet, E. and Fong, S.L.	Cochrane Database of Systematic Reviews	2021	-	4	-	Excluded	Outcome type
Broader impacts of an intervention to transform school environments on student behaviour and school functioning: post hoc analyses from the INCLUSIVE cluster randomised controlled trial	Bonell, C., Dodd, M., Allen, E., Bevilacqua, L., McGowan, J., Opondo, C., Sturgess, J., Elbourne, D., Warren, E. and Viner, R.M.	BMJ open	2020	10	5	e031589	Excluded	Outcome type
Toxicological assessment of Tobacco Heating System 2.2: Findings from an independent peer review	Boue, S. and Schlage, W. K. and Page, D. and Hoeng, J. and Peitsch, M. C.	Regulatory Toxicology and Pharmacology	2019	104	-	115-127	Excluded	Outcome type
Epiglottitis Associated With Intermittent E-cigarette Use: The Vagaries of Vaping Toxicity	Bozzella, M.J., Magyar, M., DeBiasi, R.L. and Ferrer, K.	Pediatrics	2020	145	3	-	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Electronic Cigarette Policy Recommendations: A Scoping Review	Brady, B. R. and De La Rosa, J. S. and Nair, U. S. and Leischow, S. J.	American Journal of Health Behavior	2019	43	1	88-104	Excluded	Outcome type
Answering Questions About Electronic Cigarettes Using a Multidisciplinary Model	Brel and , Alison and Balster, Robert L. and Cobb, Caroline and Fagan, Pebbles and Foulds, Jonathan and Koch, J. R and y and Lipato, Thokozeni and Saliba, Najat and Shumei, Sun and Eissenberg, Thomas	American Psychologist	2019	74	3	368-379	Excluded	Study design
Bibliometric analysis of electronic cigarette publications: 2003-2018	Briganti, M. and Delnevo, C. D. and Brown, L. and Hastings, S. E. and Steinberg, M. B.	International Journal of Environmental Research and Public Health	2019	16	3	-	Excluded	Outcome type
E-Cigarettes and Other Electronic Nicotine Delivery Systems (ENDS)	Brown, Amy and Balk, Sophie J.	Current Problems in Pediatric & Adolescent Health Care	2020	50	2	100761	Excluded	Outcome type
E-cigarette Use in Prisons With Recently Established Smokefree Policies: A Qualitative Interview Study With People in Custody in Scotland	Brown, Ashley and O'Donnell, Rachel and Eadie, Douglas and Ford, Allison and Mitchell, Danielle and Hackett, Alison and Sweeting, Helen and Bauld, Linda and Hunt, Kate	Nicotine & Tobacco Research	2021	23	6	939-946	Excluded	Outcome type
Initial Views and Experiences of Vaping in Prisons: A Qualitative Study With People in Custody Preparing for the Imminent Implementation of Scotland's Prison Smokefree Policy	Brown, Ashley and O'Donnell, Rachel and Eadie, Douglas and Purves, Richard and Sweeting, Helen and Ford, Allison and Bauld, Linda and Hunt, Kate	Nicotine & Tobacco Research	2021	23	3	543-549	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Tobacco harm reduction: are smokers becoming more hardcore?	Buchanan, T. and Magee, C. A. and H, V. See and Kelly, P. J.	Journal of Public Health Policy	2020	41	3	286-302	Excluded	Outcome type
Electronic cigarette refill liquids: Nicotine content, presence of child-resistant packaging, and in-shop compounding	Buettner-Schmidt, K., Miller, D.R., Orr, M., Balasubramanian, N., Rykal, K., Steward, K.F., Swanson, K. and Berry, M	Journal of pediatric nursing	2021	59	-	45-54	Excluded	Outcome type
Human lungs are created to breathe clean air: the questionable quantification of vaping safety "95% less harmful"	Burrowes, Kelly S. and Beckert, Lutz and Jones, Stuart	New Zealand Medical Journal	2020	133	1517	100-106	Excluded	Study design
Lifestyle modifications for nonalcohol-related fatty liver disease: a network meta-analysis.	Buzzetti, E., Linden, A., Best, L.M., Madden, A.M., Roberts, D., Chase, T.J., Freeman, S.C., Cooper, N.J., Sutton, A.J., Fritche, D. and Milne, E.J.	Cochrane Database of Systematic Reviews	2021	-	6	-	Excluded	Outcome type; exposure type
Pharmacological treatment for Buerger's disease	Cacione, D. G. and Macedo, C. R. and do Carmo Novaes, F. and Baptista-Silva, J. C. C.	Cochrane Database of Systematic Reviews	2020	-	5	-	Excluded	Exposure type
The actual and anticipated effects of a menthol cigarette ban: a scoping review	Cadham, C.J., Sanchez-Romero, L.M., Fleischer, N.L., Mistry, R., Hirschtick, J.L., Meza, R. and Levy, D.T.	BMC Public Health	2020	20	1	1-17	Excluded	Outcome type
Association of nicotine with osteochondrogenesis and osteoarthritis development: The state of the art of preclinical research	Cai, X. and Gao, L. and Cucchiarini, M. and Madry, H.	Journal of Clinical Medicine	2019	8	10	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Factors influencing the uptake and use of nicotine replacement therapy and e-cigarettes in pregnant women who smoke: a qualitative evidence synthesis	Campbell, K., Coleman-Haynes, T., Bowker, K., Cooper, S.E., Connelly, S. and Coleman, T	Cochrane Database of Systematic Reviews	2020	5	-	-	Excluded	Duplicate; outcome type
Immediate-release methylphenidate for attention deficit hyperactivity disorder (ADHD) in adults	Cândido, R.C.F., de Padua, C.A.M., Golder, S. and Junqueira, D.R	Cochrane Database of Systematic Reviews	2021	-	1	-	Excluded	Outcome type
Invited review: human air-liquid-interface organotypic airway tissue models derived from primary tracheobronchial epithelial cells-overview and perspectives	Cao, X., Coyle, J.P., Xiong, R., Wang, Y., Heflich, R.H., Ren, B., Gwinn, W.M., Hayden, P. and Rojanasakul, L.	In vitro cellular & developmental biology	2020	-		1-29	Excluded	Outcome type
A Single-Arm, Open-Label, Pilot, and Feasibility Study of a High Nicotine Strength E-Cigarette Intervention for Smoking Cessation or Reduction for People With Schizophrenia Spectrum Disorders Who Smoke Cigarettes	Caponnetto, P., DiPiazza, J., Kim, J., Maglia, M. and Polosa, R.	Nicotine & tobacco research: official journal of the Society for Research on Nicotine and Tobacco	2021	23	7	1113-1122	Excluded	Outcome type
Efficacy of smoking cessation with varenicline plus counselling for e-cigarettes users (VAREVAPE): a protocol for a randomized controlled trial	Caponnetto, P. and Maglia, M. and Polosa, R.	Contemporary clinical trials communications	2019	15	-	-	Excluded	Outcome type
Use of electronic nicotine delivery systems (ENDS) by pregnant women I: Risk of small-for-gestational-age birth	Cardenas, V.M., Cen, R., Clemens, M.M., Moody, H.L., Ekanem, U.S., Policherla, A., Fischbach, L.A., Eswaran, H., Magann, E.F., Delongchamp, R.R. and Boysen, G	Tobacco Induced Diseases	2019	17	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The use of electronic nicotine delivery systems during pregnancy and the reproductive outcomes: A systematic review of the literature	Cardenas, V. M. and Fischbach, L. A. and Chowdhury, P.	Tobacco Induced Diseases	2019	17	-	-	Excluded	Outcome type
Sensory effects of nicotine and tobacco	Carstens, E. E. and Carstens, M. I.	Nicotine & tobacco research: official journal of the Society for Research on Nicotine and Tobacco.	2021	6	-	-	Excluded	Exposure type
Investigating the role of familial and peer-related factors on electronic nicotine delivery systems (ENDS) use among U.S. adolescents	Cavazos-Rehg, P., Li, X., Kasson, E., Kaiser, N., Borodovsky, J. and Grucza, R.A.	Journal of Adolescence	2021	87	-	98-105	Excluded	Outcome type
Predicting vaping uptake, vaping frequency and ongoing vaping among daily smokers using longitudinal data from the International Tobacco Control (ITC) Four Country Surveys	Chan, G., Morphett, K., Gartner, C., Leung, J., Yong, H.H., Hall, W. and Borland, R.,	Addiction	2019	114	-	61-70	Excluded	Outcome type
A systematic review of randomized controlled trials and network meta-analysis of e-cigarettes for smoking cessation	Chan, G.C., Stjepanović, D., Lim, C., Sun, T., Anandan, A.S., Connor, J.P., Gartner, C., Hall, W.D. and Leung, J.	Addictive Behaviors	2021	-	-	106912	Excluded	Outcome type
Gateway or common liability? A systematic review and meta-analysis of studies of adolescent e-cigarette use and future smoking initiation	Chan, G.C., Stjepanović, D., Lim, C., Sun, T., Shanmuga Anandan, A., Connor, J.P., Gartner, C., Hall, W.D. and Leung, J.	Addiction	2021	116	4	743-756	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Electronic nicotine delivery system (ENDS) liquid nicotine exposure in young children presenting to US emergency departments, 2018	Chang, J. T. and Rostron, B. L.	Injury Epidemiology	2019	6	1	-	Excluded	Exposure type
National estimates of poisoning events related to liquid nicotine in young children treated in US hospital emergency departments, 2013–2017	Chang, J.T., Wang, B., Chang, C.M. and Ambrose, B.K.	Injury Epidemiology	2019	6	1	1-6	Excluded	Exposure type
National Estimates of ENDS Liquid Nicotine Exposures, U.S., 2013-2017	Chang, J.T., Wang, B., Rostron, B.L., Chen, L.H., Schroeder, T.J., Mah, J.C., Chang, C.M. and Ambrose, B.K.,	American Journal of Preventive Medicine	2020	59	5	742-745	Excluded	Exposure type
Effectiveness of an educational intervention on health risks of vaping for high school-aged adolescents	Chaplin, M.D., Brogie, J., Burch, A., Hetzler, J., Hough, D., Gustafson, B., Gray, M. and Gillette, C.	Journal of the American Pharmacists Association: JAPhA	2020	60	6	e158-e161	Excluded	Outcome type
The novel CYP2A6 inhibitor, DLCI-1, decreases nicotine self-administration in mice	Chen, Y.C., Fowler, J.P., Wang, J., Watson, C.J., Sherafat, Y., Staben, A., Lazarus, P., Denton, T.T. and Fowler, C.D	Journal of Pharmacology and Experimental Therapeutics	2020	372	1	21-29	Excluded	Exposure type
Electronic cigarette exposure reduces exercise performance and changes the biochemical profile of female mice	Chen, Y.M., Huang, C.C., Sung, H.C., Lee, M.C. and Hsiao, C.Y.	Bioscience, biotechnology, and biochemistry	2019	83	12	2318-2326	Excluded	Outcome type
전자담배와 가열담배의 국제적 규제정책 비교	Cheol Min, Lee	Journal of the Korean Medical Association / Taehan Uisa Hyophoe Chi	2020	63	2	113-118	Excluded	Foreign language

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Comparison of the risks of combustible cigarettes, e-cigarettes, and heated tobacco products	Cho, H. J.	Journal of the Korean Medical Association	2020	63	2	96-104	Excluded	Foreign language
The Case of the Nicotine Nightmare	Christensen, Deborah	ONS Voice	2019	34	10	35-35	Excluded	Exposure type
Vaping-Induced Acute Lung Injury	Christiani, David C.	New England Journal of Medicine	2020	382	10	960-962	Excluded	exposure type
Ηλεκτρονικό τσιγάρο και καρδιαγγειακές νόσοι	Christina, O., Konstantinos, N. and Konstantinos, K.,	Rostrum of Asclepius / Vima tou Asklipiou	2021	20	1	31-43	Excluded	Foreign language
Electronic Cigarette Vapor with Nicotine Causes Airway Mucociliary Dysfunction Preferentially via TRPA1 Receptors	Chung, S., Baumlin, N., Dennis, J.S., Moore, R., Salathe, S.F., Whitney, P.L., Sabater, J., Abraham, W.M., Kim, M.D. and Salathe, M.	American Journal of Respiratory & Critical Care Medicine	2019	200	9	1134-1145	Excluded	Exposure type
CrossTalk opposing view: E-cigarettes expose users to adverse effects of vapours and the potential for nicotine addiction	Chung, S., Bengtson, C.D., Kim, M.D. and Salathe, M.	Journal of Physiology	2020	598	15	3053-3056	Excluded	Study design
Novel tobacco products including electronic cigarette and heated tobacco products increase risk of allergic rhinitis and asthma in adolescents: Analysis of Korean youth survey	Chung, S.J., Kim, B.K., Oh, J.H., Shim, J.S., Chang, Y.S., Cho, S.H. and Yang, M.S.	Allergy: European Journal of Allergy and Clinical Immunology	2020	75	7	1640-1648	Excluded	Outcome type
Pharmacological interventions for promoting smoking cessation during pregnancy	Claire, R., Chamberlain, C., Davey, M.A., Cooper, S.E., Berlin, I., Leonardi-Bee, J. and Coleman, T	Cochrane Database of Systematic Reviews	2020	-	3	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Use of electronic nicotine delivery systems by pregnant women II: Hair biomarkers for exposures to nicotine and tobacco-specific nitrosamines	Clemens, M.M., Cardenas, V.M., Fischbach, L.A., Cen, R., Siegel, E.R., Eswaran, H., Ekanem, U.S., Policherla, A., Moody, H.L., Magann, E.F. and Boysen, G.	Tobacco Induced Diseases	2019	17	-	-	Excluded	Exposure type
Effect of an electronic nicotine delivery system with 0, 8, or 36 mg/mL liquid nicotine versus a cigarette substitute on tobacco-related toxicant exposure: a four-arm, parallel-group, randomised, controlled trial	Cobb, C.O., Foulds, J., Yen, M.S., Veldheer, S., Lopez, A.A., Yingst, J.M., Bullen, C., Kang, L., Eissenberg, T., Allen, S.I. and Brosnan, P.	The Lancet Respiratory Medicine	2021	-	-	-	Excluded	Exposure type
Characteristics of Urban Inpatient Smokers With and Without Chronic Pain: Foundations for Targeted Cessation Programs	Cody, Gwendolyn R. and Wang, Binhuan and Link, Alissa R. and Sherman, Scott E.	Substance Use & Misuse	2019	54	7	1138-1145	Excluded	Outcome type
E-cigarette marketing and communication: How E-Cigarette Companies Market E-Cigarettes and the Public Engages with E-cigarette Information	Collins, L., Glasser, A.M., Abudayyeh, H., Pearson, J.L. and Villanti, A.C.	Nicotine and Tobacco Research	2019	21	1	14-24	Excluded	Outcome type
Harm reduction treatment for smoking (HaRT-S): findings from a single-arm pilot study with smokers experiencing chronic homelessness	Collins, S.E., Nelson, L.A., Stanton, J., Mayberry, N., Ubay, T., Taylor, E.M., Hoffmann, G., Goldstein, S.C., Saxon, A.J., Malone, D.K. and Clifasefi, S.L.	Substance Abuse	2019	40	2	229-239	Excluded	Outcome type
Cigarette smoke and nicotine during pregnancy : where are we today?	Colomb, C., Blanchon, S. and Barazzone-Argiroffo, C.	Revue Medicale Suisse	2020	16	682	357-360	Excluded	Duplicate; foreign language

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Nonsmokers May Benefit from Lower Doses of an Oral 17β-Estradiol/ Progesterone Capsule – Data from the REPLENISH Trial	Constantine, G. D. and Santoro, N. and Graham, S. and Bernick, B. and Mirkin, S.	Menopause	2019	-	-	-	Excluded	Outcome type
Electronic cigarettes: weighing up the evidence	Cope, Graham	Practice Nursing	2019	30	6	288-291	Excluded	Exposure type
E-cigarettes and wound healing	Cope, Graham	Wounds UK	2020	16	1	34-37	Excluded	Outcome type
Electronic cigarettes: a clinical perspective	Cope, Graham	Independent Nurse	2020	2020	1	42705	Excluded	Study design
Systematic Review of Health Communication for Non-Cigarette Tobacco Products	Cornacchione Ross, J., Noar, S.M. and Sutfin, E.L.	Health Communication	2019	34	3	361-369	Excluded	Outcome type
People smoke for nicotine, but lose sexual and reproductive health for tar: a narrative review on the effect of cigarette smoking on male sexuality and reproduction	Corona, G., Sansone, A., Pallotti, F., Ferlin, A., Pivonello, R., Isidori, A.M., Maggi, M. and Jannini, E.A.	Journal of Endocrinological Investigation	2020	-	-	1-18	Excluded	Outcome type
Drugs for preventing lung cancer in healthy people	Cortés-Jofré, M., Rueda, J.R., Asenjo-Lobos, C., Madrid, E. and Cosp, X.B.	Cochrane Database of Systematic Reviews	2020	3	-	-	Excluded	Exposure type
Vascular effects of a single bout of electronic cigarette use	Cossio, R., Cerra, Z.A. and Tanaka, H	Clinical and Experimental Pharmacology and Physiology	2020	47	1	3-6	Excluded	Outcome type
Telerehabilitation for chronic respiratory disease	Cox, N.S., Dal Corso, S., Hansen, H., McDonald, C.F., Hill, C.J., Zanaboni, P., Alison, J.A., O'Halloran, P., Macdonald, H. and Holland, A.E.	Cochrane Database of Systematic Reviews	2021	-	1	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The Time Course of Compensatory Puffing With an Electronic Cigarette: Secondary Analysis of Real-World Puffing Data With High and Low Nicotine Concentration Under Fixed and Adjustable Power Settings	Cox, S., Goniewicz, M.L., Kosmider, L., McRobbie, H., Kimber, C. and Dawkins, L.	Nicotine & Tobacco Research	2021	23	7	1153-1159	Excluded	Outcome type
Chronic nausea and vomiting: Sifting through the smoke and weed	Coyle, W. J.	American Journal of Gastroenterology	2019	114	11	1704-1706	Excluded	Outcome type
Interventions for improving medication-taking ability and adherence in older adults prescribed multiple medications	Cross, A. J. and Elliott, R. A. and Petrie, K. and Kuruvilla, L. and George, J.	Cochrane Database of Systematic Reviews	2020	-	5	-	Excluded	Exposure type
Compare the Efficacy and Safety of Budesonide and Formoterol Fumarate Dihydrate Inhalation Aerosol 80/4.5 mcg per Actuation in Asthma patients	Dodia, S and Chowdhary, P	Clinical Trials Registry India	2019	-	-	-	Excluded	Outcome type
Study to compare the efficacy and safety of Deflazacort tablets versus Prednisolone Tablets versus Methylprednisolone Tablets in patients with Chronic Obstructive Pulmonary Disease (COPD)	-	Clinical Trials Registry India	2020	-	-	-	Excluded	Outcome type
A clinical study to evaluate the Efficacy and safety of Generic Fluticasone Propionate Inhalation Aerosol (pMDI, HFA 134a) in patients with Bronchial Asthma	-	Clinical Trials Registry India	2021	-	-	-	Excluded	Outcome type
Case report: The role of spatial repellant devices to prevent malaria in low-income countries	Cucchiaro, G. and van Leeuwen, J. and Goodridge, Y.	American Journal of Tropical Medicine and Hygiene	2020	102	5	1033-1036	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Dual Use of Electronic Cigarettes and Traditional Cigarettes Among Adults: Psychosocial Correlates and Associated Respiratory Symptoms	Culbreth, R.E., Spears, C.A., Brandenberger, K., Feresin, R., Self-Brown, S., Goodfellow, L.T., Swahn, M.H. and Gardenhire, D.S.	Respiratory care	2021	66	6	951-959	Excluded	Outcome type
Impact of Smoking and Smoking Cessation Medications in Aviators	Dailey, J. I. and Wilson, K. C.	Current Psychiatry Reports	2019	21	12	-	Excluded	Outcome type
Electronic cigarettes and cardiovascular risk: Caution waiting for evidence	D'Amario, D., Migliaro, S., Borovac, J.A., Vergallo, R., Galli, M., Restivo, A., Bonini, M., Romagnoli, E., Leone, A.M. and Crea, F.	European Cardiology Review	2019	14	3	151-158	Excluded	Outcome type
Systematic analysis of the scientific literature on heated tobacco	Dautzenberg, B. and Dautzenberg, M. D.	Revue des Maladies Respiratoires	2019	36	1	82-103	Excluded	Foreign language
iQOS: evidence of pyrolysis and release of a toxicant from plastic	Davis, B., Williams, M. and Talbot, P.	Tobacco control	2019	28	1	34-41	Excluded	Exposure type
Differences in JUUL Appeal Among Past and Current Youth JUUL Users	Davis, D.R., Krishnan-Sarin, S., Bold, K.W., Morean, M.E., Jackson, A., Camenga, D. and Kong, G.	Nicotine & tobacco research: Official Journal of the Society for Research on Nicotine and Tobacco	2021	23	5	807-814	Excluded	Outcome type
Novel methods for the analysis of toxicants in bronchoalveolar lavage fluid samples from e-cigarette, or vaping, product use associated lung injury (EVALI) cases: Terpenes	De Jesús, V.R., Chambers, D.M., Reese, C., Braselton, M., Espinosa, P., Corstvet, J. and Blount, B.C.	Rapid communications in mass spectrometry: RCM	2020	34	19	e8879	Excluded	Duplicate
Topical cyclosporine A therapy for dry eye syndrome	de Paiva, C. S. and Pflugfelder, S. C. and Ng, S. M. and Akpek, E. K.	Cochrane Database of Systematic Reviews	2019	-	9	-	Excluded	Outcome type; exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
E-Cigarette Burns and Explosions: What are the Patterns of Oromaxillofacial Injury?	Dekhou, A. and Oska, N. and Partiali, B. and Johnson, J. and Chung, M. T. and Folbe, A.	Journal of Oral and Maxillofacial Surgery	2021	-	-	-	Excluded	Outcome type
Smoking and pregnancy: The era of electronic nicotine delivery systems	Desai, Nikita	Obstetric Medicine (1753-495X)	2020	13	4	154-158	Excluded	Outcome type
E-cigarette manufacturers' compliance with clinical trial reporting expectations: a case series of registered trials by Juul Labs	DeVito, N. J. and Drysdale, H. and McKee, M. and Goldacre, B.	Tobacco control.	2021	14	-	-	Excluded	Study design
Patterns of e-cigarette use, biochemically verified smoking status and self-reported changes in health status of a random sample of vapeshops customers in Greece	Diamantopoulou, E., Barbouni, A., Merakou, K., Lagiou, A. and Farsalinos, K.	Internal and emergency medicine	2019	14	6	843-851	Excluded	Outcome type
Vaping, smoking, and the physical fitness of active young men	Dinkeloo, E., Grier, T.L., Brooks, R.D. and Jones, B.H.	American Journal of Preventive Medicine	2020	58	1	e31-e37	Excluded	Outcome type
Smoking Addiction and Strategies for Cessation	DiSilvio, Briana and Baqdunes, Mohammad and Alhajhusain, Ahmad and Cheema, Tariq	Critical Care Nursing Quarterly	2021	44	1	33-48	Excluded	Outcome type
Cytisine for smoking cessation in patients with tuberculosis: a multicentre, randomised, double-blind, placebo-controlled phase 3 trial	Dogar, O., Keding, A., Gabe, R., Marshall, A.M., Huque, R., Barua, D., Fatima, R., Khan, A., Zahid, R., Mansoor, S. and Kotz, D.	The Lancet Global Health	2020	8	11	e1408-e1417	Excluded	Outcome type
A content analysis of e-cigarette related calls to the Shanghai health hotline, for the period 2014-2019	Dong, J., Dong, J., Zhang, Y., He, Z., Shi, L. and Cai, Y.	Tobacco Induced Diseases	2021	19	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The Harmful Consequences of Vaping: A Public Health Threat	Douglass, Brenda and Solecki, Susan and Fay-Hillier, Theresa	Journal of Addictions Nursing	2020	31	2	79-84	Excluded	Outcome type
Perceived safety and effectiveness of electronic cigarettes among malaysian adults and public support for regulations	Draman, S., Ab Rahman, N.S., Mohamed, M.H.N., Ab Rahman, J. and Kartiwi, M.	Journal of Pharmacy and Bioallied Sciences	2020	12	Supp2	S718-S727	Excluded	Outcome type
Parental Smoking and E-cigarette Use in Homes and Cars	Drehmer, J.E., Nabi-Burza, E., Walters, B.H., Ossip, D.J., Levy, D.E., Rigotti, N.A., Klein, J.D. and Winickoff, J.P.	Pediatrics	2019	143	4	-	Excluded	Outcome type
Retrospective review of nicotine exposures in California from 2012 to 2018 and analysis of the impacts of e-cigarette regulations	Driller, G. and Plasencia, E. and Apollonio, D. E.	BMJ Open	2021	11	3	-	Excluded	Outcome type
Human Biomarker Exposure From Cigarettes Versus Novel Heat-Not-Burn Devices: A Systematic Review and Meta-Analysis	Drovandi, A., Salem, S., Barker, D., Booth, D. and Kairuz, T	Nicotine & Tobacco Research	2020	22	7	1077-1085	Excluded	Exposure type
Changes in flavor preference in a cohort of long-term electronic cigarette users	Du, P., Bascom, R., Fan, T., Sinharoy, A., Yingst, J., Mondal, P. and Foulds, J.	Annals of the American Thoracic Society	2020	17	5	573-581	Excluded	Outcome type
“Isn’t there a bunch of side effects?”: A focus group study on the beliefs about cessation treatments of non-college educated young adult smokers	Duarte, D.A., Chen-Sankey, J.C., Dang, K., Orozco, L., Jewett, B. and Choi, K.	Journal of Substance Abuse Treatment	2020	112	-	36-41	Excluded	Outcome type
Correction to Free-Base Nicotine Determination in Electronic Cigarette Liquids by 1H NMR Spectroscopy.	Duell, A.K., Pankow, J.F. and Peyton, D.H.	Chemical Research in Toxicology	2019	32	9	1900	Excluded	Publication year

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
An approach for the extract generation and toxicological assessment of tobacco-free 'modern' oral nicotine pouches	Bishop, E., East, N., Bozhilova, S., Santopietro, S., Smart, D., Taylor, M., Meredith, S., Baxter, A., Breheny, D., Thorne, D. and Gaca, M.	Food & Chemical Toxicology	2020	145	-	111713	Excluded	Exposure type
Vaping-induced diffuse alveolar hemorrhage	Edmonds, P. J. and Copel and , C. and Conger, A. and Richmond, B. W.	Respiratory Medicine Case Reports	2020	29	-	-	Excluded	Study design
Views and preferences of people living with HIV about smoking, quitting and use of nicotine products	Edwards, S., Fitzgerald, L., Mutch, A., Dean, J.A., Ford, P., Howard, C., Watts, P. and Gartner, C.	International Journal of Drug Policy	2021	97	-	-	Excluded	Outcome type
"Use of e-cigarettes for smoking cessation" - Reply	Eisenberg, M.J., Hébert-Losier, A. and Filion, K.B.	JAMA: Journal of the American Medical Association	2021	325	10	1006-1007	Excluded	Outcome type
Effect of e-cigarettes plus counseling vs counseling alone on smoking cessation: A randomized clinical trial	Eisenberg, M.J., Hébert-Losier, A., Windle, S.B., Greenspoon, T., Brandys, T., Fülöp, T., Nguyen, T., Elkouri, S., Montigny, M., Wilderman, I. and Bertrand, O.F.	JAMA: Journal of the American Medical Association	2020	324	18	1844-1854	Excluded	Outcome type
Heating of food containing sucralose might result in the generation of potentially toxic chlorinated compounds	Eisenreich, A., Gürtler, R. and Schäfer, B.	Food Chemistry	2020	321	-	-	Excluded	Outcome type
Subjective smoking satisfaction between heat-not-burn, electronic vaping, and traditional tobacco combustion cigarettes: a sub-analysis of the SUR-VAPES 2 trial	Elena Cavarretta E, Sciarretta S, Nocella C, Peruzzi M, Marullo AGM, Loffredo L, Pignatelli P, Valenti V, Coluzzi F, Frati G, Biondi-Zoccai G, Carnevale R	European journal of preventive cardiology	2019	26	8	S114	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Toxic emissions resulting from sucralose added to electronic cigarette liquids	El-Hage, R., El-Hellani, A., Haddad, C., Salman, R., Talih, S., Shihadeh, A., Eissenberg, T. and Aoun Saliba, N.	Aerosol Science and Technology	2019	53	10	1197-1203	Excluded	Exposure type
Lower smoking rates and increased perceived harm of cigarettes among French adults one year after comprehensive tobacco control measures	El-Khoury, F., Bolze, C., Gomajee, R., White, V. and Melchior, M.	Drug and Alcohol Dependence	2019	201	-	65-70	Excluded	Outcome type
Nicotine vaping products as a harm reduction tool among smokers: Review of evidence and implications for pharmacy practice	Erku, Daniel and Gartner, Coral E. and Morphett, Kylie and Snoswell, Centaine L. and Steadman, Kathryn J.	Research in Social & Administrative Pharmacy	2020	16	9	1272-1278	Excluded	Outcome type
Does the content and source credibility of health and risk messages related to nicotine vaping products have an impact on harm perception and behavioural intentions? A systematic review	Erku, D. A. and Bauld, L. and Dawkins, L. and Gartner, C. E. and Steadman, K. J. and Noar, S. M. and Shrestha, S. and Morphett, K.	Addiction	2021	10	-	-	Excluded	Outcome type
Electronic nicotine delivery systems (e-cigarettes) as a smoking cessation aid: A survey among pharmacy staff in Queensland, Australia	Erku, Daniel A. and Gartner, Coral E. and Do, Jennifer Thi and Morphett, Kylie and Steadman, Kathryn J.	Addictive Behaviors	2019	91	-	227-233	Excluded	Outcome type
Beliefs and Self-reported Practices of Health Care Professionals Regarding Electronic Nicotine Delivery Systems: A Mixed-Methods Systematic Review and Synthesis	Erku, Daniel A. and Gartner, Coral E. and Morphett, Kylie and Steadman, Kathryn J.	Nicotine & Tobacco Research	2020	22	5	619-629	Excluded	Outcome type
Nicotine vaping product use, harm perception and policy support among pharmacy customers in Brisbane, Australia	Erku, Daniel A. and Gartner, Coral E. and Tengphakwaen, Unchanok and Morphett, Kylie and Steadman, Kathryn J.	Drug & Alcohol Review	2019	38	6	703-711	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Framing and scientific uncertainty in nicotine vaping product regulation: An examination of competing narratives among health and medical organisations in the UK, Australia and New Zealand	Erku, D.A., Kisely, S., Morphett, K., Steadman, K.J. and Gartner, C.E.	International Journal of Drug Policy	2020	78	-	102699	Excluded	Outcome type
How are nicotine vaping products represented to pharmacists? A content analysis of Australian pharmacy news sources	Erku, Daniel A. and Zhang, Rebecca and Gartner, Coral E. and Morphett, Kylie and Steadman, Kathryn J.	International Journal of Pharmacy Practice	2020	28	4	390-394	Excluded	Outcome type
Quantification of Flavorants and Nicotine in Waterpipe Tobacco and Mainstream Smoke and Comparison to E-cigarette Aerosol	Erythropel, Hanno C. and Torres, Deyri S. Garcia and Woodrow, Jackson G. and Winter, Tamara M. de and Falinski, Mark M. and Anastas, Paul T. and O'Malley, Stephanie S. and Krishnan-Sarin, Suchitra and Zimmerman, Julie B. and Garcia Torres, Deyri S. and de Winter, Tamara M.	Nicotine & Tobacco Research	2021	23	3	600-604	Excluded	Outcome type
Chronic intermittent electronic cigarette exposure induces cardiac dysfunction and atherosclerosis in apolipoprotein-E knockout mice	Espinoza-Derout, J., Hasan, K.M., Shao, X.M., Jordan, M.C., Sims, C., Lee, D.L., Sinha, S., Simmons, Z., Mtume, N., Liu, Y. and Roos, K.P., Sinha-Hikim, A. P. and Friedman, T. C.	American Journal of Physiology - Heart and Circulatory Physiology	2019	317	2	H445-H459	Excluded	Outcome type

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Hepatic DNA damage induced by electronic cigarette exposure is associated with the modulation of NAD+/PARP1/SIRT1 axis	Espinoza-Derout, J. and Shao, X. M. and Bankole, E. and Hasan, K. M. and Mtume, N. and Liu, Y. and Sinha-Hikim, A. P. and Friedman, T. C.	Frontiers in Endocrinology	2019	10	-	-	Excluded	Exposure type
Are long-term vapers interested in vaping cessation support?	Etter, J.F.	Addiction	2019	114	8	1473-1477	Excluded	Outcome type
Study to assess the efficacy, safety, and tolerability of SAR440340/ REGN3500/itepekimab in chronic obstructive pulmonary disease (COPD) (AERIFY-2)	-	European Union Clinical Trials Register	2021	-	-	-	Excluded	Outcome type
A Multi-Center, 12-Week, Randomized, Double-Blind, Placebo-Controlled Study to Evaluate Safety and Tolerability of the Neutrophil Elastase Inhibitor PHP-303 in Adults with Alpha-1 Antitrypsin Deficiency (AATD)	-	European Union Clinical Trials Register	2019	-	-	-	Excluded	Exposure type
Case of e-cigarette or vaping product use-associated lung injury (EVALI) in London, UK	Evans, R.E., Herbert, S., Owen, W. and Rao, D.	BMJ Case Reports	2021	14	4	e240700	Excluded	Study design
E-cigarette environmental and fire/ life safety risks in schools reported by secondary school teachers	Fakeh Campbell, M.L., Sansone, A., Gonzalez, L.N., Schroth, K.R. and Shendell, D.G.	BMC Public Health	2020	20	1	-	Excluded	Outcome type
Are electronic cigarettes and vaping effective tools for smoking cessation? Limited evidence on surgical outcomes: A narrative review	Famiglietti, A., Memoli, J.W. and Khaitan, P.G.	Journal of Thoracic Disease	2021	13	1	384-395	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Competitions for smoking cessation	Fanshawe, T.R., Hartmann-Boyce, J., Perera, R. and Lindson, N.	Cochrane Database of Systematic Reviews	2019	-	2	-	Excluded	Outcome type
Initiating pharmacologic treatment in tobacco-dependent adults an official American thoracic society clinical practice guideline	Farber, H. J., Leone, F. T., Cruz-Lopes, L., Eaki, N. M. N., Evins, A. E., Evers-Casey, S., Fathi, J., Fennig, K., Folan, P., Fulone, I., Galiatsatos, P., Gogineni, H., Kantrow, S., Kathuria, H., Lamphere, T., Murray, R.L., Neptune, E., O'Brien K, K., Pacheco, M.C., Pakhale, S., Pavalagantharajah, S., Prezant, D., Ross, S., Sachs, D. P. L., Toll, B., Upson, D., Xiao, D., Zhang, Y. and Zhu, M.	American Journal of Respiratory and Critical Care Medicine	15	202	2	E5-E31	Excluded	Outcome type
Harms of Electronic Cigarettes: What the Healthcare Provider Needs to Know	Farber, H.J., Pacheco G., Manuel C., Galiatsatos, P., Folan, P., Lamphere, T., Pakhale, S. and Conrado Pacheco G.M.	Annals of the American Thoracic Society	2021	18	4	567-572	Excluded	Study design
Health effects of cigarettes, electronic cigarettes and waterpipes	Farkas, Á., Tomisa, G., Kis, E. and Horváth, A.	Orvosi Hetilap	2021	162	3	83-90	Excluded	Duplicate; foreign language
Histologic patterns of lung injury in patients using e-cigarettes	Fathima, Samreen and Zhang, Haiying	Baylor University Medical Center Proceedings	2020	33	4	619-620	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Beliefs, attitudes, and confidence to deliver electronic cigarette counseling among 1023 Chinese physicians in 2018	Feng, Y. and Wang, F. and Abdullah, A. S. and Wang, X. and Wang, J. and Zheng, P.	International Journal of Environmental Research and Public Health	2019	16	17	-	Excluded	Outcome type
The impact of vaping on periodontitis: A systematic review	Figueredo, C.A., Abdelhay, N., Figueredo, C.M., Catunda, R. and Gibson, M.P.	Clinical and experimental dental research	2021	7	3	376-384	Excluded	Outcome type
E-cigarettes, e-toxicity and e-commerce: a continuing public health emergency	Fitzgerald, Dominic A. and Peters, Matthew	Paediatric Respiratory Reviews	2020	36	-	73-74	Excluded	Outcome type
Cohort study of electronic cigarette use: Safety and effectiveness after 4 years of follow-up	Flacco, M. E., Ferrante, M., Fiore, M., Marzuillo, C., La Vecchia, C., Gualano, M.R., Liguori, G., Fragassi, G., Carradori, T., Bravi, F., Siliquini, R., Ricciardi, W., Villari, P. and Manzoli, L.	European Review for Medical and Pharmacological Sciences	2019	23	1	402-412	Excluded	Outcome type
E-cigarettes and head and neck cancers: A systematic review of the current literature	Flach, S. and Maniam, P. and Manickavasagam, J.	Clinical Otolaryngology	2019	44	5	749-756	Excluded	Outcome type
79 Electronic Cigarette-Related Injuries Presenting to Five Large Burn Centers, 2015–2019	Flores, C.E., Chestovich, P.J., Saquib, S.F., Carroll, J.T., Daubs, M.A.H., Foster, K.N., Delapena, S., Richey, K.J., Lallemand, M., Dennis, B.M. and Palmieri, T.L., Romanowski, K.S., Godat, L.N., and Lee, Jeanne	Journal of Burn Care & Research	2021	42	Supp1	S54-S55	Excluded	Outcome type
Low powered variable voltage E-Cigarette batteries under perform at higher power settings	Floyd, E.L., Subedi, S., Wagener, T.L., Johnson, D.L. and Oni, T.M.	Inhalation toxicology	2020	32	3	110-114	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Severe benzodiazepine use disorder in a 16-year-old adolescent: A rapid and safe inpatient taper	Fournier, C. and Jamoulle, O. and Chadi, A. and Chadi, N.	Pediatrics	2021	147	1	-	Excluded	Exposure type
Risk perception of cigarette and e-cigarette use during pregnancy: A qualitative postpartum perspective	Froggatt, S., Reissland, N. and Covey, J.	Midwifery	2021	94	-	-	Excluded	Outcome type
Acute Respiratory Failure Associated With Vaping	Fryman, Craig and Lou, Becky and Weber, Andrew G. and Steinberg, Harry N. and Khanijo, Sameer and Iakovou, Annamaria and Makaryus, Mina R.	CHEST	2020	157	3	e63-e68	Excluded	Study design
Real-world vaping experiences and smoking cessation among cigarette smoking adults	Fu, R., O'Connor, S., Diemert, L., Pelletier, H., Eissenberg, T., Cohen, J. and Schwartz, R.	Addictive Behaviors	2021	116	-	-	Excluded	Outcome type
Four Cycles of Etoposide plus Cisplatin for Patients with Good-Risk Advanced Germ Cell Tumors.	Funt, S.A., McHugh, D.J., Tsai, S., Knezevic, A., O'Donnell, D., Patil, S., Silber, D., Bromberg, M., Carousso, M., Reuter, V.E. and Carver, B.S., Sheinfeld, ., Motzer, R.J., Bajorin, D.F., Bosl, G.J. and Feldman, D.R.	Oncologist	2021	26	6	483-491	Excluded	Exposure type
Evaluation of a mobile safety center's impact on pediatric home safety behaviors	Furman, Leah and Strotmeyer, Stephen and Vitale, Christine and Gaines, Barbara A.	BMC Public Health	2021	21	1	44440	Excluded	Outcome type
Changes in Biomarkers of Exposure on Switching From a Conventional Cigarette to Tobacco Heating Products: a Randomized, Controlled Study in Healthy Japanese Subjects	Gale, N., McEwan, M., Eldridge, A.C., Fearon, I.M., Sherwood, N., Bowen, E., McDermott, S., Holmes, E., Hedge, A., Hossack, S. and Wakenshaw, L.	Nicotine & tobacco research	2019	21	9	1220-1227	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Electronic cigarette use among Italian smokers: patterns, settings, and adverse events	Gallus, S., Borroni, E., Liu, X., Carrozzi, L., Dalla P.G., Eslami Varzaneh, S., Harari, S., Inciso, G., Martucci, P., Papale, M., Pistelli, F., Polla, B., Polo, M.F., Principe, R., Pulera, N., Raschi, S., Sarzani, R., Serafini, A., Odone, A. and van den Brandt, P., and Lugo, A.	Tumori	2020	106	3	229-240	Excluded	Outcome type
Adverse effects of electronic cigarettes on the disease-naive oral microbiome	Ganesan, S.M., Dabdoub, S.M., Nagaraja, H.N., Scott, M.L., Pamulapati, S., Berman, M.L., Shields, P.G., Wewers, M.E. and Kumar, P.S.	Science advances	2020	6	22	eaaz0108	Excluded	Outcome type
Electronic cigarette use among heart failure patients: Findings from the Population Assessment of Tobacco and Health study	Gathright, Emily C. and Wu, Wen-Chih and Scott-Sheldon, Lori A. J.	Heart & Lung	2020	49	3	229-232	Excluded	Outcome type
Are Electronic Cigarettes an Effective Aid to Smoking Cessation or Reduction Among Vulnerable Groups? A Systematic Review of Quantitative and Qualitative Evidence	Gentry, Sarah and Forouhi, Nita G. and Notley, Caitlin	Nicotine & Tobacco Research	2019	21	5	602-616	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Characteristics of Persons Who Report Using Only Nicotine-Containing Products Among Interviewed Patients with E-cigarette, or Vaping, Product Use-Associated Lung Injury - Illinois, August-December 2019	Ghinai, Isaac and Navon, Livia and Gunn, Jayleen K. L. and Duca, Lindsey M. and Brister, Sarah and Love, Sarah and Brink, Rachel and Fajardo, Geroncio and Johnson, Jona and Saathoff-Huber, Lori and King, Brian A. and Jones, Christopher M. and Krishnasamy, Vikram P. and Layden, Jennifer E.	MMWR: Morbidity & Mortality Weekly Report	2020	69	3	84-89	Excluded	Outcome type
Chronic E-Cigarette Use Increases Neutrophil Elastase and Matrix Metalloprotease Levels in the Lung	Ghosh, Arunava and Coakley, Raymond D. and Ghio, Andrew J. and Muhlebach, Marianne S. and Esther Jr, Charles R. and Alexis, Neil E. and Tarran, Robert and Esther, Charles R., Jr.	American Journal of Respiratory & Critical Care Medicine	2019	200	11	1392-1401	Excluded	Outcome type
Vaping implications for children and youth	Gilley, Meghan and Beno, Suzanne	Current Opinion in Pediatrics	2020	32	3	343-348	Excluded	Exposure type
Compliance of e-cigarette refill liquids with regulations on labelling, packaging and technical design characteristics in nine European member states	Girvalaki, C., Vardavas, A., Tzatzarakis, M., Kyriakos, C.N., Nikitara, K., Tsatsakis, A.M. and Vardavas, C.I.	Tobacco Control: An International Journal	2020	29	5	531-536	Excluded	Duplicate
Patterns of E-Cigarette Use among Youth and Young Adults: Review of the Impact of E-Cigarettes on Cigarette Smoking	Glasser, A., Abudayyeh, H., Cantrell, J. and Niaura, R.	Nicotine and Tobacco Research	2019	21	10	1320-1330	Excluded	Outcome type
Potential effects of using non-combustible tobacco and nicotine products during pregnancy: a systematic review	Glover, M. and Phillips, C.V.	Harm Reduction Journal	2020	17	1	1-12	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
How effective are electronic cigarettes for reducing respiratory and cardiovascular risk in smokers? A systematic review	Goniewicz, M. L. and Miller, C. R. and Sutanto, E. and Li, D.	Harm Reduction Journal	2020	17	1	-	Excluded	Outcome type
Diagnosis and Acute Management of E-Cigarette or Vaping Product Use-Associated Lung Injury in the Pediatric Population: A Systematic Review	Gonsalves, C.L., Zhu, J.W. and Kam, A.J.	Journal of Pediatrics	2021	228	-	260-270	Excluded	Outcome type
Electronic cigarette use and metabolic syndrome development: A critical review	Gorna, I. and Napierala, M. and Florek, E.	Toxics	2020	8	4	45292	Excluded	Outcome type
Effectiveness of electronic cigarettes in smoking cessation: A systematic review and meta-analysis	rabovac, I., Oberndorfer, M., Fischer, J., Wiesinger, W., Haider, S. and Dorner, T.E.	Nicotine and Tobacco Research	2021	23	4	625-634	Excluded	Outcome type
Analysis of toxic metals in liquid from electronic cigarettes	Gray, N. and Halstead, M. and Gonzalez-Jimenez, N. and Valentin-Blasini, L. and Watson, C. and Pappas, R. S.	International Journal of Environmental Research and Public Health	2019	16	22	-	Excluded	Outcome type
Toxic Metals in Liquid and Aerosol from Pod-Type Electronic Cigarettes	Gray, N. and Halstead, M. and Valentin-Blasini, L. and Watson, C. and Pappas, R. S.	Journal of analytical toxicology.	2020	3	-	-	Excluded	Outcome type
Impact of adding and removing warning label messages from cigarette packages on adult smokers' awareness about the health harms of smoking: findings from the ITC Canada Survey	Green, A.C., Driezen, P., Noar, S.M., Hammond, D. and Fong, G.T.	Tobacco Control: An International Journal	2019	28	1	e56-e63	Excluded	Outcome type
Pulmonary Health Effects of Electronic Cigarettes: A Scoping Review	Gugala, E. and Okoh, C. M. and Ghosh, S. and Moczygemba, L. R.	Health Promotion Practice	2021	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Area-level differences in the prices of tobacco and electronic nicotine delivery systems - A systematic review	Guindon, G.E., Fatima, T., Abbat, B., Bhons, P. and Garasia, S.	Health and Place	2020	65	-	-	Excluded	Outcome type
E-Cigarettes: A scientometric assessment of global publications output during 2001-18	Gupta, B.M., Mueen Ahmed, K.K. and Visakhi, P.	Journal of Young Pharmacists	2020	12	1	29-36	Excluded	Outcome type
Electronic cigarette online marketing by New Zealand vendors	Gurram, Niveditha and Thomson, George and Wilson, Nick and Hoek, Janet	New Zealand Medical Journal	2019	132	1505	20-33	Excluded	Outcome type
Effects of combined thc and heroin vapor inhalation in rats	Gutierrez, Arnold and Nguyen, Jacques D. and Creehan, Kevin M. and Javadi-Paydar, Mehrak and Grant, Yanabel and Taffe, Michael A.	Psychopharmacology	2021	-	-	1-15	Excluded	Exposure type
Orthodox and Unorthodox Uses of Electronic Cigarettes: A Surveillance of YouTube Video Content	Guy, Mignonne C. and Helt, Jacob and Palafox, Sherilyn and Green, Kellie and Soule, Eric K. and Maloney, Sarah F. and Eissenberg, Thomas and Fagan, Pebbles	Nicotine & Tobacco Research	2019	21	10	1378-1384	Excluded	Outcome type
Prevalence and perceptions of e-cigarette use among medical students in a Saudi University	Habib, E., Helaly, M., Elshaer, A., Sriwi, D., Ahmad, M.S., Mohamed, M.I. and Obeidat, A.	Journal of Family Medicine & Primary Care	2020	9	6	3070-3075	Excluded	Outcome type
The GRAS provision - The FEMA GRAS program and the safety and regulation of flavors in the United States	Hallagan, J.B., Hall, R.L. and Drake, J.	Food and Chemical Toxicology	2020	138	-	111236	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Analysis of Toxic Metals in Electronic Cigarette Aerosols Using a Novel Trap Design	Halstead, M., Gray, N., Gonzalez-Jimenez, N., Fresquez, M., Valentin-Blasini, L., Watson, C. and Pappas, R.S.	Journal of Analytical Toxicology	2020	44	2	149-155	Excluded	Duplicate
The truth about vaping	Hamzelou, Jessica	New Scientist	2019	244	3258	20-20	Excluded	Study design
A qualitative study of e-cigarette use among young people in Ireland: Incentives, disincentives, and putative cessation	Hanafin, Joan and Clancy, Luke	PLoS ONE	2020	15	12	-	Excluded	Outcome type
Differential effects of tobacco cigarettes and electronic cigarettes on endothelial function in healthy young people	Haptonstall, K.P., Choroomi, Y., Moheimani, R., Nguyen, K., Tran, E., Lakhani, K., Ruedisueli, I., Gornbein, J. and Middlekauff, H.R.	American journal of physiology - heart and circulatory physiology	2020	319	3	H547-H556	Excluded	Outcome type
Electronic Cigarettes and Fecundability: Results From a Prospective Preconception Cohort Study	Harlow, Alyssa F. and Hatch, Elizabeth E. and Wesselink, Amelia K. and Rothman, Kenneth J. and Wise, Lauren A.	American Journal of Epidemiology	2021	190	3	353-361	Excluded	Outcome type
Anesthesia Implications of Patient Use of Electronic Cigarettes	Harris, D. E. and Foley, E. M.	AANA journal	2020	88	2	135-140	Excluded	Outcome type
Electronic cigarettes for smoking cessation	Hartmann-Boyce, J. and McRobbie, H. and Lindson, N. and Bullen, C. and Begh, R. and Theodoulou, A. and Notley, C. and Rigotti, N. A. and Turner, T. and Butler, A. R. and Fanshawe, T. R. and Hajek, P.	Cochrane Database of Systematic Reviews	2020	2021	2	-	Excluded	Duplicate

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Understanding decisions to use e-cigarettes or behavioural support to quit tobacco: a qualitative study of current and ex-smokers and stop smoking service staff	Hartwell, Greg and Egan, Matt and Petticrew, Mark	Addiction	2020	115	3	518-526	Excluded	Outcome type
Characterization of Nicotine Salts in 23 Electronic Cigarette Refill Liquids	Harvanko, Arit M. and Havel, Christopher M. and Jacob, Peyton and Benowitz, Neal L.	Nicotine & Tobacco Research	2020	22	7	1239-1243	Excluded	Exposure type
Electronic cigarettes cause alteration in cardiac structure and function in diet-induced obese mice	Hasan, K. M. and Friedman, T. C. and Parveen, M. and Espinoza-Derout, J. and Bautista, F. and Razipour, M. M. and Shao, X. M. and Jordan, M. C. and Roos, K. P. and Mahata, S. K. and Sinha-Hikim, A. P.	PLoS ONE	2020	15	10	-	Excluded	Outcome type
E-cigarettes and Western Diet: Important Metabolic Risk Factors for Hepatic Diseases	Hasan, K.M., Friedman, T.C., Shao, X., Parveen, M., Sims, C., Lee, D.L., Espinoza-Derout, J., Sinha-Hikim, I. and Sinha-Hikim, A.P.	Hepatology	2019	69	6	2442-2454	Excluded	Outcome type
Adverse effects of fetal exposure of electronic-cigarettes and high-fat diet on male neonatal hearts	Hasan, K.M., Munoz, A., Tumoyan, H., Parveen, M., Espinoza-Derout, J., Shao, X.M., Mahata, S.K., Friedman, T.C. and Sinha-Hikim, A.P.	Experimental and Molecular Pathology	2021	118	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
A Randomized Clinical Trial Examining the Effects of Instructions for Electronic Cigarette Use on Smoking-Related Behaviors and Biomarkers of Exposure	Hatsukami, D.K., Meier, E., Lindgren, B.R., Anderson, A., Reisinger, S.A., Norton, K.J., Strayer, L., Jensen, J.A., Dick, L., Murphy, S.E. and Carmella, S.G.	Nicotine & tobacco research	2020	22	9	1524-1532	Excluded	Outcome type
Vaping: UK experts defend safety in face of US lung injury cases	Hawkes, N.	BMJ (Clinical research ed.)	2019	367	-	-	Excluded	Study design
Reduction in Exposure to Selected Harmful and Potentially Harmful Constituents Approaching Those Observed Upon Smoking Abstinence in Smokers Switching to the Menthol Tobacco Heating System 2.2 for 3 Months (Part 1)	Haziza, C., de La Bourdonnaye, G., Donelli, A., Poux, V., Skiada, D., Weitkunat, R., Baker, G., Picavet, P. and Lüdicke, F.	Nicotine & tobacco research	2020	22	4	539-548	Excluded	Exposure type
Favorable Changes in Biomarkers of Potential Harm to Reduce the Adverse Health Effects of Smoking in Smokers Switching to the Menthol Tobacco Heating System 2.2 for 3 Months (Part 2)	Haziza, C., de La Bourdonnaye, G., Donelli, A., Skiada, D., Poux, V., Weitkunat, R., Baker, G., Picavet, P. and Lüdicke, F.	Nicotine & tobacco research	2020	22	4	549-559	Excluded	Exposure type
Mapping public concerns of electronic cigarettes in China	He, G., Lin, X., Ju, G. and Chen, Y.	Journal of Psychoactive Drugs	2020	52	1	13-19	Excluded	Outcome type
A Randomized Controlled Trial Evaluating the Efficacy of E-Cigarette Use for Smoking Cessation in the General Population: E3 Trial Design	Hebert-Losier, A. and Filion, K. B. and Windle, S. B. and Eisenberg, M. J.	CJC open	2020	2	3	168-175	Excluded	Outcome type
Effects of Electronic Nicotine Delivery Systems and Cigarettes on Systemic Circulation and Blood-Brain Barrier: Implications for Cognitive Decline	Heldt, N.A., Reichenbach, N., McGary, H.M. and Persidsky, Y.	American Journal of Pathology	2020	191	2	243-255	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Financial Conflicts of Interest and Stance on Tobacco Harm Reduction: A Systematic Review	Hendlin, Yogi H. and Vora, Manali and Elias, Jesse and Ling, Pamela M.	American Journal of Public Health	2019	109	7	e1-e8	Excluded	Outcome type
Effectiveness of an Opt-Out Electronic Heath Record-Based Tobacco Treatment Consult Service at an Urban Safety Net Hospital	Herbst, N., Wiener, R.S., Helm, E.D., O'Donnell, C., Fitzgerald, C., Wong, C., Bulekova, K., Waite, M., Mishuris, R.G. and Kathuria, H.	CHEST	2020	158	4	1734-1741	Excluded	Outcome type
E-cigarettes: toxicological fiasco or better than not giving up smoking?	Hering, T.	Der Internist	2020	61	6	634-643	Excluded	Duplicate
Tobacco and bone fractures: A review of the facts and issues that every orthopaedic surgeon should know	Hernigou, J. and Schuind, F.	Bone and Joint Research	2019	8	6	255-265	Excluded	Outcome type
Effectiveness of stop smoking interventions among adults: Protocol for an overview of systematic reviews and an updated systematic review	Hersi, M., Traversy, G., Thombs, B.D., Beck, A., Skidmore, B., Groulx, S., Lang, E., Reynolds, D.L., Wilson, B., Bernstein, S.L. and Selby, P., Johnson-Obaseki, S., Manuel, D., Pakhale, S., Presseau, J., Courage, S., Hutton, B., Shea, B.J., Welch, V., Morrow, M., Little, J. and Stevens, A.	Systematic Reviews	2019	8	1	1-21	Excluded	Exposure type
A pre-post pilot study of electronic cigarettes to reduce smoking in people with severe mental illness	Hickling, L.M., Perez-Iglesias, R., McNeill, A., Dawkins, L., Moxham, J., Ruffell, T., Sendt, K.V. and McGuire, P.	Psychological Medicine	2019	49	3	1033-1040	Excluded	Outcome type
Psychological interventions for co-occurring depression and substance use disorders	Hides, L., Quinn, C., Stoyanov, S., Kavanagh, D. and Baker, A.	Cochrane Database of Systematic Reviews	2019	-	11	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
An Electronic Aerosol Delivery System for Functional Magnetic Resonance Imaging	Hobkirk, A.L., Bitzer, Z., Goel, R., Sica, C.T., Livelsberger, C., Yingst, J., Houser, K.R., Rupprecht, S., Trushin, N., Karunanayaka, P., Foulds, J., Richie, J.P., Spreen, L., Hoglen, B., Wang, J., Elias, R.J., Yang, Q.X.	Substance Abuse: Research & Treatment	2020	14	-	-	Excluded	Exposure type
Interventions to increase adherence to medications for tobacco dependence	Holl and s, G. J. and Naughton, F. and Farley, A. and Lindson, N. and Aveyard, P.	Cochrane Database of Systematic Reviews	2019	-	8	-	Excluded	Outcome type
Interventions for tobacco cessation delivered by dental professionals	Holliday, R. and Hong, B. and McColl, E. and Livingstone-Banks, J. and Preshaw, P. M.	Cochrane Database of Systematic Reviews	2021	-	2	-	Excluded	Outcome type
Effect of nicotine on human gingival, periodontal ligament and oral epithelial cells. A systematic review of the literature	Holliday, R.S., Campbell, J. and Preshaw, P.M.	Journal of Dentistry	2019	86	-	81-88	Excluded	Exposure type
Repeated nicotine vapor inhalation induces behavioral sensitization in male and female C57BL/6 mice	Honeycutt, S.C., Garrett, P.I., Barraza, A.G., Maloy, A.N. and Hillhouse, T.M.	Behavioural Pharmacology	2020	31	6	583-590	Excluded	Exposure type
An Emerging Crisis: Vaping-Associated Pulmonary Injury	Hooper Ii, R and ol W. and Garfield, Jamie L. and Hooper, R and ol W., 2nd	Annals of Internal Medicine	2020	172	1	57-58	Excluded	Outcome type
The Vaping Epidemic: A Respiratory Therapy Department's Experience with Providing Education on Vaping	Hopper, Linda	AARC Times	2020	44	3	-	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Antidepressants for smoking cessation	Howes, S. and Hartmann-Boyce, J. and Livingstone-Banks, J. and Hong, B. and Lindson, N.	Cochrane Database of Systematic Reviews	2020	-	4	-	Excluded	Outcome type
Effects of aerosolized glycerol on human lung epithelial cells by air-liquid interface cloud exposure.	Hu, Y. and Feng, H. M. and Sheng, Y. H. and Yao, J. H. and Guan, Y. and Tang, L. M.	Chinese Pharmacological Bulletin	2020	-	-	640-645	Excluded	Foreign language
Withdrawal Symptoms from E-Cigarette Abstinence among Former Smokers: A Pre-Post Clinical Trial	Hughes, J.R., Peters, E.N., Callas, P.W., Peasley-Miklus, C., Oga, E., Etter, J.F. and Morley, N.	Nicotine and Tobacco Research	2020	22	5	734-739	Excluded	Outcome type
Healthcare Professionals' Beliefs, Attitudes, Knowledge, and Behavior Around Vaping in Pregnancy and Postpartum: A Qualitative Study	Hunter, Abby and Yargawa, Judith and Notley, Caitlin and Ussher, Michael and Bobak, Alex and Murray, Rachael L. and Nath, Srabani and Cooper, Sue	Nicotine & Tobacco Research	2021	23	3	471-478	Excluded	Outcome type
Single-dose intravesical chemotherapy after nephroureterectomy for upper tract urothelial carcinoma	Hwang, E. C. and Sathianathen, N. J. and Jung, J. H. and Kim, M. H. and Dahm, P. and Risk, M. C.	Cochrane Database of Systematic Reviews	2019	-	5	-	Excluded	Outcome type
Efficacy of Electronic Cigarettes for Smoking Cessation: A Systematic Review and Meta-Analysis	Ibrahim, S., Habiballah, M. and Sayed, I.E.	American journal of health promotion: AJHP	2021	35	3	442-455	Excluded	Exposure type
Identification of volatile constituents released from IQOS heat-not-burn tobacco HeatSticks using a direct sampling method	Ilies, B. D. and Moosakutty, S. and Kharbatia, N. and Sarathy, M.	Tobacco control.	2020	26	-	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Tobacco and electronic cigarettes adversely impact ECG indexes of ventricular repolarization: Implication for sudden death risk	Ip, M., Diamantakos, E., Haptonstall, K., Choroomi, Y., Moheimani, R.S., Nguyen, K.H., Tran, E., Gornbein, J. and Middlekauff, H.R.	American Journal of Physiology - Heart and Circulatory Physiology	2020	318	5	H1176-H1184	Excluded	Outcome type
The assessment efficacy of electrical brain stimulation among patients with drug-resistant epilepsy	Rezakhani, S.	Iranian Registery of Clinical Trials	2020	-	-	-	Excluded	Outcome type
A Case-Based Review of Vaping-Induced Injury-Pulmonary Toxicity and Beyond	Isakov, Kimberly M. M. and Legasto, Alan C. and Hossain, Rydhwana and Verzosa Weisman, Stacey and Toy, Dennis and Groner, Lauren K. and Feibusch, Am and a and Escalon, Joanna G.	Current Problems in Diagnostic Radiology	2021	50	3	401-409	Excluded	Study design
Does viewing false messages about e-cigarette harms on Twitter change current smokers' perceptions of e-cigarettes in the US and the UK? A randomised controlled experiment	Wright, C	ISRCTN registry	2020	-	-	-	Excluded	Outcome type
Do e-cigarettes help smokers quit when not accompanied by intensive behavioural support?	Meyers-Smith, K	ISRCTN registry	2020	-	-	-	Excluded	Outcome type
Study of first dosing of a new compound DNDi-6148 in healthy volunteers to assess safety and drug levels in blood and urine after escalating single dose	Delhomme, S	ISRCTN registry	2020	-	-	-	Excluded	Exposure type
Mainstream smoke constituents and in vitro toxicity comparative analysis of 3R4F and 1R6F reference cigarettes	Jaccard, G. and Djoko, D. T. and Korneliou, A. and Stabbert, R. and Belushkin, M. and Esposito, M.	Toxicology Reports	2019	6	-	222-231	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Initiating Pharmacologic Treatment in Tobacco-Dependent Adults	Jain, A. and Davis, A. M.	JAMA - Journal of the American Medical Association	19	325	3	301-302	Excluded	Exposure type
Early life exposure to nicotine: Postnatal metabolic, neurobehavioral and respiratory outcomes and the development of childhood cancers	Jamshed, L., Perono, G.A., Jamshed, S. and Holloway, A.C.	Toxicological Sciences	2020	178	1	3-15	Excluded	Outcome type
Phosphodiesterase 4 inhibitors for chronic obstructive pulmonary disease	Janjua, S., Fortescue, R. and Poole, P.	Cochrane Database of Systematic Reviews	2020	-	5	-	Excluded	Outcome type
Smoking as a risk factor of onset and relapse of Multiple Sclerosis - a review	Jasielski, P. and Piedel, F. and Rocka, A. and Petit, V. and Rejdak, K.	Neurologia i Neurochirurgia Polska	2020	54	3	243-251	Excluded	Exposure type
Five-Day Changes in Biomarkers of Exposure Among Adult Smokers After Completely Switching From Combustible Cigarettes to a Nicotine-Salt Pod System	Jay, J. and Pfaunmiller, E. L. and Huang, N. J. and Cohen, G. and Graff, D. W.	Nicotine & tobacco research	2020	22	8	1285-1293	Excluded	Exposure type
E-Cigarettes and Similar Devices	Jenssen, Brian P. and Walley, Susan C.	Pediatrics	2019	143	2	-	Excluded	Outcome type
Investigation of the association between smoking behavior and metabolic syndrome using lipid accumulation product index among south korean adults	Jeong, S. H. and Jang, B. N. and Kim, S. H. and Jang, S. I. and Park, E. C.	International Journal of Environmental Research and Public Health	2021	18	8	-	Excluded	Outcome type
Association between Smoking Behavior and Insulin Resistance Using Triglyceride-Glucose Index among South Korean adults	Jeong, S. H. and Joo, H. J. and Kwon, J. and Park, E. C.	The Journal of clinical endocrinology and metabolism.	2021	23	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Associations of electronic and conventional cigarette use with periodontal disease in South Korean adults	Jeong, W., Choi, D.W., Kim, Y.K., Lee, H.J., Lee, S.A., Park, E.C. and Jang, S.I	Journal of Periodontology	2020	91	1	55-64	Excluded	Outcome type
The hazards of smoking and the benefits of cessation: A critical summation of the epidemiological evidence in high-income countries	Jha, P.	eLife	2020	9	-	-	Excluded	Outcome type
Nicotine induces cardiac toxicity through blocking mitophagic clearance in young adult rat	Jia, G., Meng, Z., Liu, C., Ma, X., Gao, J., Liu, J., Guo, R., Yan, Z., Christopher, T., Lopez, B., Liu, W., Dai, H., Lau, W.B., Jiao, X., Zhao, J., Wang, Z.X., Cao, J. and Wang, Y.	Life Sciences	2020	257	-	-	Excluded	Exposure type
Magnetic seizure therapy for treatment-resistant depression.	Jiang, J. and Zhang, C. and Li, C. and Chen, Z. and Cao, X. and Wang, H. and Li, W. and Wang, J.	Cochrane Database of Systematic Reviews	2021	-	6	-	Excluded	Outcome type
Interventions for Tobacco Cessation in Adults, Including Pregnant Persons: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force	Jin, Jill and Patnode, Carrie D. and Henderson, Jillian T. and Coppola, Erin L. and Melnikow, Joy and Durbin, Shauna and Thomas, Rachel G.	JAMA: Journal of the American Medical Association	2021	325	3	316-316	Excluded	Outcome type
A biomonitoring assessment of secondhand exposures to electronic cigarette emissions	Johnson, Jona M. and Naeher, Luke P. and Yu, Xiaozhong and Sosnoff, Connie and Wang, Lanqing and Rathbun, Stephen L. and De Jesús, Víctor R. and Xia, Baoyun and Holder, Cory and Muilenburg, Jessica L. and Wang, Jia-Sheng	International Journal of Hygiene & Environmental Health	2019	222	5	816-823	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Safety of electronic cigarette use during breastfeeding: Qualitative study using online forum discussions	Johnston, Emily Jade and Campbell, Katarzyna and Coleman, Tim and Lewis, Sarah and Orton, Sophie and Cooper, Sue	Journal of Medical Internet Research Vol 21(8), 2019, ArtID e11506	2019	21	8	-	Excluded	Outcome type
A Study of TAK-861 in Healthy Adult	Nonomura, H	Japan Primary Registry Network	2021	-	-	-	Excluded	Outcome type; exposure type
Comparative assessment of in vitro BBB tight junction integrity following exposure to cigarette smoke and e-cigarette vapor: a quantitative evaluation of the protective effects of metformin using small-molecular-weight paracellular markers	Kadry, H. and Noorani, B. and Bickel, U. and Abbruscato, T. J. and Cucullo, L.	Fluids and barriers of the CNS	2021	18	1	1-15	Excluded	Outcome type
E-cigarettes and Smoking Cessation in Smokers With Chronic Conditions	Kalkhoran, Sara and Chang, Yuchiao and Rigotti, Nancy A.	American Journal of Preventive Medicine	2019	57	6	786-791	Excluded	Outcome type
Use of electronic cigarettes in european populations: A narrative review	Kapan, A., Stefanac, S., Sandner, I., Haider, S., Grabovac, I. and Dorner, T. E.	International Journal of Environmental Research and Public Health	2020	17	6	-	Excluded	Outcome type
Use of Electronic Vapor Products Before, During, and After Pregnancy Among Women with a Recent Live Birth - Oklahoma and Texas, 2015	Kapaya, M., D'Angelo, D.V., Tong, V.T., England, L., Ruffo, N., Cox, S., Warner, L., Bombard, J., Guthrie, T., Lampkins, A. and King, B.A.	MMWR: Morbidity & Mortality Weekly Report	2019	68	8	189-194	Excluded	Outcome type
Electronic cigarette use amongst youth: A threat to public health?	Kar, Ankita and Thakur, Shalini and Rao, Vishal U. S.	Oral oncology	2020	104	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Effect of Electronic Cigarettes on the Inner Mucosa of the Craniofacial Region	Kar, M., Emre, I.E., Muluk, N.B. and Cingi, C.	The Journal of Craniofacial Surgery	2019	30	3	e235-e238	Excluded	Outcome type
E-cigarette and vaping product use-associated lung injury in the pediatric population: A critical review of the current literature	Kaslow, J. A. and Rosas-Salazar, C. and Moore, P. E.	Pediatric Pulmonology	2021	56	7	1857-1867	Excluded	Outcome type
Perceived barriers to quitting cigarettes among hospitalized smokers with substance use disorders: A mixed methods study	Kathuria, H., Seibert, R.G., Cobb, V., Herbst, N., Weinstein, Z.M., Gowarty, M., Jhunjhunwala, R., Helm, E.D. and Wiener, R.S.	Addictive Behaviors	2019	95	-	41-48	Excluded	Outcome type
Beliefs about e-cigarettes: A focus group study with college students	Katz, S.J., Erkinnen, M., Lindgren, B. and Hatsukami, D.	American Journal of Health Behavior	2019	43	1	76-87	Excluded	Outcome type
High school youth and e-cigarettes: The influence of modified risk statements and flavors on e-cigarette packaging	Katz, S.J., Shi, W., Erkkinen, M., Lindgren, B. and Hatsukami, D.	American Journal of Health Behavior	2020	44	2	130-145	Excluded	Outcome type
Cost-Effectiveness Analysis of Smoking Cessation Interventions in the United Kingdom Accounting for Major Neuropsychiatric Adverse Events	Keeney, E., Welton, N.J., Stevenson, M., Dalili, M.N., López-López, J.A., Caldwell, D.M., Phillippo, D.M., Munafò, M.R. and Thomas, K.H.	Value in Health	2021	24	6	780-788	Excluded	Outcome type
Comparison of Achilles Tendon Healing After Exposure to Combusted Tobacco, Vaping, and Control in a Rat Model	Kennedy, Patrick and Saloky, Kaitlin and Yadavalli, Aditya and Barlow, Erin and Aynardi, Michael and Garner, Matthew and Bible, Jesse and Lewis, Greg and Dhawan, Aman	Orthopaedic Journal of Sports Medicine	2019	7	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Everything you wanted to know about e-cigarettes and vaping but were afraid to ask: A guide for mental health clinicians	Ker, S., Peckham, E., Gilbody, S. and Bonner, S.	BJPsych Advances	2019	25	5	279-286	Excluded	Outcome type
Smoking e-cigarettes an increasing trend among young saudi generation: A questionnaire survey	Khalid, A. S. A. and Alzahrani, M. and Alharbi, W. A. and Shabbir, A.	Pakistan Journal of Medical and Health Sciences	2021	15	4	799-802	Excluded	Outcome type
Adjunctive systemic antimicrobials for the non-surgical treatment of periodontitis	Khattri, S., Nagraj, S.K., Arora, A., Eachempati, P., Kusum, C.K., Bhat, K.G., Johnson, T.M. and Lodi, G.	Cochrane Database of Systematic Reviews	2020	-	11	-	Excluded	Exposure type
Is e-cigarette use in non-smoking young adults associated with later smoking? A systematic review and meta-analysis	Khouja, J. N. and Suddell, S. F. and Peters, S. E. and Taylor, A. E. and Munafo, M. R.	Tobacco control.	2020	10	-	-	Excluded	Outcome type
Proton pump inhibitors for chronic obstructive pulmonary disease	Kikuchi, S. and Imai, H. and Tani, Y. and Tajiri, T. and Watanabe, N.	Cochrane Database of Systematic Reviews	2020	-	8	-	Excluded	Outcome type
A Toxic Blend: Assessing the Effects of Cross-Source Media Coverage of Flavored E-Cigarettes on Youth and Young Adult Perceptions	Kikut, Ava and Williams, Sharon and Hornik, Robert	Journal of Health Communication	2020	25	8	640-649	Excluded	Outcome type
261. Transforming Influence to Wellness: identifying Adolescents' Affect and Preferences During the Preliminary Design of a Social Board Game for Tobacco Prevention	Kim, J. and Khalil, G. E. and Moor, A.	Journal of adolescent health	2020	66	2	S132-S133	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Changes in Multiple and Different Tobacco Product Use Behaviors in Women Before and During Pregnancy: An Analysis of Longitudinal Population Assessment of Tobacco and Health Data	Kim, Sooyong	American Journal of Preventive Medicine	2020	59	4	588-592	Excluded	Outcome type
Electronic cigarettes may not be a "safer alternative" of conventional cigarettes during pregnancy: evidence from the nationally representative PRAMS data	Kim, Sooyong and Oancea, S and a Cristina	BMC Pregnancy & Childbirth	2020	20	1	-	Excluded	Outcome type
Flexibility exercise training for adults with fibromyalgia	Kim, S.Y., Busch, A.J., Overend, T.J., Schachter, C.L., van der Spuy, I., Boden, C., Góes, S.M., Foulds, H.J. and Bidonde, J.	Cochrane Database of Systematic Reviews	2019	-	9	-	Excluded	Outcome type; exposure type
Motivations for using electronic cigarettes in young adults: A systematic review	Kinouani, S. and Leflot, C. and V and erkam, P. and Auriacombe, M. and Langlois, E. and Tzourio, C.	Substance abuse	2020	41	3	315-322	Excluded	Outcome type
Young people's perspectives of e-cigarette use in the home	Kirkcaldy, Andrew and Fairbrother, Hannah and Weiner, Kate and Curtis, Penny	Health & Place	2019	57	-	157-164	Excluded	Outcome type
e-Cigarettes for smoking cessation: do they deliver?	Kitzen, J. M. and McConaha, J. L. and Bookser, M. L. and Pergolizzi, J. V. and Taylor, R. and Raffa, R. B.	Journal of clinical pharmacy and therapeutics	2019	44	4	650-655	Excluded	Duplicate
Electronic Cigarettes: Common Questions and Answers	Klein, Michael D. and Sokol, Natasha A. and Stroud, Laura R.	American Family Physician	2019	100	4	227-235	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Radiologic, pathologic, clinical, and physiologic findings of electronic cigarette or vaping product use-associated lung injury (EVALI): Evolving knowledge and remaining questions	Kligerman, S. and Raptis, C. and Larsen, B. and Henry, T. S. and Caporale, A. and Tazelaar, H. and Schiebler, M. L. and Wehrli, F. W. and Klein, J. S. and Kanne, J.	Radiology	2020	294	2	491-505	Excluded	Exposure type
E-cigarettes and the clinical encounter: Physician perspectives on e-cigarette safety, effectiveness, and patient educational needs	Kollath-Cattano, C., Dorman, T., Albano Jr, A.W., Jindal, M., Strayer, S.M. and Thrasher, J.F.	Journal of Evaluation in Clinical Practice	2019	25	5	761-768	Excluded	Duplicate
Effects of Tobacco Smoking on Cardiovascular Disease	Kondo, T. and Nakano, Y. and Adachi, S. and Murohara, T.	Circulation Journal	2019	83	10	1980-1985	Excluded	Exposure type
Early and late adverse renal effects after potentially nephrotoxic treatment for childhood cancer	Kooijmans, E.C., Bökenkamp, A., Tjahjadi, N.S., Tettero, J.M., van Dulmen-den Broeder, E., van der Pal, H.J. and Veening, M.A	Cochrane Database of Systematic Reviews	2019	-	3	-	Excluded	Outcome type
Vaping Associated Pulmonary Injury (VAPI) with superimposed Mycoplasma pneumoniae infection	Kooragayalu, S. and El-Zarif, S. and Jariwala, S.	Respiratory Medicine Case Reports	2020	29	-	-	Excluded	Study design
Health consequences of smoking-focusing on alternative smoking methods	Kopa, P.N. and Pawliczak, R.	Alergologia Polska - Polish Journal of Allergology	2019	6	3	100-109	Excluded	Outcome type
IQOS - a heat-not-burn (HnB) tobacco product - chemical composition and possible impact on oxidative stress and inflammatory response. A systematic review	Kopa, P.N. and Pawliczak, R.	Toxicology Mechanisms & Methods	2020	30	2	81-87	Excluded	Exposure type
Pharmacotherapy for smoking cessation in schizophrenia: a systematic review	Kozak, K. and George, T. P.	Expert Opinion on Pharmacotherapy	2020	21	5	581-590	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Interventions for Tobacco Smoking Cessation in Adults, Including Pregnant Persons: US Preventive Services Task Force Recommendation Statement	Krist, Alex H. and Davidson, Karina W. and Mangione, Carol M. and Barry, Michael J. and Cabana, Michael and Caughey, Aaron B. and Donahue, Katrina and Doubeni, Chyke A. and Epling, John W., Jr. and Kubik, Martha and Ogedegbe, Gbenga and Pbert, Lori and Silverstein, Michael and Simon, Melissa A. and Tseng, Chien-Wen and Wong, John B.	JAMA: Journal of the American Medical Association	2021	325	3	265-279	Excluded	Outcome type
An E-Liquid Flavor Wheel: A Shared Vocabulary Based on Systematically Reviewing E-Liquid Flavor Classifications in Literature	Krüsemann, E.J., Boesveldt, S., De Graaf, K. and Talhout, R.	Nicotine and Tobacco Research	2019	21	10	1310-1319	Excluded	Outcome type
A numerical investigation of the potential effects of e-cigarette smoking on local tissue dosimetry and the deterioration of indoor air quality	Kuga, K., Ito, K., Chen, W., Wang, P. and Kumagai, K.	Indoor air	2020	30	5	1018-1038	Excluded	Exposure type
Perceptions and Sentiments About Electronic Cigarettes on Social Media Platforms: Systematic Review	Kwon, M. and Park, E.	JMIR Public Health and Surveillance	2020	6	1	e13673	Excluded	Outcome type
Non-Pharmacological and Pharmacological Interventions for Smoking Cessation Programs in Youth: A Review of Clinical Effectiveness and Guidelines	Lachance, C. and Frey, N.	Canadian Agency for Drugs and Technologies in Health	2020	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Assessing the appeal of Instagram electronic cigarette refill liquid promotions and warnings among young adults: Mixed methods focus group study	Laestadius, Linnea I. and Penndorf, Kendall E. and Seidl, Melissa and Cho, Young I.	Journal of Medical Internet Research	2019	21	11	-	Excluded	Outcome type
6 Holistic Fitness Foundation: Steps to Staying Strong	Laing, Karen	Beginnings	2020	40	3	-	Excluded	Study design
Cardio-oncology: where do we stand for in Belgium?	Lancellotti, P., De Pauw, M. and Claeys, M.	Acta Cardiologica	2021	76	2	204-208	Excluded	Outcome type
Life-threatening bronchiolitis related to electronic cigarette use in a Canadian youth	L and man, Simon T. and Dhaliwal, Inderdeep and Mackenzie, Constance A. and Martinu, Tereza and Steele, Andrew and Bosma, Karen J.	CMAJ: Canadian Medical Association Journal	2019	191	48	E1321-E1331	Excluded	Study design
Nonanimal toxicology testing approaches for traditional and deemed tobacco products in a complex regulatory environment: Limitations, possibilities, and future directions	Lauterstein, D., Savidge, M., Chen, Y., Weil, R. and Yeager, R.P.	Toxicology in Vitro	2020	62	-	-	Excluded	Outcome type
Walking for hypertension	Lee, L. L. and Mulvaney, C. A. and Wong, Y. K. and Chan, E. S. Y. and Watson, M. C. and Lin, H. H.	Cochrane Database of Systematic Reviews	2021	-	2	-	Excluded	Outcome type
Endotoxin and (1->3)-beta-D-glucan contamination in electronic cigarette products sold in the United States	Lee, M. S. and Allen, J. G. and Christiani, D. C.	Environmental Health Perspectives	2019	127	4	-	Excluded	-
Considerations related to vaping as a possible gateway into cigarette smoking: An analytical review	Lee, P. N. and Coombs, K. J. and Afolalu, E. F.	F1000Research	2019	7	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Effect of Electronic Cigarettes on Smoking Reduction and Cessation in Korean Male Smokers: a Randomized Controlled Study	Lee, S. H. and Ahn, S. H. and Cheong, Y. S.	Journal of the American Board of Family Medicine	2019	32	4	567-574	Excluded	Outcome type
Youth and Young Adult Use of Pod-Based Electronic Cigarettes From 2015 to 2019: A Systematic Review	Lee, Stella Juhyun and Rees, Vaughan W. and Yossefy, Noam and Emmons, Karen M. and Tan, Andy S. L.	JAMA Pediatrics	2020	174	7	714-720	Excluded	Outcome type
Route of administration effects on nicotine discrimination in female and male mice	Lefever, T.W., Thomas, B.F., Kovach, A.L., Snyder, R.W. and Wiley, J.L.	Drug and Alcohol Dependence	2019	204	-	-	Excluded	Exposure type
E-cigarette use and its predictors: Results from an online cross-sectional survey in Poland	Lewek, P. and Wozniak, B. and Maludzinska, P. and Smigielski, J. and Kardas, P.	Tobacco Induced Diseases	2019	17	-	-	Excluded	Outcome type
Home smoking and vaping policies among US adults: results from the Population Assessment of Tobacco and Health (PATH) study, wave 3	Li, D., Shi, H., Xie, Z., Rahman, I., McIntosh, S., Bansal-Travers, M., Winickoff, J.P., Drehmer, J.E. and Ossip, D.J	Preventive Medicine	2020	139	-	-	Excluded	Outcome type
Treatment regimens for administration of anti-vascular endothelial growth factor agents for neovascular age-related macular degeneration	Li, E. and Donati, S. and Lindsley, K. B. and Krzystolik, M. G. and Virgili, G.	Cochrane Database of Systematic Reviews	2020	-	5	-	Excluded	Outcome type
Effects of Electronic Cigarettes on Indoor Air Quality and Health	Li, Liqiao and Lin, Yan and Xia, Tian and Zhu, Yifang	Annual Review of Public Health	2020	41	-	363-380	Excluded	Exposure type
Limited Aggregation and E-Cigarettes	Lim, J. E.	Nicotine and Tobacco Research	2021	23	1	21-25	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Smoking susceptibility among non-smoking school-going adolescents in Malaysia: Findings from a national school-based survey	Lim, K. H. and Ghazali, S. M. and Lim, H. L. and Cheong, K. C. and Teh, C. H. and Lim, K. K. and Heng, P. P. and Cheah, Y. K. and Lim, J. H.	BMJ Open	2019	9	10	-	Excluded	Outcome type
Surgical Smoke Exposure in Operating Room Personnel: A Review	Limchantra, Ice V. and Fong, Yuman and Melstrom, Kurt A.	JAMA Surgery	2019	154	10	960-967	Excluded	Exposure type
Different doses, durations and modes of delivery of nicotine replacement therapy for smoking cessation	Lindson, N., Chepkin, S.C., Ye, W., Fanshawe, T.R., Bullen, C. and Hartmann-Boyce.	Cochrane Database of Systematic Reviews	2019	-	4	-	Excluded	Outcome type
Smoking reduction interventions for smoking cessation	Lindson, N., Klemperer, E., Hong, B., Ordóñez-Mena, J.M. and Aveyard, P.	Cochrane Database of Systematic Reviews	2019	-	9	-	Excluded	Outcome type
Motivational interviewing for smoking cessation	Lindson, N. and Thompson, T. P. and Ferrey, A. and Lambert, J. D. and Aveyard, P.	Cochrane Database of Systematic Reviews	2019	-	7	-	Excluded	Outcome type
Metabolomic Analysis Identified Reduced Levels of Xenobiotics, Oxidative Stress, and Improved Vitamin Metabolism in Smokers Switched to Vuse Electronic Nicotine Delivery System	Liu, Gang and Lin, Chi Jen and Yates, Charles R. and Prasad, G. L.	Nicotine & Tobacco Research	2021	23	7	1133-1142	Excluded	Outcome type
Baclofen for alcohol withdrawal	Liu, J. and Wang, L. N.	Cochrane Database of Systematic Reviews	2019	-	11	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
A phase II study of copper-depletion using tetrathiomolybdate (TM) in patients (pts) with high risk breast cancer (BC): role of collagen processing and tumor microenvironment	Liu, Y. L. and Bager, C. L. and Willumsen, N. and Kornhauser, N. and Cobham, M. and Andreopoulou, E. and Cigler, T. and Moore, A. and LaPolla, D. and Fitzpatrick, V. and et al.	Cancer research	2019	79	4	-	Excluded	Outcome type
Electronic Nicotine Delivery Systems or E-cigarettes: American College of Preventive Medicine's Practice Statement	Livingston, Catherine J. and Freeman, R and all J. and Costales, Victoria C. and Westhoff, John L. and Caplan, Lee S. and Sherin, Kevin M. and Niebuhr, David W.	American Journal of Preventive Medicine	2019	56	1	167-178	Excluded	Outcome type
Electronic Nicotine Delivery Systems: Current trends and patient education opportunities for dental hygienists	Loewen, Jill M. and Relich, Erin E.	Journal of Dental Hygiene	2019	93	1	43-51	Excluded	Outcome type
Trajectories of Tobacco and Nicotine Use Across Young Adulthood, Texas, 2014-2017	Loukas, Alex and ra and Marti, C. Nathan and Perry, Cheryl L.	American Journal of Public Health	2019	109	3	465-471	Excluded	Outcome type; exposure type
Vaping-related Lung Injury in an Adolescent	Lu, Monica A. and Jabre, Nicholas A. and Mogayzel Jr, Peter J. and Mogayzel, Peter J., Jr.	American Journal of Respiratory & Critical Care Medicine	2020	201	4	481-482	Excluded	Study design
Gun access, ownership, gun-related experiences, and substance use in young adults: a latent class analysis	Lu, Yu and Temple, Jeff R.	American Journal of Drug & Alcohol Abuse	2020	46	3	333-339	Excluded	Outcome type
Benefits of e-cigarettes in smoking reduction and in pulmonary health among chronic smokers undergoing a lung cancer screening program at 6 months	Lucchiari, C., Masiero, M., Mazzocco, K., Veronesi, G., Maisonneuve, P., Jemos, C., Salè, E.O., Spina, S., Bertolotti, R. and Pravettoni, G.	Addictive Behaviors	2020	103	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Potential for non-combustible nicotine products to reduce socioeconomic inequalities in smoking: a systematic review and synthesis of best available evidence	Lucherini, M. and Hill, S. and Smith, K.	BMC Public Health	2019	19	1	1-12	Excluded	Outcome type
Pharmacokinetic Comparison of a Novel Non-tobacco-Based Nicotine Pouch (ZYN) With Conventional, Tobacco-Based Swedish Snus and American Moist Snuff	Lunell, E., Fagerström, K., Hughes, J. and Pendrill, R.	Nicotine & tobacco research	2020	22	10	1757-1763	Excluded	Duplicate
Using social media for smoking cessation interventions: a systematic review	Luo, T., Li, M.S., Williams, D., Phillippi, S., Yu, Q., Kantrow, S., Kao, Y.H., Celestin, M., Lin, W.T. and Tseng, T.S	Perspectives in Public Health	2021	141	1	50-63	Excluded	Outcome type
Urinary Cyanoethyl Mercapturic Acid, a Biomarker of the Smoke Toxicant Acrylonitrile, Clearly Distinguishes Smokers From Nonsmokers	Luo, Xianghua and Carmella, Steven G. and Chen, Menglan and Jensen, Joni A. and Wilkens, Lynne R. and March and , Loic Le and Hatsukami, Dorothy K. and Murphy, Sharon E. and Hecht, Stephen S. and Le March and , Loic	Nicotine & Tobacco Research	2020	22	10	1744-1747	Excluded	Duplicate
Electronic cigarettes and cardiovascular health: what do we know so far?	MacDonald, Andrea and Middlekauff, Holly R.	Vascular Health & Risk Management	2019	15	-	159-174	Excluded	Outcome type
Persistent Severe Fixed Airways Obstruction in a High-Dosing E-cigarette User	Macedonia, Tony V. and Krefft, Silpa D. and Rose, Cecile S.	JGIM: Journal of General Internal Medicine	2020	35	1	345-349	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Cluster analysis of urinary tobacco biomarkers among U.S. adults: Population Assessment of Tobacco and Health (PATH) biomarker study (2013-2014)	Majeed, Ban and Linder, Daniel and Eissenberg, Thomas and Tarasenko, Yelena and Smith, Danielle and Ashley, David	Preventive Medicine	2020	140	-	N.PAG-N.PAG	Excluded	Outcome type
Once daily long-acting beta-agonists and long-acting muscarinic antagonists in a combined inhaler versus placebo for chronic obstructive pulmonary disease	Maqsood, U. and Ho, T. N. and Palmer, K. and Eccles, F. J. R. and Munavvar, M. and Wang, R. and Crossingham, I. and Evans, D. J. W.	Cochrane Database of Systematic Reviews	2019	-	3	-	Excluded	Outcome type
Electronic cigarettes in the indoor environment	Marcham, Cheryl L. and Springston, John P.	Reviews on Environmental Health	2019	34	2	105-124	Excluded	Exposure type
How bad are e-cigarettes? What can we learn from animal exposure models?	Marczylo, T.	Journal of Physiology	2020	598	22	5073-5089	Excluded	Outcome type
The impact of vaping on ocular health: a literature review	Martheswaran, T. and Shmunes, M. H. and Ronquillo, Y. C. and Moshirfar, M.	International Ophthalmology	2021	-	-	1-8	Excluded	Outcome type
Electronic Cigarette Use and Blood Pressure Endpoints: a Systematic Review	Martinez-Morata, I. and Sanchez, T. R. and Shimbo, D. and Navas-Acien, A.	Current Hypertension Reports	2021	23	1	-	Excluded	Duplicate
E-cigarettes May Support Smokers With High Smoking-Related Risk Awareness to Stop Smoking in the Short Run: Preliminary Results by Randomized Controlled Trial	Masiero, M., Lucchiari, C., Mazzocco, K., Veronesi, G., Maisonneuve, P., Jemos, C., Salè, E.O., Spina, S., Bertolotti, R. and Pravettoni, G.	Nicotine & Tobacco Research	2019	21	1	119-126	Excluded	Duplicate
Modifications to Electronic Nicotine Delivery Systems: Content Analysis of YouTube Videos	Massey, Z.B., Li, Y., Holli, J., Churchill, V., Yang, B., Henderson, K., Ashley, D.L., Huang, J. and Popova, L.	Journal of Medical Internet Research	2020	22	6	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The effects of varying electronic cigarette warning label design features on attention, recall, and product perceptions among young adults	Mays, D., Villanti, A., Niaura, R.S., Lindblom, E.N. and Strasser, A.A.	Health Communication	2019	34	3	317-324	Excluded	Outcome type
The Messages Presented in Electronic Cigarette-Related Social Media Promotions and Discussion: Scoping Review	McCausland, K., Maycock, B., Leaver, T. and Jancey, J.	Journal of Medical Internet Research	2019	21	2	-	Excluded	Outcome type
Exposure to and perceptions of health warning labels on nicotine vaping products: Findings from the 2016 International Tobacco Control Four Country Smoking and Vaping Survey	McDermott, M.S., Li, G., McNeill, A., Hammond, D., Thrasher, J.F., O'Connor, R.J., Cummings, K.M., Borland, R., Fong, G.T. and Hitchman, S.C.	Addiction	2019	114	-	134-143	Excluded	Outcome type
Electronic cigarettes: A position statement from the Thoracic Society of Australia and New Zealand*	McDonald, C.F., Jones, S., Beckert, L., Bonevski, B., Buchanan, T., Bozier, J., Carson-Chahhoud, K.V., Chapman, D.G., Dobler, C.C., Foster, J.M. and Hamor, P., Hodge, S., Holmes, P.W., Larcombe, A.N., Marshall, H.M., McCallum, G.B., Miller, A., Pattemore, P., Roseby, R., See, H.V., Stone, E., Thompson, B.R., Ween, M.P. and Peters, M. J.	Respirology	2020	25	10	1082-1089	Excluded	Duplicate
Smoking in pregnancy: pathophysiology of harm and current evidence for monitoring and cessation	McDonnell, Brendan P. and Regan, Carmen	Obstetrician & Gynaecologist	2019	21	3	169-175	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Evidence and E-Cigarettes: Explaining English Exceptionalism	McKee, Martin	American Journal of Public Health	2019	109	7	965-966	Excluded	Outcome type
ES13.04 Comparing ENDS to NRT for Smoking Cessation	McRobbie, H.	Journal of thoracic oncology	2019	14	10	S47-S48	Excluded	Outcome type
Nicotine replacement treatment, e-cigarettes and an online behavioural intervention to reduce relapse in recent ex-smokers: a multinational four-arm RCT	McRobbie, H. J. and Phillips-Waller, A. and El Zerbi, C. and McNeill, A. and Hajek, P. and Pesola, F. and Balmford, J. and Ferguson, S. G. and Li, L. and Lewis, S. and et al.	Health technology assessment	2020	24	68	1-81	Excluded	Outcome type
Vaping-Related Mobile Apps Available in the Google Play Store After the Apple Ban: Content Review	Meacham, Meredith C. and Vogel, Erin A. and Thrul, Johannes	Journal of Medical Internet Research	2020	22	11	-	Excluded	Outcome type
Impact of non-menthol flavours in e-cigarettes on perceptions and use: an updated systematic review	Meernik, C. and Baker, H. M. and Kowitt, S. D. and Ranney, L. M. and Goldstein, A. O.	BMJ Open	2019	9	10	-	Excluded	Outcome type
Retroperitoneal versus transperitoneal approach for elective open abdominal aortic aneurysm repair	Mei, F. and Hu, K. and Zhao, B. and Gao, Q. and Chen, F. and Zhao, L. and Wu, M. and Feng, L. and Wang, Z. and Yang, J. and et al.	Cochrane Database of Systematic Reviews	2021	-	6	-	Excluded	Exposure type
Development of a self-help smoking cessation intervention for dual users of tobacco cigarettes and e-cigarettes	Meltzer, L.R., Simmons, V.N., Piñeiro, B., Drobes, D.J., Quinn, G.P., Meade, C.D., Brandon, K.O., Palmer, A., Unrod, M., Harrell, P.T. and Bullen, C., Eissenberg, T. and Brandon, T. H.	International Journal of Environmental Research and Public Health	2021	18	5	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Should psychiatrists support the availability of nicotine e-cigarettes in Australia?	Mendelsohn, Colin Paul	Australasian Psychiatry	2019	27	6	657-658	Excluded	Outcome type
Smoking cessation in 2019	Mendes, Aysha	British Journal of Community Nursing	2019	24	3	144-145	Excluded	Outcome type
The vaping controversy: evidence remains a smoky affair	Mendes, Aysha	Journal of Prescribing Practice	2019	1	8	374-375	Excluded	Study design
Barriers and Facilitators of Adherence to Nicotine Replacement Therapy: A Systematic Review and Analysis Using the Capability, Opportunity, Motivation, and Behaviour (COM-B) Model	Mersha, A.G., Gould, G.S., Bovill, M. and Eftekhari, P.	International Journal of Environmental Research & Public Health	2020	17	23	30	Excluded	Outcome type
Cardiovascular effects of electronic cigarettes	Middlekauff, Holly R.	Nature Reviews Cardiology	2020	17	7	379-381	Excluded	Outcome type
A systematic review of refillable e-liquid nicotine content accuracy	Miller, D.R., Buettner-Schmidt, K., Orr, M., Rykal, K. and Niewojna, E.	Journal of the American Pharmacists Association	2020	61	1	20-26	Excluded	Outcome type
Maintenance agonist treatments for opiate-dependent pregnant women	Minozzi, S. and Amato, L. and Jahanfar, S. and Bellisario, C. and Ferri, M. and Davoli, M.	Cochrane Database of Systematic Reviews	2020	-	11	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Workshop Series to Identify, Discuss, and Develop Recommendations for the Optimal Generation and Use of in Vitro Assay Data for Tobacco Product Evaluation: Phase 1 Genotoxicity Assays	Moore, M.M., Clements, J., Desai, P., Doshi, U., Gaca, M., Guo, X., Hashizume, T., Jordan, K.G., Lee, K.M., Leverette, R. and McHugh, D., Miller-Holt, J., Phillips, G., Raabe, H., Recio, L., Roy, S., Smart, D.J., Stankowski, L.F., Thorne, D., Weber, E., Wieczorek, R., Yoshino, K. and Curren, R.	Applied In Vitro Toxicology	2020	6	2	49-63	Excluded	Study design
Risk versus regulation: an update on the state of e-cigarette control in Australia	Morgan, Jody and Breitbarth, Andreas K. and Jones, Alison L.	Internal Medicine Journal	2019	49	1	110-113	Excluded	Outcome type
Protectors or puritans? Responses to media articles about the health effects of e-cigarettes	Morphett, Kylie and Herron, Lisa and Gartner, Coral	Addiction Research & Theory	2020	28	2	95-102	Excluded	Outcome type
Characterization of E-cigarette coil temperature and toxic metal analysis by infrared temperature sensing and scanning electron microscopy-energy-dispersive X-ray	Mulder, H.A., Stewart, J.B., Blue, I.P., Krakowiak, R.I., Patterson, J.L., Karin, K.N., Royals, J.M., DuPont, A.C., Forsythe, K.E., Poklis, J.L., Poklis, A., Butler, S. N., Turner, J.B.M. and Peace, M. R.	Inhalation Toxicology	2020	32	13	447-455	Excluded	Exposure type
Pulmonary toxicity and inflammatory response of e-cigarette vape cartridges containing medium-chain triglycerides oil and vitamin E acetate: Implications in the pathogenesis of EVALI	Muthumalage, T. and Lucas, J. H. and Wang, Q. and Lamb, T. and McGraw, M. D. and Rahman, I.	Toxics	2020	8	8	-	Excluded	Duplicate

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
E-cigarettes versus nicotine replacement treatment as harm reduction interventions for smokers who find quitting difficult: Randomised controlled trial	Myers Smith, K., Phillips-Waller, A., Pesola, F., McRobbie, H., Przulj, D., Orzol, M. and Hajek, P.	Addiction	2021	-	-	-	Excluded	Outcome type
Vaping During Pregnancy: What Are the Potential Health Outcomes and Perceptions Pregnant Women Have?	Nagpal, T. S. and Green, C. R. and Cook, J. L.	Journal of Obstetrics & Gynaecology Canada	2020	-	-	-	Excluded	Outcome type
Vaping Instead of Cigarette Smoking: A Panacea or Just Another Form of Cardiovascular Risk?	Nayeri, A. and Middlekauff, H.	Canadian Journal of Cardiology	2020	37	5	690-698	Excluded	Outcome type
Vaping High vs. Low Nicotine E-Liquid	Benowitz, N., and Yassin, S.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Exposure type
The Acute Effects of E-cigarette Inhalation on Vascular Function, Microcirculation and Thrombosis	Näslund, E.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Study design
Electronic Hookah and Endothelial Cell Function	Rezk-Hanna, M., and Mann, S.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Study design
The ESTxENDS Trial: pulmonary Function Substudy	Funke-Chambour, M., and Auer, R.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Study design
Biomarkers of Exposure and Effect in Standardized Research E-cigarette (SREC) Users	Stepanov, I., and Vanderloo, H.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Impact of Alternative Nicotine-Delivery Products on Combustible Cigarette Use	Piper, M.E.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Outcome type
Impact of New Product Standards for JUUL Among Dual JUUL/Combusted Cigarette Users	Pacek, L.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Outcome type
Low Nicotine Content Cigarettes in Vulnerable Populations: affective Disorders	Tidey, J.W., and Plucinski, S.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Duplicate
Low Nicotine Content Cigarettes in Vulnerable Populations: women of Reproductive Age	Higgins, S.T., and Markesich, C.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Outcome type
Changes in Biomarkers of Cigarette Smoke Exposure After Switching Either Exclusively or Partly to JUUL ENDS	Rubinstein, M.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Study design
Transcranial Magnetic Stimulation and Tobacco Use Disorder	Petersen, N.	U.S. National Library of Medicine, ClinicalTrials.gov	2019	-	-	-	Excluded	Outcome type
JUUL vs. Mod E-cigarette Study	Smith, T.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Study design
Understanding Factors That Influence Electronic Cigarette Nicotine Delivery Through PET Imaging of Beta-2 Nicotinic Acetylcholine Receptors	Baldassarri, S.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Electronic Cigarettes as a Harm Reduction Strategy Among Patients With COPD	Sherman, S.E., and Stevens, E.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
The ESTxENDS Trial- Effects of Using Electronic Nicotine Delivery Systems (ENDS/Vaporizer/E-cig) on Olfactory Function	Auer, R.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Study design
Acute Health Effects of Passive Vape Among COPD Patients	Laursen, K.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Duplicate
ESTxENDS Trial: MN Substudy - Micronuclei in Buccal Epithelium, a Surrogate Measure of Future Cancer Risk, Induced by Electronic Nicotine Delivery Systems (ENDS/Vaporizer/E-cig)	Hopf, N., and Auer, R.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Study design
A Study to Evaluate Nicotine Uptake and Biomarkers in Adult Smokers Using mybluTM Electronic Cigarettes	-	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Duplicate
PACE Vape Messaging Study	Villanti, A.C.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
Cigarette Consumption After switchinG to High or Low Nicotine strENght E-cigaretteS In Smokers With Schizophrenia	Capponetto, P.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Effects of Nicotine in E-cigarettes on Smoking Behaviors	Jackson, A., and DeFrank, M.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Exposure type
Cardiovascular Effects of Heated Tobacco Products (HTP)	Lundbäck, M., and Jernberg, T	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Exposure type
Comparative Abuse Liability Among African American and White Smokers	Leavens, E., and Lambart, L.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Exposure type
Short-Term Cardiovascular Effects of E-Cigarettes: influence of E-Liquid pH	Helen, G., and Yassin, S.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Study design
Clinical Trial Evaluating the Effect of BCG Vaccination on the Incidence and Severity of SARS-CoV-2 Infections Among Healthcare Professionals During the COVID-19 Pandemic in Poland	Czajka, H., and Mazur, A.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
Evaluation of Big Decisions in Three South Texas School Districts	-	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
The Effect of Curcumin on the Development of Prednisolone-induced Hepatic Insulin Resistance	Knop, F.K., and Hellmann, P.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The ESTxENDS Trial- Electronic Nicotine Delivery Systems as an Aid for Smoking Cessation-extension of Follow-up	Auer, R	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
Relapse Prevention in Stimulant Use Disorder	London, E.D., and McClintick, M.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type; exposure type
Smoking Cessation in Hospitalized Patients Using an App	Garcia-Pazo, P.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
A Study to Compare the Similarity in Efficacy and Safety Between TRS003 and China-approved Bevacizumab® in NSCLC	Yuankai, S., and Yilin, L.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
The Effectiveness of Nintendo Wii Fit and Inspiratory Muscle Training in Older Patients With Heart Failure	Rengin, D., and Kiliç, C.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
Efficacy of Therapist Guided e-Therapy Versus Self-Help Therapy on Psychological Distress Among Individuals in Oman During COVID-19 Pandemic	Alawi, M.A.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type
Attenuation of Airway and Cardiovascular Responses to Extubation in Chronic Smokers	Abdulwahhab, A.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Exposure type
Pilot RCT of Cytisine vs Combination NRT in Relapsed Smokers	Reid, B., and Wooding, E.	U.S. National Library of Medicine, ClinicalTrials.gov	2020	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Do Flavors Increase the Addiction Potential of Nicotine?	Hughes, J.R.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Study design
E-cigarette Nicotine Study	Klemperer, E.M., and Meyers, S.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Outcome type
Developing and Testing Health Warning Labels on the ENDS Device	Maziak, W., and Vargas-Rivera, M.E.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Outcome type
Sustaining Aviator Performance During Extended Operational Flight	Feltman, K.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Exposure type
Concentration Impact Nicotine Salt	Liakoni, E.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Exposure type
Characterization of Product Use in Smokers Switching From Cigarettes to a RELX Electronic Nicotine Delivery System	Adams, M., and Graff, D.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Outcome type
Amino Acid Profile and Muscle Protein Synthetic Response to Consuming Meat or Plant-based Alternatives	Baar, K., Schaal, K., and Kain, C.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Exposure type
Effects of Intravenous (IV) Citalopram Hydrochloride During Transcranial Magnetic Stimulation in Major Depressive Disorder (MDD)	-	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Food and Circadian Timing	McHill, A.	U.S. National Library of Medicine, ClinicalTrials.gov	2021	-	-	-	Excluded	Outcome type
Does Smoking Intensity Predict Cessation Rates? A Study of Light-Intermittent, Light-Daily, and Heavy Smokers Enrolled in Two Telephone-Based Counseling Interventions	Ni, Katherine and Wang, Binhuan and Link, Alissa R. and Sherman, Scott E.	Nicotine & Tobacco Research	2020	22	3	423-430	Excluded	Outcome type
Changes in electronic cigarette use and label awareness among smokers before and after the European Tobacco Products Directive implementation in six European countries: findings from the EUREST-PLUS ITC Europe Surveys	Nikitara, K., Girvalaki, C., Kyriakos, C.N., Driezen, P., Filippidis, F.T., Kahnert, S., Hitchman, S.C., Mons, U., Fernández, E., Trofor, A.C., Przewoźniak, K., Demjén, T. Katsaounou, P.A., Zatoński, W., Fong, G.T., Vardavas, C.I., and the Eurest-Plus Consortium	European Journal of Public Health	2020	30	Supp3	iii62-iii67	Excluded	Outcome type
Adolescents' receptivity to e-cigarette harms messages delivered using text messaging	Noar, S.M., Rohde, J.A., Horvitz, C., Lazard, A.J., Ross, J.C. and Sutfin, E.L.	Addictive Behaviors	2019	91	-	201-207	Excluded	Outcome type
Development of a complex intervention for the maintenance of postpartum smoking abstinence: process for defining evidence-based intervention	Notley, C. and Brown, T. J. and Bauld, L. and Hardeman, W. and Holl and , R. and Naughton, F. and Orton, S. and Ussher, M.	International Journal of Environmental Research and Public Health	2019	16	11	-	Excluded	Outcome type
Incentives for smoking cessation	Notley, C., Gentry, S., Livingstone-Banks, J., Bauld, L., Perera, R. and Hartmann-Boyce, J.	Cochrane Database of Systematic Reviews	2019	-	7	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Association between electronic cigarette use and tobacco cigarette smoking initiation in adolescents: a systematic review and meta-analysis	O'Brien, D., Long, J., Quigley, J., Lee, C., McCarthy, A. and Kavanagh, P	BMC Public Health	2021	21	1	1-10	Excluded	Outcome type
A randomised, open-label, cross-over clinical study to evaluate the pharmacokinetic profiles of cigarettes and e-cigarettes with nicotine salt formulations in US adult smokers	O'Connell, G., Pritchard, J.D., Prue, C., Thompson, J., Verron, T., Graff, D. and Walele, T.	Internal and Emergency Medicine	2019	14	6	853-861	Excluded	Exposure type
Local and State Policy Action Taken in the United States to Address the Emergence of E-Cigarettes and Vaping: A Scoping Review of Literature	O'Connell, M. and Kephart, L.	Health Promotion Practice	2020	-	-	-	Excluded	Outcome type
Vaping and Pregnancy: Health and Policy Concerns	O'Donnell, Darby	Neonatology Today	2019	14	11	51-53	Excluded	Outcome type
Tobacco harm reduction in the 21st century	O'Leary, R., and Polosa, R.	Drugs & Alcohol Today	2020	20	3	219-234	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Critical appraisal of the European Union Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) Preliminary Opinion on electronic cigarettes	O'Leary, R., Polosa, R., Li Volti, G., Alaimo, S., Anfuso, C. D. Barbagallo, I. Basile, F. Battiato, S. Bertino, G. Bianchi, A. Biondi, A. G. Brand i, M. L. Cacciola, E. Cacciola, R. R. Cacopardo, B. S. Calogero, A. E. Cambria, M. T. Campagna, D. Caraci, F. Cariola, A. Caruso, M. Caponnetto, P. Cibella, F. Di Mauro, M. Di Nuovo, S. Di Stefano, A. Drago, F. Failla, S. Faraci, R. Ferlito, S. Ferrante, M. Ferro, A. Ferro, G. A. Frasca, F. Frittitta, L. Furneri, P. M. Gallo, G. Galvano, F. Gagliano, A. Grasso, G. Guarino, F. Gulino, A. Jannini, E. A. Vignera, S. L. A. Lazzarino, G. Longo, A. Lupo, G. Malerba, M. Marletta, L. Nicolosi, G. Nocera, F. Oliveri Conti, G. Parenti, R. Pulvirenti, A. Purrello, F. Rapisarda, F. Rapisarda, V. Reibaldi, M. Rizzo, R. Ronsisvalle, S. Ruggieri, M. Santagati, M. C. Satriano, C. Sciacca, L. Signorelli, M. S. Tatullo, M. Tibullo, D. Tomaselli, V. Zanoli, L.; and Zappala, A.	Harm Reduction Journal	2021	18	1	1-15	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Probiotics to prevent infantile colic	Ong, T. G. and Gordon, M. and Banks, S. S. C. and Thomas, M. R. and Akobeng, A. K.	Cochrane Database of Systematic Reviews	2019	3	-	-	Excluded	Exposure type
Chronic exposure to e-cig aerosols during early development causes vascular dysfunction and offspring growth deficits	Orzabal, M.R., Lunde-Young, E.R., Ramirez, J.I., Howe, S.Y., Naik, V.D., Lee, J., Heaps, C.L., Threadgill, D.W. and Ramadoss, J.,	Translational Research: The Journal of Laboratory & Clinical Medicine	2019	207	-	70-82	Excluded	Exposure type
Association Between E-Cigarette Use and Chronic Obstructive Pulmonary Disease by Smoking Status: Behavioral Risk Factor Surveillance System 2016 and 2017	Osei, A.D., Mirbolouk, M., Orimoloye, O.A., Dzaye, O., Uddin, S.I., Benjamin, E.J., Hall, M.E., DeFilippis, A.P., Bhatnagar, A., Biswal, S.S. and Blaha, M.J.,	American Journal of Preventive Medicine	2020	58	3	336-342	Excluded	Outcome type
The association between e-cigarette use and asthma among never combustible cigarette smokers: behavioral risk factor surveillance system (BRFSS) 2016 & 2017	Osei, A.D., Mirbolouk, M., Orimoloye, O.A., Dzaye, O., Uddin, S.I., Dardari, Z.A., DeFilippis, A.P., Bhatnagar, A. and Blaha, M.J.	BMC Pulmonary Medicine	2019	19	1	1-6	Excluded	Outcome type
Knowledge and risk perception of e-cigarettes and hookah amongst youths in Lagos State, Nigeria: An exploratory study	Osibogun, O., Odukoya, O.O., Odusolu, Y.O. and Osibogun, A.	The Nigerian postgraduate medical journal	2020	27	4	384-390	Excluded	Outcome type
Primary Care Interventions for Prevention and Cessation of Tobacco Use in Children and Adolescents: US Preventive Services Task Force Recommendation Statement	Owens, D.K., Davidson, K.W., Krist, A.H., Barry, M.J., Cabana, M., Caughey, A.B., Curry, S.J., Donahue, K., Doubeni, C.A., Epling, J.W. Kubik, M., Ogedegbe, G., Pbert, L., Silverstein, M., Simon, M.A., Tseng, C.W. and Wong, J. B.	JAMA - Journal of the American Medical Association	2020	323	16	1590-1598	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
'The lesser devil you don't know': A qualitative study of smokers' responses to messages communicating comparative risk of electronic and combusted cigarettes	Owusu, Daniel and Lawley, Rachel and Yang, Bo and Henderson, Katherine and Bethea, Brittaney and LaRose, Christopher and Stallworth, Sam and Popova, Lucy	Tobacco Control: An International Journal	Mar	29	2	217-223	Excluded	Outcome type
An experimental study of messages communicating potential harms of electronic cigarettes	Owusu, D. and Massey, Z. and Popova, L.	PloS one	2020	15	10	-	Excluded	Outcome type
An experimental study on topical application of 2% lignocaine jelly for preventing coughing and sore throat post extubation in elective surgeries in smokers vs. non-smokers	Padhi, S. and Bhat, S.	Biomedical and Pharmacology Journal	2020	13	1	291-298	Excluded	Exposure type
Non-pharmacological care for opioid withdrawal in newborns	Pahl, A. and Young, L. and Buus-Frank, M. E. and Marcellus, L. and Soll, R.	Cochrane Database of Systematic Reviews	2020	-	12	-	Excluded	Exposure type
Smoking is associated with COVID-19 progression: A meta-analysis	Patanavanich, R. and Glantz, S.A.	Nicotine and Tobacco Research	2020	22	9	1653-1656	Excluded	Outcome type
Headspace analysis of E-cigarette fluids using comprehensive two dimensional GCxGC-TOF-MS reveals the presence of volatile and toxic compounds	Patel, D., Taudte, R.V., Nizio, K., Herok, G., Cranfield, C. and Shimmon, R.	Journal of Pharmaceutical and Biomedical Analysis	2021	196	-	-	Excluded	Exposure type
A systematic review of the impact of cigarettes and electronic cigarettes in otology	Patel, S. and Wooles, N. and Martin, T.	Journal of Laryngology & Otology	2020	134	11	951-956	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Are electronic nicotine delivery systems (ENDs) helping cigarette smokers quit?-Current evidence	Patil, S., Arakeri, G., Patil, S., Ali Baeshen, H., Raj, T., Sarode, S.C., Sarode, G.S., Awan, K.H., Gomez, R. and Brennan, P.A.	Journal of Oral Pathology & Medicine	2020	49	3	181-189	Excluded	Outcome type
Interventions for tobacco cessation in adults, including pregnant women: an evidence update for the US Preventive Services Task Force.	Patnode, C.D., Henderson, J.T., Melnikow, J., Coppola, E.L., Durbin, S. and Thomas, R.	-	2021	-	-	-	Excluded	Outcome type
Vaping: “a safe alternative to smoking”	Pearce, B. and Yadav, R. and Hegwood, E. and Ghafoor, A. and Mundell, J. and Preston, T.	CHEST	2020	157	-	A121-A121	Excluded	Study design
The EVALI program: Recommandations for toxicological investigations in subjects with lung injury associated with vaping product use	Pelissier-Alicot, A. L.	Toxicologie Analytique et Clinique	2020	32	2	92-94	Excluded	Foreign language
A randomized, double-blind, placebo-controlled, parallel-group, 52-week pivotal study to assess the efficacy, safety, and tolerability of dupilumab in patients with moderate-to-severe chronic obstructive pulmonary disease (copd) with type 2 inflammation	Paravesino, S.N., and Ayma, M.A.N.	Clinical Trials Peruvian Registry	2020	-	-	-	Excluded	Outcome type
Vaping-induced lung injury in a 21-year-old woman	Perrenoud, Abby and Vetos, Develyn and Wabwire, Godfrey	BMJ Case Reports	2020	-	-	44287	Excluded	Study design
Interventions for preventing venous thromboembolism in adults undergoing knee arthroscopy	Perrotta, C. and Chahla, J. and Badariotti, G. and Ramos, J.	Cochrane Database of Systematic Reviews	2020	-	5	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Research on Youth and Young Adult Tobacco Use, 2013-2018, From the Food and Drug Administration-National Institutes of Health Tobacco Centers of Regulatory Science	Perry, C.L., Creamer, M.R., Chaffee, B.W., Unger, J.B., Sutfin, E.L., Kong, G., Shang, C., Clendennen, S.L., Krishnan-Sarin, S. and Pentz, M.A.	Nicotine & Tobacco Research	2020	22	7	1063-1076	Excluded	Outcome type
Perceived relative harm of using e-cigarettes predicts future product switching among US adult cigarette and e-cigarette dual users	Persoskie, A., O'Brien, E.K. and Poonai, K.	Addiction	2019	114	12	2197-2205	Excluded	Outcome type
Behavioural interventions delivered through interactive social media for health behaviour change, health outcomes, and health equity in the adult population	Petkovic, J. and Duench, S. and Trawin, J. and Dewidar, O. and Pardo Pardo, J. and Simeon, R. and DesMeules, M. and Gagnon, D. and Hatcher Roberts, J. and Hossain, A. and et al.	Cochrane Database of Systematic Reviews	2021	-	5	-	Excluded	Outcome type
Taxation of unprocessed sugar or sugar-added foods for reducing their consumption and preventing obesity or other adverse health outcomes	Pfinder, M. and Heise, T. L. and Hilton Boon, M. and Pega, F. and Fenton, C. and Griebler, U. and Gartlehner, G. and Sommer, I. and Katikireddi, S. V. and Lhachimi, S. K.	Cochrane Database of Systematic Reviews	2020	-	4	-	Excluded	Exposure type
A six-month systems toxicology inhalation/cessation study in ApoE−/− mice to investigate cardiovascular and respiratory exposure effects of modified risk tobacco products, CHTP 1.2 and THS 2.2, compared with conventional cigarettes	Phillips, B., Szostak, J., Titz, B., Schlage, W.K., Guedj, E., Leroy, P., Vuillaume, G., Martin, F., Buettner, A., Elamin, A., Sewer, A., Sierro, N., Choukrallah, M.A., Schneider, T., Ivanov, N.V., Teng, C., Tung, C.K., Lim, W., Yeo, Y.S., Vanscheeuwijck, P., Peitsch, M.C. and Hoeng, J.	Food & Chemical Toxicology	2019	126	-	113-141	Excluded	Exposure type

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
E-Cigarette-Associated Endothelial Damage: A Potential Mechanism for Erectile Dysfunction	Pincus, J., Sandoval, V., Dick, B., Sanekommu, G., Rajasekaran, R., Ramasamy, R. and Raheem, O.	Sexual Medicine Reviews	2021	-	-	-	Excluded	Outcome type
A conflict of interest is strongly associated with tobacco industry-favourable results, indicating no harm of e-cigarettes	Pisinger, C. and Godtfredsen, N. and Bender, A. M.	Preventive Medicine	2019	119	-	124-131	Excluded	Outcome type
E-cigarette Advertising Exposure, Explicit and Implicit Harm Perceptions, and E-cigarette Use Susceptibility Among Nonsmoking Young Adults	Pokhrel, Pallav and Herzog, Thaddeus A. and Fagan, Pebbles and Unger, Jennifer B. and Stacy, Alan W.	Nicotine & Tobacco Research	2019	21	1	127-131	Excluded	Outcome type
Heat-not-burn Tobacco Products and the Increased Risk for Poly-tobacco Use	Pokhrel, Pallav and Herzog, Thaddeus A. and Kawamoto, Crissy T. and Fagan, Pebbles	American Journal of Health Behavior	2021	45	1	195-204	Excluded	Outcome type; exposure type
Smoking cessation in individuals who use vaping as compared with traditional nicotine replacement therapies: A systematic review and meta-analysis	Pound, C. M. and Zhang, J. Z. and Kodua, A. T. and Sampson, M.	BMJ Open	2021	11	2	-	Excluded	Outcome type
Smoking history, smoking intensity, and type of cigarette as risk factors of bladder cancer: A literature review	Pramod, S.V., Safriadi, F., Hernowo, B.S., Dwiyana, R.F. and Batista, B.	Urological Science	2020	31	4	147-155	Excluded	Outcome type
Nasal mucociliary clearance in smokers: A systematic review	Prasetyo, A., Sadhana, U. and Budiman, J.	International Archives of Otorhinolaryngology	2021	25	-	160-169	Excluded	Outcome type
Epidemiology and adverse consequences of hookah/waterpipe use: A systematic review	Pratiti, R. and Mukherjee, D.	Cardiovascular and Hematological Agents in Medicinal Chemistry	2019	17	2	82-93	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Biological effects of nicotine exposure: A narrative review of the scientific literature	Price, L. R. and Martinez, J.	F1000Research	2019	8	-	-	Excluded	Exposure type
Mimicking cigarette smoke exposure to assess cutaneous toxicity	Prieux, R. and Eeman, M. and Rothen-Rutishauser, B. and Valacchi, G.	Toxicology in Vitro	2020	62	-	-	Excluded	Exposure type
Clinical handbook of psychotropic drugs., 23rd ed	Procyshyn, Ric M. and Bezchlibnyk-Butler, Kalyna Z. and Jeffries, J. Joel	Clinical handbook of psychotropic drugs; Hogrefe Publishing; Germany	2019	-	-	-	Excluded	Study design
Discordant bilateral bronchoalveolar lavage findings in a patient with acute eosinophilic pneumonia associated with counterfeit tetrahydrocannabinol oil vaping	Puebla Neira, D. and Tambra, S. and Bhasin, V. and Nawgiri, R. and Duarte, A. G.	Respiratory Medicine Case Reports	2020	29	-	-	Excluded	Exposure type
Nicotine toxicity: Protecting children from e-cigarette exposure	Quail, M. Thomas	Nursing	2020	50	1	44-48	Excluded	Exposure type
Evaluating Nicotine Abstinence, Smoking Cessation, Reduction and its Relapsed Among Electronic Cigarettes Single and Dual Malaysian Users: A One Year Observational Study	Rahman, Azizur and Mohamed, Mohamad Haniki Nik and Mahmood, Syed and Nik Mohamed, Mohamad Haniki	Journal of Pharmacy & Pharmaceutical Sciences	2021	24	-	200-209	Excluded	Outcome type
Smoke and Heart Should Stay Apart: A Look at E Cigarettes and Other Alternatives to Conventional Cigarettes, and Their Impact on Cardiovascular Health	Raja, J., Khouzam, A., Khouzam, N. and Khouzam, R.N., 2021	Current Problems in Cardiology	2021	46	3	-	Excluded	Outcome type
Effects of Electronic Cigarettes on Oral Cavity: A Systematic Review	Ralho A, Coelho A, Ribeiro M, Paula A, Amaro I, Sousa J, Marto C, Ferreira M, Carrilho E.	Journal of Evidence-Based Dental Practice	2019	19	4	-	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Heat not burn tobacco product-a new global trend: Impact of heat-not-burn tobacco products on public health, a systematic review	Ratajczak, A. and Jankowski, P. and Strus, P. and Feleszko, W.	International Journal of Environmental Research and Public Health	2020	17	2	-	Excluded	Exposure type
A systamatic review on dental enamel	Ravikanth, P. and Mannam, R.	European Journal of Molecular and Clinical Medicine	2020	7	7	5657-5663	Excluded	Outcome type
Nicotine gateway effects on adolescent substance use	Ren, M. and Lotfipour, S.	Western Journal of Emergency Medicine	2019	20	5	696-709	Excluded	Exposure type
High Carbon Monoxide Levels from Charcoal Combustion Mask Acute Endothelial Dysfunction Induced by Hookah (Waterpipe) Smoking in Young Adults	Rezk-Hanna, Mary and Mosenifar, Zab and Benowitz, Neal L. and Rader, Florian and Rashid, Mohamad and Davoren, Katherine and Moy, Norma B. and Doering, Lynn and Robbins, Wendie and Sarna, Linda and Li, Ning and Chang, L. Cindy and Elashoff, Robert M. and Victor, Ronald G.	Circulation	2019	139	19	2215-2224	Excluded	Exposure type
E-cigarettes: A new hazard for children and adolescents	Richmond, S.A., Pike, I., Maguire, J.L. and Macpherson, A.	Paediatrics & Child Health	2020	25	5	317-321	Excluded	Outcome type
Randomized Trials of e-Cigarettes for Smoking Cessation	Rigotti, Nancy A.	JAMA: Journal of the American Medical Association	2020	324	18	1835-1837	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Reducing pediatric exposure to environmental tobacco smoke: The effects of pediatric exposure to environmental tobacco smoke and the role of pediatric perioperative care	Riley, C. and Ladak, N.	Paediatric Anaesthesia	2020	30	11	1199-1203	Excluded	Outcome type
Pine bark (Pinus spp.) extract for treating chronic disorders	Robertson, N. U. and Schoonees, A. and Br and , A. and Visser, J.	Cochrane Database of Systematic Reviews	2020	-	9	-	Excluded	Outcome type
Botulinum toxin type A versus anticholinergics for cervical dystonia	Rodrigues, F.B., Duarte, G.S., Castelão, M., Marques, R.E., Ferreira, J., Sampaio, C., Moore, A.P. and Costa, J.,	Cochrane Database of Systematic Reviews	2021	-	4	-	Excluded	Outcome type
Smoking cessation intervention for reducing disease activity in chronic autoimmune inflammatory joint diseases	Roelsgaard, I.K., Esbensen, B.A., Østergaard, M., Rollefstad, S., Semb, A.G., Christensen, R. and Thomsen, T.	Cochrane Database of Systematic Reviews	2019	-	9	-	Excluded	Outcome type
E-Cigarette Health Harm Awareness and Discouragement: Implications for Health Communication	Rohde, Jacob A. and Noar, Seth M. and Mendel, Jennifer R. and Hall, Marissa G. and Baig, Sabeeh A. and Ribisl, Kurt M. and Brewer, Noel T.	Nicotine & Tobacco Research	2020	22	7	1131-1138	Excluded	Outcome type
Debate: should the use of e-cigarettes be encouraged among smokers?	Ross, Louise and Watson, Jane	Nursing Times	2019	115	4	22-23	Excluded	Study design
Association of E-cigarettes with adolescent alcohol use and binge drinking-drunkenness: A systematic review and meta-analysis	Rothrock, A. N. and Andris, H. and Swetl and , S. B. and Chavez, V. and Isaak, S. and Pagane, M. and Romney, J. and Rothrock, S. G.	American Journal of Drug and Alcohol Abuse	2020	46	6	684-698	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Biomarkers of Tobacco Exposure Decrease After Smokers Switch to an E-Cigarette or Nicotine Gum	Round, Elaine K. and Chen, Peter and Taylor, Anthony K. and Schmidt, Eckhardt	Nicotine & Tobacco Research	2019	21	9	1239-1247	Excluded	Exposure type
Effect of acupuncture and auricular acupressure on smoking cessation: Protocol of a systematic review and Bayesian network meta-analysis	Runjing, Dai and Jie, Zhang and Hailiang, Zhang and Na, Zhao and Fujian, Song and Jingchun, Fan and Dai, Runjing and Zhang, Jie and Zhang, Hailiang and Zhao, Na and Song, Fujian and Fan, Jingchun	Medicine	2020	99	22	44287	Excluded	Outcome type
Free-Base and Total Nicotine, Reactive Oxygen Species, and Carbonyl Emissions From IQOS, a Heated Tobacco Product	Salman, Rola and Talih, Soha and El-Hage, Rachel and Haddad, Christina and Karaoghlanian, Nareg and El-Hellani, Ahmad and Saliba, Najat A. and Shihadeh, Alan	Nicotine & Tobacco Research	2019	21	9	1285-1288	Excluded	Exposure type
Case series of patients with e-cigarette or vaping product-associated lung injury: insights from a safety net hospital	Sanivarapu, Raghavendra and Arjun, Shiva and Mashaal, Hyfaa and Gutierrez, Alej and ro and Meshoyrer, Daniel and Anjum, Fatima and Iqbal, Javed and Akella, Jagadish	CHEST	2020	158	-	A2367-A2367	Excluded	Study design
SÍNDROME DE BURNOUT E ESTILO DE VIDA EM ESTUDANTES DE ENSINO MÉDIO	Santos, Anna and Mineiro, Henrique and Cruz, Lucas and Santos, Luiz and Silveira, Marise and de Pinho, Lucineia	Portuguese Journal of Mental Health Nursing / Revista Portuguesa de Enfermagem de Saude Mental	2019	-	21	16-22	Excluded	Foreign language
E-cigarettes use in the United States: reasons for use, perceptions, and effects on health	Sapru, Sakshi and Vardhan, Mridula and Li, Qianhao and Guo, Yuqi and Li, Xin and Saxena, Deepak	BMC Public Health	2020	20	1	N.PAG-N. PAG	Excluded	Outcome type

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Severe neurological nicotine intoxication by e-cigarette liquids: Systematic literature review	Scarpino, M., Rosso, T., Lanzo, G., Lolli, F., Bonizzoli, M., Lazzeri, C., Mannaioni, G., Baronti, R., Fattapposta, F. and Grippo, A.	Acta Neurologica Scandinavica	2021	143	2	121-130	Excluded	Exposure type
Comparison of high tone therapy and transcutaneous electrical nerve stimulation therapy in chemotherapy-induced polyneuropathy	Schaffler-Schaden, D. and Sassmann, R. and Johansson, T. and Gampenrieder, S. P. and Rinnerthaler, G. and Lampl, K. and Herfert, J. and Lenzhofer, C. and L and kammer, Y. T. and Rieder, F. and et al.	Medicine	2020	99	19	e20149	Excluded	Outcome type
An exploratory non-randomized study of a 3-month electronic nicotine delivery system (ENDS) intervention with people accessing a homeless supported temporary accommodation service (STA) in Ireland	Scheibein, F. and McGirr, K. and Morrison, A. and Roche, W. and Wells, J. S. G.	Harm Reduction Journal	2020	17	1	-	Excluded	Outcome type
Screening strategies for hypertension	Schmidt, B. M. and Durao, S. and Toews, I. and Bavuma, C. M. and Hohlfeld, A. and Nury, E. and Meerpohl, J. J. and Kredo, T.	Cochrane Database of Systematic Reviews	2020	-	5	-	Excluded	-
Vaper, Beware: The Unique Toxicological Profile of Electronic Cigarettes	Schmidt, Silke	Environmental Health Perspectives	2020	128	5	-	Excluded	Study design
MicroRNAs as epigenetic targets of cigarette smoke during embryonic development	Seelan, R. S. and Greene, R. M. and Pisano, M. M.	MicroRNA	2020	9	3	168-173	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Intranasal corticosteroids for non-allergic rhinitis	Segboer, C., Gevorgyan, A., Avdeeva, K., Chusakul, S., Kanjanaumporn, J., Aeumjaturapat, S., Reeskamp, L.F., Snidvongs, K. and Fokkens, W.,	Cochrane Database of Systematic Reviews	2019	-	11	-	Excluded	Outcome type
Indoor e-cigarette use can set off smoke detectors: Perceptions of an emerging issue	Seidenberg, Andrew and Ribisl, Kurt M.	Tobacco Control: An International Journal	2020	29	4	464-465	Excluded	Exposure type
Knowledge and Awareness of Added Sugar in Cigarettes	Seidenberg, Andrew B. and Jo, Catherine L. and Ribisl, Kurt M.	Nicotine & Tobacco Research	2019	21	12	1689-1694	Excluded	Outcome type
Health effects of electronic cigarette (e-cigarette) use on organ systems and its implications for public health	Seiler-Ramadas, R. and S and ner, I. and Haider, S. and Grabovac, I. and Dorner, T. E.	Wiener Klinische Wochenschrift	2020	-	-	1-8	Excluded	Outcome type
Primary Care-Relevant Interventions for Tobacco and Nicotine Use Prevention and Cessation in Children and Adolescents: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force	Selph, S. and Patnode, C. and Bailey, S. R. and Pappas, M. and Stoner, R. and Chou, R.	JAMA - Journal of the American Medical Association	2020	323	16	1599-1608	Excluded	Outcome type
Vaping for Tobacco Cessation: What Does the Evidence Say?	Sergakis, Georgianna	AARC Times	2020	44	3	44378	Excluded	Outcome type
Evaluation of the Effects of a Brief Educational Module About Electronic Cigarettes on Undergraduate Health Professional Students Knowledge, Attitudes, and Self-Efficacy: A Pilot Study	Sergakis, Georgianna G. and Clutter, Jill E. and Edler, Bianca and Ali, Basal and Chom, Chhunheng and Hodgson, Lorraine	Respiratory Care Education Annual	2019	28	-	53-57	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Feasibility, Acceptability, and Adoption of an Inpatient Tobacco Treatment Service at a Safety-Net Hospital: A Mixed-Methods Study	Seth, Bhavna and Herbst, Nicole and Oleinik, Katia and Clark, Kristopher and Helm, Eric D. and O'Donnell, Charles and Fitzgerald, Carmel and Wong, Carolina and Wiener, Renda Soylemez and Kathuria, Hasmeena	Annals of the American Thoracic Society	2020	17	1	63-71	Excluded	Outcome type
A meta-analysis of microRNAs expressed in human aerodigestive epithelial cultures and their role as potential biomarkers of exposure response to nicotine-containing products	Sewer, A. and Zanetti, F. and Isk and ar, A. R. and Guedj, E. and Dulize, R. and Peric, D. and Born and , D. and Mathis, C. and Martin, F. and Ivanov, N. V. and Peitsch, M. C. and Hoeng, J.	Toxicology Reports	2020	7	-	1282-1295	Excluded	Exposure type
Severe Acute Toxicity of Inhaled Nicotine and e-Cigarettes: Seizures and Cardiac Arrhythmia	Shao, Xuesi M. and Fang, Zhuang T.	CHEST	2020	157	3	506-508	Excluded	Exposure type
Patterns of tobacco and e-cigarette use status in India: A cross-sectional survey of 3000 vapers in eight Indian cities	Sharan, Rajeshwar Nath and Chanu, Tongbram Malemnganbi and Chakrabarty, Tapan Kumar and Farsalinos, Konstantinos	Harm Reduction Journal	2020	17	1	1-11	Excluded	Outcome type
Adolescent's Health Perceptions of E-Cigarettes: A Systematic Review	Sharma, Anupriya and McCausl and , Kahlia and Jancey, Jonine	American Journal of Preventive Medicine	2021	60	5	716-725	Excluded	Outcome type
E-cigarette use among Asian Americans: a systematic review	Shi, M. and Gette, J. A. and Giss and aner, T. D. and Cooke, J. T. and Littlefield, A. K.	Journal of Ethnicity in Substance Abuse.	2020	-	-	-	Excluded	Outcome type
Electronic cigarettes and e-cigarette/vaping product use associated lung injury (EVALI)	Shinbashi, Meagan and Rubin, Bruce K.	Paediatric Respiratory Reviews	2020	36	-	87-91	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Heat-not-burn tobacco products: a systematic literature review	Simonavicius, E. and McNeill, A. and Shahab, L. and Brose, L. S.	Tobacco control	2019	28	5	582-594	Excluded	Exposure type
E-cigarettes and youth: Patterns of use, potential harms, and recommendations	Singh, S., Windle, S.B., Filion, K.B., Thombs, B.D., O'Loughlin, J.L., Grad, R. and Eisenberg, M.J.,	Preventive Medicine	2020	133	-	-	Excluded	Outcome type
Alcohol and other drug health-care providers and their client's perceptions of e-cigarette use, safety and harm reduction	Skelton, E., Guillaumier, A., Tzelepis, F., Walsberger, S., Paul, C.L., Dunlop, A.J., Palazzi, K. and Bonevski, B.	Drug and Alcohol Review	2021	-	-	-	Excluded	Outcome type
Cardiovascular effects of electronic cigarettes: A systematic review and meta-analysis	Skotsimara, G., Antonopoulos, A.S., Oikonomou, E., Siasos, G., Ioakeimidis, N., Tsalamandris, S., Charalambous, G., Galiatsatos, N., Vlachopoulos, C. and Tousoulis, D.	European Journal of Preventive Cardiology	2019	26	11	1219-1228	Excluded	Outcome type
Perceptions of E-cigarettes and Flavor Restrictions among Tobacco Retailers in Los Angeles	Smiley, Sabrina L. and Heesung, Shin and Rose, Shyanika W. and Rodriguez, Yaneth L. and Barahona, Rosa and Baezconde-Garbanati, Lourdes	American Journal of Health Behavior	2020	44	6	893-901	Excluded	Outcome type
The emerging norms of e-cigarette use among adolescents: A meta-ethnography of qualitative evidence	Smith, H., Lucherini, M., Amos, A. and Hill, S.	International Journal of Drug Policy	2021	94	-	-	Excluded	Outcome type
Impact of E-cigarette Sampling on Cigarette Dependence and Reinforcement Value	Smith, Tracy T. and Wahlquist, Amy E. and Heckman, Bryan W. and Cummings, K. Michael and Carpenter, Matthew J.	Nicotine & Tobacco Research	2020	22	2	297-301	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Main and Interactive Effects of Nicotine Product Type on Sleep Health Among Dual Combustible and E-Cigarette Users	So, C.J., Meers, J.M., Alfano, C.A., Garey, L. and Zvolensky, M.J.,	American Journal on Addictions	2021	30	2	147-155	Excluded	Duplicate
Indoor Air Quality and Passive E-cigarette Aerosol Exposures in Vape-Shops	Son, Yeongkwon and Giovenco, Daniel P. and Delnevo, Cristine and Khlystov, Andrey and Samburova, Vera and Meng, Qingyu	Nicotine & Tobacco Research	2020	22	10	1772-1779	Excluded	Exposure type
US young adults' perceived effectiveness of draft pictorial e-cigarette warning labels	Sontag, J., Manderski, M.T.B., Hammond, D. and Wackowski, O.A.,	Tobacco Control: An International Journal	2019	28	e1	e49-e51	Excluded	Outcome type
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	Sontag, J. M. and Wackowski, O. A. and Hammond, D.	Preventive Medicine Reports	2019	16	-	-	Excluded	Exposure type
Health practitioners should caution about misinformation and association of adverse effects of electronic cigarette use and COVID-19	Soule, E. K. and Kheradmand, F. and Eissenberg, T.	Preventive Medicine Reports	2020	20	-	-	Excluded	Outcome type
Radiological findings of e-cigarette or vaping product use associated lung injury: A systematic review	Sreedharan, S., Mian, M., Robertson, R.A. and Rhodes, A	Heart and Lung	2021	50	5	736-741	Excluded	Outcome type
Intersection of smoking, e-cigarette use, obesity, and metabolic and bariatric surgery: a systematic review of the current state of evidence	Srikanth, N. and Xie, L. and Morales-Marroquin, E. and Ofori, A. and de la Cruz-Munoz, N. and Messiah, S. E.	Journal of Addictive Diseases	2021	39	3	331-346	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
GPs' and nurses' perceptions of electronic cigarettes in England: a qualitative interview study	Stepney, Melissa and Aveyard, Paul and Begh, Rachna	British Journal of General Practice	2019	69	678	e8-e14	Excluded	Outcome type
Electronic cigarettes in physician practice: a complex debate	Stone, Emily and Marshall, Henry	Internal Medicine Journal	2019	49	4	438-445	Excluded	Outcome type
Toxic ketene gas forms on vaping Vitamin E acetate prompting interest in its possible role in the EVALI outbreak	Strongin, R. M.	Proceedings of the National Academy of Sciences of the United States of America	2020	117	14	7553-7554	Excluded	Study design
An introduction to the electronic waterpipe	Stroup, A. M. and Branstetter, S. A.	Addictive Behaviors	2019	91	-	90-94	Excluded	Outcome type
Electronic nicotine delivery systems: Oral health implications and oral cancer risk	Sultan, Ahmed S. and Jessri, Maryam and Farah, Camile S.	Journal of Oral Pathology & Medicine	2021	50	3	316-322	Excluded	-
Implications of electronic cigarette use for depressive mood: A nationwide cross-sectional study	Sumin, Lee and Yunhwan, Oh and Hyeonju, Kim and Mihee, Kong and Jihyun, Moon and Lee, Sumin and Oh, Yunhwan and Kim, Hyeonju and Kong, Mihee and Moon, Jihyun	Medicine	2020	99	40	44348	Excluded	Outcome type
Perceived effectiveness of objective features of pictorial warning messages	Sutton, Jazmyne A. and Yang, Sijia and Cappella, Joseph N.	Tobacco Control: An International Journal	2019	28	e1	e24-e30	Excluded	Outcome type
Nicotine Inhalation and Suicide: Clinical Correlates and Behavioral Mechanisms	Swann, A. C. and Graham, D. P. and Wilkinson, A. V. and Kosten, T. R.	American Journal on Addictions	2021	-	-	-	Excluded	Exposure type
Electronic Cigarettes and Head and Neck Cancer Risk - Current State of Art	Szukalska M, Szyfter K, Florek E, Rodrigo JP, Rinaldo A, Mäkitie AA, Strojan P, Takes RP, Suárez C, Saba NF, Braakhuis BJM, Ferlito A.	Cancers	2020	12	11	3274	Excluded	Duplicate

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Might limiting liquid nicotine concentration result in more toxic electronic cigarette aerosols?	Talih, S., Salman, R., El-Hage, R., Karam, E., Karaoghlanian, N., El-Hellani, A., Saliba, N., Eissenberg, T. and Shihadeh, A	Tobacco control	2021	30	3	348-350	Excluded	Exposure type
A comparison of the electrical characteristics, liquid composition, and toxicant emissions of JUUL USA and JUUL UK e-cigarettes	Talih, S., Salman, R., El-Hage, R., Karam, E., Salam, S., Karaoghlanian, N., El-Hellani, A., Saliba, N. and Shihadeh, A	Scientific reports	2020	10	1	1-4	Excluded	Outcome type
E-Cigarettes and Cardiopulmonary Health	Tarran, R., Barr, R.G., Benowitz, N.L., Bhatnagar, A., Chu, H.W., Dalton, P., Doerschuk, C.M., Drummond, M.B., Gold, D.R., Goniewicz, M.L. and Gross, E.R and Hansel, N. N., Hopke, P. K., Kloner, R. A., Mikheev, V. B., Neczypor, E. W., Pinkerton, K. E., Postow, L., Rahman, I., Samet, J. M., Salathe, M., Stoney, C. M., Tsao, P. S., Widome, R., Xia, T., Xiao, D. and Wold, L. E.	Function	2021	2	2	-	Excluded	Outcome type
E-cigarette, or vaping, product use-associated lung injury in adolescents: a review of imaging features	Thakrar, Pooja D. and Boyd, Kevin P. and Swanson, Craig P. and Wideburg, Eric and Kumbhar, Sachin S.	Pediatric Radiology	2020	50	3	338-344	Excluded	Exposure type
E-cigarettes: time to realign our approach?	Strick, K	The Lancet	2019	394	1297	10-1016	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Nicotine addiction as a moral problem: Barriers to e-cigarette use for smoking cessation in two working-class areas in Northern England	Thirlway, Frances	Social Science & Medicine	2019	238	-	-	Excluded	Outcome type
Risk of neuropsychiatric and cardiovascular adverse events following treatment with varenicline and nicotine replacement therapy in the UK Clinical Practice Research Datalink: a case cross-over study	Thomas, Kyla H. and Davies, Neil M. and Taylor, Amy E. and Taylor, Gemma M. J. and Gunnell, David and Martin, Richard M. and Douglas, Ian	Addiction	2021	116	6	1532-1545	Excluded	Outcome type
Genotoxicity evaluation of tobacco and nicotine delivery products: Part Two. In vitro micronucleus assay	Thorne, D., Leverette, R., Breheny, D., Lloyd, M., McEnaney, S., Whitwell, J., Clements, J., Bombick, B. and Gaça, M.	Food and Chemical Toxicology	2019	132	-	-	Excluded	Duplicate
Varenicline: mode of action, efficacy, safety and accumulated experience salient for clinical populations	Tonstad, S., Arons, C., Rollema, H., Berlin, I., Hajek, P., Fagerström, K., Els, C., McRae, T. and Russ, C.	Current Medical Research and Opinion	2020	36	5	713-730	Excluded	Outcome type
Vaping-associated lung injury	Treese, N. M. and Pitarys, S.	U.S. Pharmacist	2020	45	7	HS2-HS8	Excluded	Study design
Knowledge, Attitudes, and Perceptions of Young Adults About Electronic Nicotine Delivery Systems in the United States: An Integrative Review	Tremblay, B. and Turk, M. T. and Cooper, M. R. and Zoucha, R.	Journal of Cardiovascular Nursing	2020	30	-	-	Excluded	Outcome type
Tweets About Acute Nicotine Toxicity Due to e-Liquid Exposure	Trigger, S. and Johnson, M. A. and Zarndt, A. N. and Hill, D. K.	Tobacco Regulatory Science	2021	7	1	46-58	Excluded	Exposure type
Smoking cessation in asthmatic patients and its impact	Underner, M. and Peiffer, G. and Perriot, J. and Jaafari, N.	Revue des Maladies Respiratoires	2020	38	1	87-107	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Contribution of electronic cigarettes in smoking patients with psychotic disorders. A literature review	Underner, M. and Perriot, J. and Brousse, G. and de Chazeron, I. and Schmitt, A. and Peiffer, G. and Afshari, R. and Ebrahimighavam, S. and Jaafari, N.	Encephale.	2021	-	-	-	Excluded	Exposure type
Stopping and reducing smoking in patients with schizophrenia	Underner, M. and Perriot, J. and Brousse, G. and de Chazeron, I. and Schmitt, A. and Peiffer, G. and Harika-Germaneau, G. and Jaafari, N.	Encephale	2019	45	4	345-356	Excluded	Outcome type
[Why stopping smoking is difficult in patients suffering from schizophrenia? How better to take care of them?]	Underner, M. and Perriot, J. and Peiffer, G. and Harika-Germaneau, G. and Jaafari, N.	Revue Medicale de Liege	2019	74	1	23-27	Excluded	Duplicate; foreign language
[Electronic cigarette use in patients with asthma]	Underner, M. and Perriot, J. and Peiffer, G. and Jaafari, N.	Revue Medicale de Liege	2020	75	9	613-618	Excluded	Foreign language
"I'm using cigarettes to quit JUUL": An analysis of Twitter posts about JUUL cessation	Unger, Jennifer B. and Rogers, Christopher and Barrington-Trimis, Jessica and Majmundar, Anuja and Sussman, Steve and Allem, Jon-Patrick and Soto, Daniel W. and Cruz, Tess Boley	Addictive Behaviors Reports	2020	12	-	-	Excluded	Outcome type
[The e-cigarette: a toxicological box of Pandora]	van den Berg, M.	Nederlands Tijdschrift voor Geneeskunde	2020	164	-	-	Excluded	Duplicate; foreign language
Comparison of monoamine oxidase inhibition by cigarettes and modified risk tobacco products	van der Toorn, M. and Koshibu, K. and Schlage, W. K. and Majeed, S. and Pospisil, P. and Hoeng, J. and Peitsch, M. C.	Toxicology Reports	2019	6	-	1206-1215	Excluded	Outcome type

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Approaches for discontinuation versus continuation of long-term antidepressant use for depressive and anxiety disorders in adults	Van Leeuwen, E. and van Driel, M. L. and Horowitz, M. A. and Kendrick, T. and Donald, M. and De Sutter, A. I. M. and Robertson, L. and Christiaens, T.	Cochrane Database of Systematic Reviews	2021	-	4	-	Excluded	Exposure type
Vaping epidemic in US teens: Problem and solutions	Venkata, A. N. and Palagiri, R. D. R. and Vaithilingam, S.	Current Opinion in Pulmonary Medicine	2021	27	2	88-94	Excluded	Outcome type
E-cigarettes: Out of the frying pan into the fire?	Venkatnarayan, K., Rajamuri, N.K.R., Krishnaswamy, U.M., Devaraj, U., Ramachandran, P. and Veluthat, C.	Lung India	2020	37	4	329-332	Excluded	Study design
Interventions to reduce tobacco use in people experiencing homelessness	Vijayaraghavan, M. and Elser, H. and Frazer, K. and Lindson, N. and Apollonio, D.	Cochrane Database of Systematic Reviews	2020	-	12	-	Excluded	Outcome type
Impact of Brief Nicotine Messaging on Nicotine-Related Beliefs in a U.S. Sample	Villanti, Andrea C. and West, Julia C. and Mays, Darren and Donny, Eric C. and Cappella, Joseph N. and Strasser, Andrew A.	American Journal of Preventive Medicine	2019	57	4	e135-e142	Excluded	Outcome type
Vaping: Safer Than Smoking?	Villar, Paola Galan and Alhasan, Faysal and Lippmann, Steven	Southern Medical Journal	2020	113	3	146-146	Excluded	Study design
Dermatologic manifestations associated with electronic cigarette use	Visconti, M. J. and Ashack, K. A.	Journal of the American Academy of Dermatology	2019	81	4	1001-1007	Excluded	Outcome type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The E-cigarette ban in India- A step in the right direction?	Vishal Rao, Uchilla S. and Arakeri, Gururaj and Ravishankar, Sambhavi and Kar, Ankita and Thakur, Shalini and Li, Ryan J. and Dhananjay, K. V. and Surya, Tejaswi and Chaturvedi, Pankaj and Gomez, Ricardo S. and Brennan, Peter A. and Dhananjay, K. V.	Journal of Oral Pathology & Medicine	2020	49	7	617-620	Excluded	Outcome type
E-vaping and high-fat diet consumption: It's all a hazy memory	Vlahos, Ross	Brain, Behavior, and Immunity	2021	95	-	23-24	Excluded	Outcome type
Randomized within-subject trial to evaluate smokers' initial perceptions, subjective effects and nicotine delivery across six vaporized nicotine products	Voos, Natalie and Kaiser, Lisa and Mahoney, Martin C. and Bradizza, Clara M. and Kozlowski, Lynn T. and Benowitz, Neal L. and O'Connor, Richard J. and Goniewicz, Maciej L.	Addiction	2019	114	7	1236-1248	Excluded	Duplicate
A simple predictive model for estimating relative e-cigarette toxic carbonyl levels	Vreeke, S. and Zhu, X. and Strongin, R. M.	PLoS ONE	2020	15	8	-	Excluded	Exposure type
Injuries associated with electronic nicotine delivery systems: A systematic review	Vyncke, Tom and De Wolf, Edward and Hoeksema, Henk and Verbelen, Jozef and De Coninck, Petra and Buncamper, Marlon and Monstrey, Stan and Claes, Karel E. Y. and Buncamper, M. and Claes, Karel Ey	Journal of Trauma & Acute Care Surgery	2020	89	4	783-791	Excluded	Outcome type
How safe are e-cigarettes?	Wadia, R.	British Dental Journal	2021	230	-	662	Excluded	Study design

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Nicotine patches used in combination with e-cigarettes (with and without nicotine) for smoking cessation: a pragmatic, randomised trial	Walker, N. and Parag, V. and Verbiest, M. and Laking, G. and Laugesen, M. and Bullen, C.	The lancet. Respiratory medicine	2020	8	1	54–64	Excluded	Outcome type
Effectiveness and safety of nicotine patches combined with e-cigarettes (with and without nicotine) for smoking cessation: study protocol for a randomised controlled trial	Walker, N. and Verbiest, M. and Kurdziel, T. and Laking, G. and Laugesen, M. and Parag, V. and Bullen, C.	BMJ open	2019	9	2	-	Excluded	Outcome type
Just a spoonful of sugar helps the messages go down: Using stories and vicarious self-affirmation to reduce e-cigarette use	Walter, Nathan and Demetriades, Stefanie Z. and Murphy, Sheila T.	Health Communication	2019	34	3	352-360	Excluded	Outcome type
Repurposing dextromethorphan and metformin for treating nicotine-induced cancer by directly targeting CHRNA7 to inhibit JAK2/STAT3/SOX2 signaling	Wang, L. and Liang, D. and Xiong, X. and Lin, Y. and Zhu, J. and Yao, Z. and Wang, S. and Guo, Y. and Chen, Y. and Geary, K. and Pan, Y. and Zhou, F. and Gao, S. and Zhang, D. and Yeung, S. C. J. and Zhang, H.	Oncogene	2021	40	11	1974-1987	Excluded	Exposure type
Comparison of biological and transcriptomic effects of conventional cigarette and electronic cigarette smoke exposure at toxicological dose in BEAS-2B cells	Wang, L. and Wang, Y. and Chen, J. and Yang, X. M. and Jiang, X. T. and Liu, P. and Li, M.	Ecotoxicology and Environmental Safety	2021	222	-	-	Excluded	Exposure type
E-cigarette-induced pulmonary inflammation and dysregulated repair are mediated by nAChR α7 receptor: role of nAChR α7 in SARS-CoV-2 Covid-19 ACE2 receptor regulation	Wang, Qixin and Sundar, Isaac K. and Li, Dongmei and Lucas, Joseph H. and Muthumalage, Thivanka and McDonough, Samantha R. and Rahman, Irfan	Respiratory Research	2020	21	1	154	Excluded	Exposure type
E-Cigarette Use and Adult Cigarette Smoking Cessation: A Meta-Analysis	Wang, R. J. and Bhadriraju, S. and Glantz, S. A.	American Journal of Public Health	2021	111	2	230-246	Excluded	Outcome type

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Awareness and use of e-cigarettes among university students in Shanghai, China	Wang, W. and Lu, M. and Cai, Y. and Feng, N.	Tobacco Induced Diseases	2020	18	-	-	Excluded	Outcome type
A Qualitative Exploration of Consumers' Perceived Impacts, Behavioural Reactions, and Future Reflections of the EU Tobacco Products Directive (2017) as Applied to Electronic Cigarettes	Ward, Emma and Anholt, Claudia and Gentry, Sarah and Dawkins, Lynne and Holl and , Richard and Notley, Caitlin	Tobacco Use Insights	2020	13	-	44440	Excluded	Outcome type
What are the reasons that smokers reject ENDS? A national probability survey of U.S. Adult smokers, 2017-2018	Weaver, Scott R. and Heath, J. Wesley and Ashley, David L. and Huang, Jidong and Pechacek, Terry F. and Eriksen, Michael P.	Drug & Alcohol Dependence	2020	211	-	N.PAG-N. PAG	Excluded	Outcome type
Sources of Aerosol Dispersion During Singing and Potential Safety Procedures for Singers	Westphalen, C. and Kniesburges, S. and Veltrup, R. and Gantner, S. and Peters, G. and Benthaus, T. and Jakubass, B. and Koberlein, M. and Dollinger, M. and Echternach, M.	Journal of Voice.	2021	-	-	-	Excluded	Outcome type; exposure type
E-Cigarette Exposure Delays Implantation and Causes Reduced Weight Gain in Female Offspring Exposed In Utero	Wetendorf, Margeaux and R and all, Lewis T. and Lemma, Mahlet T. and Hurr, Sophia H. and Pawlak, John B. and Tarran, Robert and Doerschuk, Claire M. and Caron, Kathleen M.	Journal of the Endocrine Society	2019	3	10	1907-1916	Excluded	Outcome type
[Studies on toxicity and inflammatory reactions induced by e-cigarettes: In vitro exposure of human nasal mucosa cells to propylene glycol at the air-liquid interface]	Wiest, F. and Scherzad, A. and Ickrath, P. and Poier, N. and Hackenberg, S. and Kleinsasser, N.	HNO	2021	-	-	-	Excluded	Duplicate

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
E-cigarette use and respiratory disorders: An integrative review of converging evidence from epidemiological and laboratory studies	Wills, T. A. and Soneji, S. S. and Choi, K. and Jaspers, I. and Tam, E. K.	European Respiratory Journal	2021	57	1	-	Excluded	Outcome type
E-cigarettes are safer than smoking but not without risks, concludes toxicity review	Wise, J.	BMJ (Clinical research ed.)	2020	-	-	-	Excluded	Study design
The association between perceived e-cigarette and nicotine addictiveness, information-seeking, and e-cigarette trial among U.S. adults	Wiseman, K. P. and Margolis, K. A. and Bernat, J. K. and Grana, R. A.	Preventive Medicine	2019	118	-	66-72	Excluded	Outcome type
Acute and subacute inhalation toxicity assessment of WS-23 in Sprague-Dawley rats	Wu, Z. H. and Liu, Y. S. and Li, X. D. and Xu, T. and Xu, J. and Yang, X. M. and Ma, R. Q. and Jiang, X. T.	Journal of Applied Toxicology.	2021	-	-	-	Excluded	Study design
E-cigarette users are associated with asthma disease: A meta-analysis	Xian, S. and Chen, Y.	Clinical Respiratory Journal	2021	15	5	457-466	Excluded	Outcome type
Association of Electronic Cigarette Use With Incident Respiratory Conditions Among US Adults From 2013 to 2018	Xie, Wubin and Kathuria, Hasmeena and Galiatsatos, Panagis and Blaha, Michael J. and Hamburg, Naomi M. and Robertson, Rose Marie and Bhatnagar, Aruni and Benjamin, Emelia J. and Stokes, Andrew C.	JAMA Network Open	2020	e3	11	e2020816-e2020816	Excluded	Outcome type

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Gender differences in reasons for using electronic cigarettes and product characteristics: Findings from the 2018 ITC Four Country Smoking and Vaping Survey	Yimsaard, P. and McNeill, A. and Yong, H. H. and Cummings, K. M. and Chung-Hall, J. and Hawkins, S. S. and Quah, A. C. K. and Fong, G. T. and O'Connor, R. J. and Hitchman, S. C.	Nicotine and Tobacco Research	2021	23	4	678-686	Excluded	Outcome type
Association of Internet Addiction with Adolescents' Lifestyle: A National School-Based Survey	Ying Ying, C. and Awaluddin, S. M. and Kuang Kuay, L. and Siew Man, C. and Baharudin, A. and Miaw Yn, L. and Sahril, N. and Omar, M. A. and Ahmad, N. A. and Ibrahim, N.	International Journal of Environmental Research & Public Health	2021	18	1	168	Excluded	Duplicate
Measurement of Electronic Cigarette Frequency of Use Among Smokers Participating in a Randomized Controlled Trial	Yingst, Jessica and Foulds, Jonathan and Veldheer, Susan and Cobb, Caroline O. and Yen, Miao-Shan and Hrabovsky, Shari and Allen, Sophia I. and Bullen, Christopher and Eissenberg, Thomas	Nicotine & Tobacco Research	2020	22	5	699-704	Excluded	Outcome type
Nicotine absorption during electronic cigarette use among regular users	Yingst, J. M. and Foulds, J. and Veldheer, S. and Hrabovsky, S. and Trushin, N. and Eissenberg, T. T. and Williams, J. and Richie, J. P. and Nichols, T. T. and Wilson, S. J. and Hobkirk, A. L.	PLoS ONE	2019	14	7	-	Excluded	Exposure type

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Reasons for regular vaping and for its discontinuation among smokers and recent ex-smokers: findings from the 2016 ITC Four Country Smoking and Vaping Survey	Yong, H.H., Borland, R., Cummings, K.M., Gravely, S., Thrasher, J.F., McNeill, A., Hitchman, S., Greenhalgh, E., Thompson, M.E. and Fong, G.T.	Addiction	2019	114	-	35-48	Excluded	Outcome type
위해감축의 관점에서 본 전자담배	Yoo Seock, Cheong	Journal of the Korean Medical Association / Taehan Uisa Hyophoe Chi	2020	63	2	105-111	Excluded	Foreign language
Gross and Histopathological Findings in the First Reported Vaping-Induced Lung Injury Death in the United States	Youmans, A. J. and Harwood, J.	The American journal of forensic medicine and pathology	2020	41	1	44287	Excluded	Study design
Real-Time Digital Surveillance of Vaping-Induced Pulmonary Disease	Yulin, Hswen and Brownstein, John S. and Hswen, Yulin	New England Journal of Medicine	2019	381	-	1778-1780	Excluded	Outcome type
[Analysis of electronic cigarettes safety]	Zeng, D. C. and Lu, L. M. and Zhao, X. S. and Yang, S. Y. and Jiang, Y. and Tong, Z. and Feng, Y.	Chung-Hua Chieh Ho Ho Hu Hsi Tsa Chih Chinese Journal of Tuberculosis & Respiratory Diseases	2019	42	5	393-397	Excluded	Foreign language
Electronic cigarettes: Emerging trends and research hotspots	Zhang, Q. and Fan, X. and Yue, Y. and Zheng, R.	Tobacco Induced Diseases	2020	18	-	-	Excluded	Outcome type
More to Explore: Further Definition of Risk Factors for COPD - Differential Gender Difference, Modest Elevation in PM2.5, and e-Cigarette Use	Zhang, Y. and Wang, L. and Mutlu, G. M. and Cai, H.	Frontiers in Physiology	2021	-	-	-	Excluded	Duplicate

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The effect of e-cigarettes on smoking cessation and cigarette smoking initiation: An evidence-based rapid review and meta-analysis	Zhang, Y. Y. and Bu, F. L. and Dong, F. and Wang, J. H. and Zhu, S. J. and Zhang, X. W. and Robinson, N. and Liu, J. P.	Tobacco Induced Diseases	2021	19	-	-	Excluded	Wrong outcome
Reasons why Chinese smokers prefer not to use electronic cigarettes	Zongshuan, Duan and Yu, Wang and Jidong, Huang and Redmon, Pamela B. and Eriksen, Michael P.	Tobacco Induced Diseases	2020	18	-	44531	Excluded	Wrong outcome
Electronic cigarettes: A task force report from the European Respiratory Society	Bals, R. and Boyd, J. and Esposito, S. and Foronjy, R. and Hiemstra, P. S. and Jimenez-Ruiz, C. A. and Katsaounou, P. and Lindberg, A. and Metz, C. and Schober, W. and Spira, A. and Blasi, F.	European Respiratory Journal	2019	53	2	-	Excluded	Study design
Selected Harmful and Potentially Harmful Constituents Levels in Commercial e-Cigarettes	Belushkin, M. and Djoko, D. T. and Esposito, M. and Korneliou, A. and Jeannet, C. and Lazzerini, M. and Jaccard, G.	Chemical Research in Toxicology	2020	33	9	657-668	Excluded	Wrong outcome
2019 Year in Review: Aerosol Therapy	Berlinski, A.	Respiratory Care	2020	65	5	705-712	Excluded	Study design
An update on controversies in e-cigarettes	Bhatt, J.M., Ramphul, M. and Bush, A	Paediatric Respiratory Reviews	2020	36	-	75-86	Excluded	Study design
Electronic nicotine delivery systems and pregnancy: Recent research on perceptions, cessation, and toxicant delivery	Brel and , A. and McCubbin, A. and Ashford, K.	Birth Defects Research	2019	111	17	1284-1293	Excluded	Study design

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
The electronic cigarette epidemic in youth and young adults: A practical review	Burt, B. and Li, J.	Journal of the American Academy of Physician Assistants	2020	33	3	17-23	Excluded	Study design
Toxicity of electronic cigarettes: A general review of the origins, health hazards, and toxicity mechanisms	Cao, Y. and Wu, D. and Ma, Y. and Ma, X. and Wang, S. and Li, F. and Li, M. and Zhang, T.	Science of the Total Environment	2021	772	-	-	Excluded	Study design
Pulmonary Toxicity and the Pathophysiology of Electronic Cigarette, or Vaping Product, Use Associated Lung Injury	Ch and , H. S. and Muthumalage, T. and Maziak, W. and Rahman, I.	Frontiers in Pharmacology	2019	10	1619	-	Excluded	Study design
Identification of flavouring chemicals and potential toxicants in e-cigarette products in Ontario, Canada	Czoli, C.D., Goniewicz, M.L., Palumbo, M., Leigh, N., White, C.M. and Hammond, D	Canadian Journal of Public Health	2019	110	5	542-550	Excluded	Wrong outcome
Policy, toxicology and physicochemical considerations on the inhalation of high concentrations of food flavour	Dinu, V., Kilic, A., Wang, Q., Ayed, C., Fadel, A., Harding, S.E., Yakubov, G.E. and Fisk, I.D.	Npj Science of Food	2020	4	15	-	Excluded	Study design
Impact of Electronic Cigarettes on Various Organ Systems	Eltorai, A.E., Choi, A.R. and Eltorai, A.S.	Respiratory Care	2019	64	3	328-336	Excluded	Study design
Toxicity classification of e-cigarette flavouring compounds based on European Union regulation: Analysis of findings from a recent study	Farsalinos, K. and Lagoumintzis, G.	Harm Reduction Journal	2019	16	-	-	Excluded	Wrong outcome
Culprit or correlate? An application of the Bradford Hill criteria to Vitamin E acetate	Feldman, R., Meiman, J., Stanton, M. and Gummin, D. D.	Archives of Toxicology	2020	94	6	2249-2254	Excluded	Study design

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Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Cancer and non-cancer risk concerns from metals in electronic cigarette liquids and aerosols	Fowles, J., Barreau, T. and Wu, N.	International Journal of Environmental Research and Public Health	2020	17	6	-	Excluded	Study design
What are the respiratory effects of e-cigarettes?	Gotts, J. E. and Jordt, S. E. and McConnell, R. and Tarran, R.	BMJ	2019	366	-	-	Excluded	Study design
Developmental toxicity of e-cigarette aerosols	Greene, R. M. and Pisano, M. M.	Birth Defects Research	2019	111	17	1294-1301	Excluded	Study design
Health Hazards and Complications Associated with Electronic Cigarettes: A Review	Gülşen A, Uslu B.	Turk Toraks Dergisi / Turkish Thoracic Journal	2020	21	3	201-208	Excluded	Study design
Vaping: Anesthesia Considerations for Patients Using Electronic Cigarettes	Hobson, A	AANA Journal	2020	88	1	27-34	Excluded	Study design
Low-temperature (<200 °C) degradation of electronic nicotine delivery system liquids generates toxic aldehydes	Jaegers, N.R., Hu, W., Weber, T.J. and Hu, J.Z.	Scientific reports	2021	11	1	7800	Excluded	Wrong outcome
What is new in electronic-cigarettes research?	Jenssen, B.P. and Wilson, K.M.	Current Opinion in Pediatrics	2019	31	2	262-266	Excluded	Study design
Current Perspectives on Characteristics, Compositions, and Toxicological Effects of E-Cigarettes Containing Tobacco and Menthol/Mint Flavors	Kaur, G., Gaurav, A., Lamb, T., Perkins, M., Muthumalage, T. and Rahman, I	Frontiers in Physiology	2020	11	-	-	Excluded	Study design
The Cardiovascular Effects of Electronic Cigarettes	Khadka, S., Awasthi, M., Lamichhane, R.R., Ojha, C., Mamudu, H.M., Lavie, C.J., Daggubati, R. and Paul, T.K	Current Cardiology Reports	2021	23	5	44378	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
A Brief Overview of the National Outbreak of e-Cigarette, or Vaping, Product Use-Associated Lung Injury and the Primary Causes	Kiernan, E., Click, E.S., Melstrom, P., Evans, M.E., Layer, M.R., Weissman, D.N., Reagan-Steiner, S., Wiltz, J.L., Hocevar, S., Goodman, A.B. and Twentyman, E.	CHEST	2021	159	1	426-431	Excluded	Study design
Biological Toxicity of the Compositions in Electronic-Cigarette on Cardiovascular System	Lai, L. and Qiu, H.	Journal of Cardiovascular Translational Research	2021	14	2	371-376	Excluded	Study design
Electronic nicotine delivery systems (ENDS): not still ready to put on END	Lavacchi, D., Roviello, G. and Rodriquenz, M.G.	Journal of Thoracic Disease	2020	12	7	3857	Excluded	Study design
Are electronic cigarettes a healthier alternative to conventional tobacco smoking?	Lohler, J. and Wollenberg, B.	European Archives of Oto-Rhino-Laryngology	2019	276	1	17-25	Excluded	Study design
Dynamic Imaging and Characterization of Volatile Aerosols in E-Cigarette Emissions Using Deep Learning-Based Holographic Microscopy	Luo, Y., Wu, Y., Li, L., Guo, Y., Çetintaş, E., Zhu, Y. and Ozcan, A.	ACS sensors	2021	-	-	-	Excluded	Wrong outcome
An updated overview of e-cigarette impact on human health	Marques, P., Piqueras, L., and Sanz, M.J.	Respiratory Research	2021	22	1	41640	Excluded	Study design
Promotion of a Protease-Antiprotease Imbalance in the Airways through Chronic Vaping	Martin, S.L. and Reihill, J.A.	American Journal of Respiratory & Critical Care Medicine	2019	-	-	1337-1339	Excluded	Study design
Electronic cigarettes: Modern instruments for toxic lung delivery and posing risk for the development of chronic disease	McAlinden, K.D., Lu, W., Eapen, M.S. and Sohal, S.S.	International Journal of Biochemistry and Cell Biology	2021	137	-	-	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
There can be smoke without fire: Warranted caution in promoting electronic cigarettes and heat not burn devices as a safer alternative to cigarette smoking	McAlinden, K.D., Sohal, S.S. and Sharma, P.	ERJ Open Research	2019	5	3	-	Excluded	Study design
Recent updates on biomarkers of exposure and systemic toxicity in e-cigarette users and EVALI	McDonough, S.R., Rahman, I., and Sundar, I. K.	American Journal of Physiology - Lung Cellular and Molecular Physiology	2021	320	5	L661-L679	Excluded	Study design
PBPK modeling characterization of potential acute impairment effects from inhalation of ethanol during e-cigarette use	More, S.L., Thornton, S.A., Maskrey, J.R., Sharma, A., de Gandiaga, E., Cheng, T.J., Fung, E.S., Bernal, A.J. and Madl, A.K.	Inhalation Toxicology	2020	32	1	14-23	Excluded	Study design
Effects of tobacco cigarettes, e-cigarettes, and waterpipe smoking on endothelial function and clinical outcomes	Münzel, T., Hahad, O., Kuntic, M., Keaney Jr, J.F., Deanfield, J.E. and Daiber, A	European Heart Journal	2020	41	41	4057-4070	Excluded	Study design
Does 'Dry Hit' vaping of vitamin E acetate contribute to EVALI? Simulating toxic ketene formation during e-cigarette use	Narimani, M. and da Silva, G.	PLoS ONE	2020	15	9	-	Excluded	Study design
E-cigarettes induce toxicity comparable to tobacco cigarettes in airway epithelium from patients with COPD	Omaiye, E.E., Luo, W., McWhirter, K.J., Pankow, J.F. and Talbot, P	Chemical Research in Toxicology	2021	33	12	2972-2987	Excluded	Wrong outcome
A review of toxic effects of electronic cigarettes/vaping in adolescents and young adults	Overbeek, D.L., Kass, A.P., Chiel, L.E., Boyer, E.W. and Casey, A.M.	Critical Reviews in Toxicology	2020	50	6	531-538	Excluded	Study design
Main and side stream effects of electronic cigarettes	Papaefstathiou, E., Stylianou, M., and Agapiou, A.	Journal of Environmental Management	2019	238	-	43009	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Toxic Metal-Containing Particles in Aerosols from Pod-Type Electronic Cigarettes	Pappas, R.S., Gray, N., Halstead, M., Valentin-Blasini, L. and Watson, C.	Journal of analytical toxicology	2021	45	4	337-347	Excluded	Wrong outcome
Vaping Cardiovascular Health Risks: an Updated Umbrella Review	Peruzzi, M., Biondi-Zoccai, G., Carnevale, R., Cavarretta, E., Frati, G. and Versaci, F.	Current Emergency and Hospital Medicine Reports	2020	8	3	103-109	Excluded	Study design
Neurotoxicity of e-cigarettes	Ruszkiewicz, J. A., Zhang, Z., Goncalves, F. M., Tizabi, Y., Zelikoff, J. T. and Aschner, M.	Food and Chemical Toxicology	2020	138	-	-	Excluded	Study design
Impact of Nicotine Replacement and Electronic Nicotine Delivery Systems on Fetal Brain Development	Sailer, S., Sebastiani, G., Andreu-Férnández, V. and García-Algar, O	International journal of environmental research and public health	2019	16	24	5113	Excluded	Study design
Flavor-Toxicant Correlation in E-cigarettes: A Meta-Analysis	Salam, S., Saliba, N.A., Shihadeh, A., Eissenberg, T. and El-Hellani, A.	Chemical Research in Toxicology	2020	33	12	2932-2938	Excluded	Wrong outcome
Investigating E-Cigarette Particle Emissions and Human Airway Depositions under Various E-Cigarette-Use Conditions	Son, Y., Mainelis, G., Delnevo, C., Wackowski, O.A., Schwander, S. and Meng, Q.	Chemical Research in Toxicology	2020	33	2	343-352	Excluded	Wrong outcome
The use of Genomic Allergen Rapid Detection (GARD) assays to predict the respiratory and skin sensitising potential of e-liquids	Stevenson, M., Czekala, L., Simms, L., Tschierske, N., Larne, O. and Walele, T.	Regulatory Toxicology and Pharmacology	2019	103	-	158-165	Excluded	Study design
Review of data on chemical content in an aerosol resulting from heating a tobacco or a solution used in e-cigarettes and in the smoke generated from the reference cigarettes	Szparaga, M., Swiercz, R. and Stepnik, M.	Toxicology Mechanisms and Methods	2021	31	5	323-333	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
Characteristics and toxicant emissions of JUUL electronic cigarettes	Talih, S., Salman, R., El-Hage, R., Karam, E., Karaoghlanian, N., El-Hellani, A., Saliba, N. and Shihadeh, A.	Tobacco control	2019	28	6	678-680	Excluded	Wrong outcome
Electrical features, liquid composition and toxicant emissions from 'pod-mod'-like disposable electronic cigarettes	Talih, S., Salman, R., Soule, E., El-Hage, R., Karam, E., Karaoghlanian, N., El-Hellani, A., Saliba, N. and Shihadeh, A.	Tobacco control.	2021	12	-	-	Excluded	Wrong outcome
Electronic cigarettes: where to from here?	Theron, A.J., Feldman, C., Richards, G.A., Tintinger, G.R. and Anderson, R.	Journal of Thoracic Disease	2019	11	12	5572	Excluded	Study design
Vaping and Cardiovascular Health: the Case for Health Policy Action	Verhaegen, A. and Van Gaal, L.	Current Cardiovascular Risk Reports	2019	13	12	44501	Excluded	Study design
A Public Health Crisis: Electronic Cigarettes, Vape, and JUUL	Walley, Susan C., Wilson, K.M., Winickoff, J.P. and Groner, J.	Pediatrics	2019	143	6	-	Excluded	Study design
Toxicity assessment of electronic cigarettes	Wang, G., Liu, W. and Song, W.	Inhalation Toxicology	2019	31	7	259-273	Excluded	Study design
Electronic nicotine delivery system design and aerosol toxicants: A systematic review	Ward, A.M., Yaman, R. and Ebbert, J. O.	PLoS ONE	2020	15	6	-	Excluded	Wrong outcome
Risk assessment of inhaled diacetyl from electronic cigarette use among teens and adults	White, A.V., Wambui, D.W. and Pokhrel, L. R.	Science of the Total Environment	2021	772	-	-	Excluded	Study design
Toxicological assessment of electronic cigarette vaping: an emerging threat to force health, readiness and resilience in the U.S. Army	Williams, M.A., Reddy, G., Quinn, M.J. and Millikan Bell, A.	Drug and Chemical Toxicology	2021	-	-	13516	Excluded	Study design

Table 4 continued

Title	Author(s)	Journal	Year Published	Volume	Issue	Pages	Include (Yes or No)	Exclusion reason(s)
EVALI and the Pulmonary Toxicity of Electronic Cigarettes: A Review	Winnicka, L. and Shenoy, M.A.	JGIM: Journal of General Internal Medicine	2020	35	7	2130-2135	Excluded	Study design
A narrative review evaluating the safety and efficacy of e-cigarettes as a newly marketed smoking cessation tool	Worku, D. and Worku, E.	SAGE Open Medicine	2019	7	-	-	Excluded	Study design
Potential for release of pulmonary toxic ketene from vaping pyrolysis of Vitamin E acetate	Wu, D. and O'Shea, D. F.	Proceedings of the National Academy of Sciences of the United States of America	2020	117	12	6349-6355	Excluded	Study design
Are in Silico Approaches Applicable As a First Step for the Prediction of e-Liquid Toxicity in e-Cigarettes?	Zarini, D., Sangion, A., Ferri, E., Caruso, E., Zucchi, S., Orro, A. and Papa, E	Chemical Research in Toxicology	2020	33	9	2381-2389	Excluded	Study design
Influence of battery power setting on carbonyl emissions from electronic cigarettes	Zelinkova, Z. and Wenzl, T.	Tobacco Induced Diseases	2020	18	-	-	Excluded	Wrong outcome
Influence of puffing conditions on the carbonyl composition of e-cigarette aerosols	Beauval N, Verrièle M, Garat A, Fronval I, Dusautoir R, Anthérieu S, Garçon G, Lo-Guidice JM, Allorge D, Locoge N.	International Journal of Hygiene & Environmental Health	2019	222	1	136-146	Excluded	Wrong outcome
Toxicological comparison of cigarette smoke and e-cigarette aerosol using a 3D in vitro human respiratory model	Czekala, L., Simms, L., Stevenson, M., Tschierske, N., Maione, A.G. and Walele, T	Regulatory Toxicology and Pharmacology	2019	103	-	314-324	Excluded	Study design

Appendix E: Table of characteristics for included studies

Table 5: Summary of included studies

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Tobacco-use behavior and toxicant exposure among current dual users of electronic cigarettes and tobacco cigarettes	Cobb, Caroline O. and Lester, Rebecca C. and Rudy, Alyssa K. and Hoetger, Cosima and Scott, Megan and Austin, Makeda and Montpetit, Alison and Lipato, Thokozeni and Graham, Am and a L. and Barnes, Andrew J. and Eissenberg, Thomas	Experimental and Clinical Psychopharmacology	2021	-	-	-	Clinical study	General toxicity	**Population:** e-cigarette and cigarette users **Exposure:** e-cigarettes; cigarettes **Comparator:** e-cigarette exposure vs cigarette exposure vs dual exposure vs no exposure **Modifying factors:** n/a
Biomarkers of Toxicant Exposure and Inflammation Among Women of Reproductive Age Who Use Electronic or Conventional Cigarettes	Perez, M.F., Mead, E.L., Atuegwu, N.C., Mortensen, E.M., Goniewicz, M. and Oncken, C	Journal of Women's Health	2021	30	4	539-550	Cross-sectional study	Changes to levels of tobacco-related biomarkers when switching to e-cigarettes	**Population:** women of reproductive age that use e-cigarettes or traditional cigarettes **Exposure:** e-cigarettes; cigarettes **Comparator:** e-cigarette exposure vs traditional cigarette exposure vs no exposure **Modifying factors:** n/a
E-cigarette liquid provokes significant embryotoxicity and inhibits angiogenesis	Ashour, A. A. and Alhussain, H. and Rashid, U. B. and Abughazzah, L. and Gupta, I. and Malki, A. and Vranic, S. and Al Moustafa, A. E.	Toxics	2020	8	2	38	Experimental (animal study)	Embryotoxicity; Angiogenesis	**Population:** chicken embryo **Exposure:** e-cigarette liquid ("Virginia tobacco") **Comparator:** exposure vs no exposure **Modifying factors:** day of exposure during embryogensis

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Systemic toxicity evaluation of novel tobacco products in Caenorhabditis elegans	Cai, H. and Xu, Y. and Tang, S. and Yang, X. and Zou, Y. and Wang, X. and Mo, L. and Wu, B. and Liang, Z. and Li, Y. and Wei, X. and Ao, Q. and Meng, L. and Zhang, N. and Chen, M. and Lan, C. and Li, X. and Lu, C.	Toxicology in Vitro	2020	62	-	-	Experimental (animal study)	General toxicity	**Population:** Caenorhabditis elegans **Exposure:** e-liquids; e-aerosol **Comparator:** exposure vs no exposure; e-liquid vs e-aerosol vs mint flovour snus vs black tea flavour snus **Modifying factors:** concentration
Neuroinflammatory and Behavioral Outcomes Measured in Adult Offspring of Mice Exposed Prenatally to E-Cigarette Aerosols	Church, Jamie S. and Chace-Donahue, Fiona and Blum, Jason L. and Ratner, Jill R. and Zelikoff, Judith T. and Schwartzer, Jared J.	Environmental Health Perspectives	2020	128	4	-	Experimental (animal study)	Developmental toxicity	**Population:** pregnant mice **Exposure:** filtered air, propylene glycol and vegetable glycerol (50:50 PG/VG vehicle), or to PG/VG with 16mg/mL nicotine. **Comparator:** exposure vs no exposure **Modifying factors:** n/a
The Customizable E-cigarette Resistance Influences Toxicological Outcomes: Lung degeneration, inflammation, and oxidative stress-induced in a rat model	Cirillo, S. and Vivarelli, F. and Turrini, E. and Fimognari, C. and Burattini, S. and Falcieri, E. and Rocchi, M. B. L. and Cardenia, V. and Rodriguez-Estrada, M. T. and Paolini, M. and Canistro, D.	Toxicological Sciences	2019	172	1	132-145	Experimental (animal study)	General toxicity	**Population:** Sprague Dawley rats **Exposure:** e-aerosol **Comparator:** exposure vs no exposure **Modifying factors:** e-cigarette resistance

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Evaluation of toxicity of aerosols from flavored e-liquids in Sprague-Dawley rats in a 90-day OECD inhalation study, complemented by transcriptomics analysis	Ho, J., Sciuscio, D., Kogel, U., Titz, B., Leroy, P., Vuillaume, G., Talikka, M., Martin, E., Pospisil, P., Lebrun, S., Xia, W., Lee, T., Chng, Y. X., Phillips, B. W., Veljkovic, E., Guedj, E., Xiang, Y., Ivanov, N.V., Peitsch, M.C., Hoeng, J., and Vanscheeuwijck, P.	Archives of Toxicology	2020	94	6	2179–2206	Experimental (animal study)	General toxicity	**Population:** Sprague–Dawley rats **Exposure:** aeorosol from flavoured e-liquids **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Impact of maternal e-cigarette vapor exposure on renal health in the offspring	Li, G., Chan, Y.L., Nguyen, L.T., Mak, C., Zaky, A., Anwer, A.G., Shi, Y., Nguyen, T., Pollock, C.A., Oliver, B.G. and Saad, S.	Annals of the New York Academy of Sciences	2019	-	-	-	Experimental (animal study)	Developmental toxicity	**Population:** female Balb/c mice **Exposure:** e-cigarette vapour; tobacco cigarette smoke **Comparator:** e-cigarette vapour exposure vs tobacco cigarette smoke exposure vs no exposure **Modifying factors:** n/a
Replacing smoking with vaping during pregnancy: Impacts on metabolic health in mice	Li, G., Chan, Y.L., Wang, B., Saad, S., Oliver, B.G. and Chen, H.	Reproductive Toxicology	2020	96	-	293-299	Experimental (animal study)	Developmental toxicity	**Population:** female Balb/c mice **Exposure:** e-cigarette vapour; tobacco cigarette smoke **Comparator:** e-cigarette vapour exposure vs tobacco cigarette smoke exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Electronic cigarettes disrupt lung lipid homeostasis and innate immunity independent of nicotine	Matthew C. Madison, Cameron T. Landers, Bon-Hee Gu, Cheng-Yen Chang, Hui-Ying Tung, Ran You, Monica J. Hong, Nima Baghaei, Li-Zhen Song, Paul Porter, Nagireddy Putluri, Ramiro Salas, Brian E. Gilbert, Ilya Levental, Matthew J. Campen, David B. Corry, and Farrah Kheradmand	Journal of Clinical Investigation	2019	129	10	4290-4304	Experimental (animal study)	Cytotoxicity	**Population:** alveolar macrophages and epithelial cells; mice **Exposure:** ENDS **Comparator:** exposure vs no exposure **Modifying factors:** presence of nicotine
Neurological Effects in the Offspring after Switching from Tobacco Cigarettes to E-Cigarettes during Pregnancy in a Mouse Model	Nguyen, T., Li, G.E., Chen, H., Cranfield, C.G., McGrath, K.C. and Gorrie, C.A.	Toxicological Sciences	2019	172	1	191-200	Experimental (animal study)	Developmental toxicity	**Population:** female Balb/c mice **Exposure:** e-cigarette vapour; tobacco cigarette smoke **Comparator:** e-cigarette vapour exposure vs tobacco cigarette smoke exposure vs no exposure **Modifying factors:** n/a
The oxidative stress induced by the vapours of electronic-hookah on mice liver tissues	Nima, R. S. and Aziz, D. Z.	Systematic Reviews in Pharmacy	2020	11	9	420-423	Experimental (animal study)	Cytotoxicity	**Population:** mice **Exposure:** e-hookah **Comparator:** exposure vs no exposure **Modifying factors:**

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Short-term E-cigarette toxicity effects on brain cognitive memory functions and inflammatory responses in mice	Prasedya, E.S., Ambana, Y., Martyasari, N.W.R. and Aprizal, Y.M.	Toxicological Research	2020	36	3	267-273	Experimental (animal study)	Neurotoxicity	**Population:** BALB/c mice **Exposure:** e-cigarette vapour; cigarette smoke **Comparator:** e-cigarette vapour exposure vs cigarette smoke exposure vs no exposure **Modifying factors:** n/a
Less burn, more fat: electronic cigarettes and pulmonary lipid homeostasis	Singanayagam, Aran and Snelgrove, Robert J.	Journal of Clinical Investigation	2019	129	10	4077-4079	Experimental (animal study)	Pulmonary toxicity	**Population:** mice **Exposure:** chronic ENDS exposure **Comparator:** exposure vs no exposure **Modifying factors:** n/a
A 6-month systems toxicology inhalation study in Apoe−/− mice demonstrates reduced cardiovascular effects of E-vapor aerosols compared with cigarette smoke	Szostak, J., Wong, E.T., Titz, B., Lee, T., Wong, S.K., Low, T., Lee, K.M., Zhang, J., Kumar, A., Schlage, W.K., Guedj, E., Phillips, B., Leroy, P., Buettner, A., Xiang, Y., Martin, F., Sewer, A., Kuczaj, A., Ivanov, N.V., Luettich, K., Vanscheeuwijck, P., Peitsch, M. C. and Hoeng, J.	American journal of physiology	2021	318	3	H604-H631	Experimental (animal study)	Cardiotoxicity	**Population:** never-smokers (adults) **Exposure:** e-cigs containing only 50% propylene glycol (PG) and 50% vegetable glycerine **Comparator:** exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
A 6-month inhalation toxicology study in Apoe−/− mice demonstrates substantially lower effects of e-vapor aerosol compared with cigarette smoke in the respiratory tract	Wong, E.T., Szostak, J., Titz, B., Lee, T., Wong, S.K., Lavrynenko, O., Merg, C., Corciulo, M., Simicevic, J., Auberson, M., Peric, Dulize, R.,d Bornand, D., Loh, G.J., Lee, K.M., Zhang, J., Miller, J.H., Schlage, W.K., Guedj, E., Schneider, T., Phillips, B., Leroy, P., Choukrallah, M.A., Sierro, N., Buettner, A., Xiang, Y., Kuczaj, A., Ivanov, N.V., Luettich, K., Vanscheeuwijck, P., Peitsch, M.C., and Hoeng, J.	Archives of Toxicology	2021	95	5	1805-1829	Experimental (animal study)	Cardiorespiratory toxicity	**Population:** Apoe−/− mice **Exposure:** cigarette smoke; e-vapour aerosols containing nicotine and flavour **Comparator:** cogarette smoke exposure vs e-vapour exposure vs no exposure **Modifying factors:** n/a
In vitro and in vivo cardiac toxicity of flavored electronic nicotine delivery systems	Abouassali, O. and Chang, M. and Chidipi, B. and Martinez, J. L. and Reiser, M. and Kanithi, M. and Soni, R. and McDonald, T. V. and Herweg, B. and Saiz, J. and Calcul, L. and Noujaim, S. F.	American Journal of Physiology - Heart and Circulatory Physiology	2021	320	1	H133-H143	Experimental (animal study) Experimental (cell study)	Cardiotoxicity	**Population:** mice; human induced pluripotent stem cell-derived cardiomyocytes **Exposure:** vanillin and cinnamaldehyde flavoured ENDS **Comparator:** exposure vs no expsoure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
In vivo assessment of the toxicity of electronic cigarettes to zebrafish (Danio rerio) embryos, following gestational exposure, in terms of mortality, developmental toxicity, and hair cell damage: Toxicity of E-cigs to zebrafish embryos	Chang, Y. S. and Park, S. M. and Rah, Y. C. and Han, E. J. and Koun, S. I. and Chang, J. and Choi, J.	Human & Experimental Toxicology	2021	40	1	148-157	Experimental (animal study); experimental (cell study)	Developmental toxicity	**Population:** zebrafish embryos **Exposure:** e-liquids **Comparator:** exposure vs no exposure **Modifying factors:** concentration
Short-term e-cigarette vapour exposure causes vascular oxidative stress and dysfunction: Evidence for a close connection to brain damage and a key role of the phagocytic NADPH oxidase (NOX-2)	Kuntic, M., Oelze, M., Steven, S., Kröller-Schön, S., Stamm,P.,Kalinovic,S., Frenis, K., Vujacic-Mirski, K., Bayo Jimenez, M.T., Kvandova, M. and Filippou, K., Al Zuabi, A., Bruckl, V., Hahad, O., Daub, S., Varveri, F., Gori, T., Huesmann, R., Hoffmann, T., Schmidt, F.P., Keaney, J.F., Daiber, A., and Munzel, T.	European Heart Journal	2020	41	26	2472-2483	Experimental (animal study); experimental (cell study)	Pulmonary function	**Population:** chronic smokers; mice **Exposure:** e-cigarette vapour **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Dose-dependent pulmonary toxicity of aerosolized Vitamin E acetate	Matsumoto, S., Fang, X., Traber, M.G., Jones, K.D., Langelier, C., Hayakawa Serpa, P., Calfee, C.S., Matthay, M.A. and Gotts, J.E	American Journal of Respiratory Cell and Molecular Biology	2020	63	6	748-757	Experimental (animals study); experimental (cell study)	Pulmonary toxicity	**Population:** adult mice; primary human alveolar epithelial type II (AT II) cells **Exposure:** vitamin E acetate aerosol **Comparator:** exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Formation of flavorant-propylene Glycol Adducts With Novel Toxicological Properties in Chemically Unstable E-Cigarette Liquids	Erythropel, H.C., Jabba, S.V., DeWinter, T.M., Mendizabal, M., Anastas, P.T., Jordt, S.E. and Zimmerman, J.B.	Nicotine & Tobacco Research	2019	21	9	1248-1258	Experimental (biochemical study); Experimental (cell study)	Toxicant identification & quantification	**Population:** Human embryonic kidney 293 cells **Exposure:** e-liquids **Comparator:** exposure vs no exposure **Modifying factors:** n/a
High-Nicotine Electronic Cigarette Products: Toxicity of JUUL Fluids and Aerosols Correlates Strongly with Nicotine and Some Flavor Chemical Concentrations	Omaiye, E.E., McWhirter, K.J., Luo, W., Pankow, J.F. and Talbot, P.	Chemical Research in Toxicology	2019	32	6	1058-1069	Experimental (cell study)	Cytotoxicity	**Population:** BEAS-2B lung epithelial cells **Exposure:** currently marketed prefilled JUUL e-cigarette cartridges ("pods") **Comparator:** non-JUUL pods **Modifying factors:** different flavour variants
Cytotoxic and genotoxic effects of e-liquids and their potential associations with nicotine, menthol and phthalate esters	Al-Saleh, I. and Elkhatib, R. and Al-Rajoudi, T. and Al-Qudaihi, G. and Manogarannogaran, P. and Eltabache, C. and Alotaibi, A. and Mummer, A. B. and Almugbel, S.	Chemosphere	2020	249	-	126-153	Experimental (cell study)	Genotoxicity; Cytotoxicity	**Population:** human lymphoblastoid TK6 and Chinese hamster ovary (CHO) cells **Exposure:** 33 e-liquids **Comparator:** exposure vs no expsoure **Modifying factors:** n/a
Identification of flavouring substances of genotoxic concern present in e-cigarette refills	Barhdadi, S. and Mertens, B. and Van Bossuyt, M. and Van De Maele, J. and Anthonissen, R. and Canfyn, M. and Courselle, P. and Rogiers, V. and Deconinck, E. and Vanhaecke, T.	Food and Chemical Toxicology	2021	147	-	-	Experimental (cell study)	Genotoxicity	**Population:** in vitro assays **Exposure:** 129 e-liquids **Comparator:** exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Electronic cigarette extract induced toxic effect in iPS-derived cardiomyocytes	Basma, H., Tatineni, S., Dhar, K., Qiu, F., Rennard, S. and Lowes, B.D.	BMC Cardiovascular Disorders	2020	20	1	357	Experimental (cell study)	Cardiotoxicity	**Population:** cardiomyocytes **Exposure:** e-cigarette extract **Comparator:** conventional cigarette smoke extract **Modifying factors:** n/a
Reactive Oxygen Species, Mitochondrial Membrane Potential, and Cellular Membrane Potential Are Predictors of E-Liquid Induced Cellular Toxicity	Correia-Álvarez, E., Keating, J.E., Glish, G., Tarran, R. and Sassano, M.F	Nicotine & Tobacco Research	2020	22	Supp1	S4-S13	Experimental (cell study)	Cytotoxicity	**Population:** human cell line HEK293T **Exposure:** e-liquids, vanillin, benzyl alcohol, acetoin, cinnamaldehyde, and methyl-cyclopentenolone **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Refill liquids for electronic cigarettes display peculiar toxicity on human endothelial cells	De Martin, S., Gabbia, D., Bogialli, S., Biasioli, F., Boschetti, A., Gstir, R., Rainer, D. and Cappellin, L.	Toxicology Reports	2021	8	-	456-462	Experimental (cell study)	Cytotoxicity	**Population:** human endothelial cells **Exposure:** e-cigarette refill liquids **Comparator:** different refill liquid products **Modifying factors:** n/a
Novel instrument to generate representative e-cigarette vapors for physicochemical particle characterization and in-vitro toxicity	Delaval, M., Egli, D., Schüpfer, P., Benarafa, C., Geiser, M. and Burtscher, H.	Journal of Aerosol Science	2019	129	-	40-52	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial endothelial cells **Exposure:** e-aerosols **Comparator:** exposure vs no exposure **Modifying factors:** puffing regimen

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Comparison of the chemical composition of aerosols from heated tobacco products, electronic cigarettes and tobacco cigarettes and their toxic impacts on the human bronchial epithelial BEAS-2B cells	Dusautoir, R., Zarcone, G., Verriele, M., Garçon, G., Fronval, I., Beauval, N., Allorge, D., Riffault, V., Locoge, N., Lo-Guidice, J.M. and Anthérieu, S..	Journal of Hazardous Materials	2021	401	-	-	Experimental (cell study)	Toxicant identification & quantification	**Population:** human bronchial epithelial BEAS-2B cells **Exposure:** e-cigarettes aerosols; tobacco cigarette aerosols; heated tobacco product aerosols **Comparator:** e-cigarettes vs tobacco cigarettes vs heated tobacco products **Modifying factors:** n/a
In Vitro Toxicity and Chemical Characterization of Aerosol Derived from Electronic Cigarette Humectants Using a Newly Developed Exposure System	Escobar, Y.N.H., Nipp, G., Cui, T., Petters, S.S., Surratt, J.D. and Jaspers, I.	Chemical Research in Toxicology	2020	33	7	1677-1688	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelial cells **Exposure:** propylene glycol and glycerol **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Addressing the challenges of E-cigarette safety profiling by assessment of pulmonary toxicological response in bronchial and alveolar mucosa models	Ganguly, K., Nordstrom, A., Thimraj, T. A., Rahman, M., Ramstrom, M., Sompa, S. I., Lin, E. Z., O'Brien, F., Koelmel, J., Ernstgard, L., Johanson, G., Pollitt, K. J. G., Palmberg, L. and Upadhyay, S.	Scientific reports	2020	10	-	-	Experimental (cell study)	Pulmonary toxicity	**Population:** n/a; human bronchial and alveolar lung mucosa models **Exposure:** fruit flavoured e-liquids **Comparator:** exposure vs no exposure **Modifying factors:** nicotine content; vaping regimen

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Effect of sub-chronic exposure to cigarette smoke, electronic cigarette and waterpipe on human lung epithelial barrier function	Ghosh B, Reyes-Caballero H, Akgün-Ölmez SG, Nishida K, Chandrala L, Smirnova L, Biswal S, Sidhaye VK.	BMC Pulmonary Medicine	2020	20	1	216	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelial cells **Exposure:** cigarette smoke; e-cigarette aerosol; tobacco waterpipe exposure **Comparator:** cigarette smoke vs e-cigarette aerosol vs tobacco waterpipe exposure vs no exposure **Modifying factors:** n/a
Comparison between in vitro toxicities of tobacco- and menthol-flavored electronic cigarette liquids on human middle ear epithelial cells	Go, Y. Y. and Mun, J. Y. and Chae, S. W. and Chang, J. and Song, J. J.	Scientific reports	2020	10	-	-	Experimental (cell study)	Cytotoxicity	**Population:** human middle ear epithelial cells **Exposure:** e-liquids **Comparator:** exposure vs no exposure **Modifying factors:** different flavours (menthol vs tobacco flavoured)
In vitro and in silico genetic toxicity screening of flavor compounds and other ingredients in tobacco products with emphasis on ENDS	Hung, P. H., Savidge, M., De, M., Kang, J., Healy, S.M., and Valerio, L. G.	Journal of Applied Toxicology	2020	40	11	1566-1587	Experimental (cell study)	Genotoxicity	**Population:** human TK6 cells **Exposure:** e-aerosols **Comparator:** exposure vs no exposure **Modifying factors:** different flavoured e-cigs

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
A lower impact of an acute exposure to electronic cigarette aerosols than to cigarette smoke in human organotypic buccal and small airway cultures was demonstrated using systems toxicology assessment	Iskandar, A.R., Zanetti, F., Kondylis, A., Martin, F., Leroy, P., Majeed, S., Steiner, S., Xiang, Y., Torres, L.O., Trivedi, K., Guedj, E., Merg, C., Frentzel, S., Ivanov, N.V., Doshi, U. Lee, K.M., McKinney, W.J., Peitsch, M.C., Hoeng, J., and McKinney, W.J., Jr.	Internal & Emergency Medicine	2019	14	6	863-883	Experimental (cell study)	General toxicity	**Population:** human organotypic buccal and small airway cultures **Exposure:** e-cigarettes **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Application of a multi-layer systems toxicology framework for in vitro assessment of the biological effects of Classic Tobacco e-liquid and its corresponding aerosol using an e-cigarette device with MESHTM technology	Iskandar, A.R., Zanetti, F., Marescotti, D., Titz, B., Sewer, A., Kondylis, A., Leroy, P., Belcastro, V., Torres, L.O., Acali, S. and Majeed, S., Steiner, S., Trivedi, K., Guedj, E., Merg, C., Schneider, T., Frentzel, S., Martin, F., Ivanov, N. V., Peitsch, M.C., and Hoeng, J.	Archives of Toxicology	2019	93	11	3229-3247	Experimental (cell study)	Cytotoxicity	**Population:** bronchial epithelial cell cultures; human organotypic air-liquid interface buccal and small airway epithelial cultures **Exposure:** Classic Tobacco e-liquid; Base e-liquid **Comparator:** Classic Tobacco e-liquid exposure vs base e-liquid exposure **Modifying factors:** n/a
Chemical Adducts of Reactive Flavor Aldehydes Formed in E-Cigarette Liquids Are Cytotoxic and Inhibit Mitochondrial Function in Respiratory Epithelial Cells	Jabba, S.V., Diaz, A.N., Erythropel, H.C., Zimmerman, J.B. and Jordt, S.E.	Nicotine & Tobacco Research	2020	22	Supp1	S25-S34	Experimental (cell study)	Cytotoxicity	**Population:** bronchial (BEAS-2B) and alveolar (A549) epithelial cells **Exposure:** benzaldehyde, vanillin, ethyl vanillin, and their corresponding propylene glycol acetals **Comparator:** parent aldehydes vs their corresponding propylene glycol acetals **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Chemical and Toxicological Characterization of Vaping Emission Products from Commonly Used Vape Juice Diluents	Jiang, H., Ahmed, C.S., Martin, T.J., Canchola, A., Oswald, I.W., Garcia, J.A., Chen, J.Y., Koby, K.A., Buchanan, A.J., Zhao, Z. and Zhang, H	Chemical Research in Toxicology	2020	33	8	2157-2163	Experimental (cell study)	Toxicant identification & quantification; Cytotoxicity	**Population:** human airway epithelial cells **Exposure:** vaping emission products **Comparator:** exposure to emissions vs e-liquid constituents **Modifying factors:** n/a
The flavoring and not the nicotine content is a decisive factor for the effects of refill liquids of electronic cigarette on the redox status of endothelial cells	Kerasioti, E., Veskoukis, A.S., Skaperda, Z., Zacharias, A., Poulas, K., Lazopoulos, G. and Kouretas, D.	Toxicology Reports	2020	7	-	1095-1102	Experimental (cell study)	Cytotoxicity	**Population:** human endothelial cells (EA.hy926 cell line) **Exposure:** three e-liquids with different flavors (tobacco, vanilla, apple/mint) **Comparator:** exposure vs no exposure **Modifying factors:** nicotine concentration
E-cigarette aerosol induced cytotoxicity, DNA damages and late apoptosis in dynamically exposed A549 cells	Khalil, C., Chahine, J.B., Haykal, T., Al Hageh, C., Rizk, S. and Khnayzer, R.S.	Chemosphere	2021	263	-	-	Experimental (cell study)	Cytotoxicity	**Population:** adenocarcinomic human alveolar basal epithelial cells **Exposure:** acute e-aerosol exposure (thirty puffs at 40 W of power and higher) **Comparator:** exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
E-Liquid Containing a Mixture of Coconut, Vanilla, and Cookie Flavors Causes Cellular Senescence and Dysregulated Repair in Pulmonary Fibroblasts: Implications on Premature Aging	Lucas, J.H., Muthumalage, T., Wang, Q., Friedman, M.R., Friedman, A.E. and Rahman, I.	Frontiers in Physiology	2020	11	-	-	Experimental (cell study)	Pulmonary toxicity	**Population:** pulmonary fibroblasts **Exposure:** e-liquid containing a mixture of tobacco, coconut, vanilla, and cookie flavors **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Systems toxicology assessment of a representative e-liquid formulation using human primary bronchial epithelial cells	Diego Marescotti, Carole Mathis, Vincenzo Belcastro, Patrice Leroy, Stefano Acali, Florian Martin, Rémi Dulize, David Bornand, Dariusz Peric, Emmanuel Guedj, Laura Ortega Torres, Matteo Biasioli, Matthieu Fuhrimann, Estela Fernandes, Felix Frauendorfer, Ignacio Gonzalez Suarez, Davide Sciuscio, Nikolai V. Ivanov, Manuel C. Peitsch, Julia Hoeng	Toxicology Reports	2020	7	-	67-80	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelial cells **Exposure:** 28 flavouring substances commonly used in e-liquid formulations, dissolved individually or as a mixture in a base solution composed of propylene glycol, vegetable glycerin, and 0.6% nicotine **Comparator:** exposure to individual flavouring substantces vs mixed flavours **Modifying factors:** n/a
Airway basal cell injury after acute diacetyl (2,3-butanedione) vapor exposure	McGraw, M.D., Kim, S.Y., Reed, C., Hernady, E., Rahman, I., Mariani, T.J. and Finkelstein, J.N.	Toxicology Letters	2020	325	-	25-33	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelial cells **Exposure:** diacetyl vapour **Comparator:** exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Menthol in electronic cigarettes: A contributor to respiratory disease?	Nair, V., Tran, M., Behar, R.Z., Zhai, S., Cui, X., Phandthong, R., Wang, Y., Pan, S., Luo, W., Pankow, J.F. and Volz, D.C	Toxicology and Applied Pharmacology	2020	407	-	-	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelium **Exposure:** menthol **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** n/a
Sub-ohm vaping increases the levels of carbonyls, is cytotoxic, and alters gene expression in human bronchial epithelial cells exposed at the air-liquid interface	Noël, A., Hossain, E., Perveen, Z., Zaman, H., and Penn, A. L.	Respiratory Research	2020	21	1	43831	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelial cells (H292) **Exposure:** butter-flavoured or cinnamon-flavoured e-cig aerosols via third-generation e-cigarette device **Comparator:** exposure to butter-flovured aerosols vs exposure to cinnamon-flavoured aerosol **Modifying factors:** n/a
Quantification of selected aroma compounds in e-cigarette products and toxicity evaluation in HUVEC/Tert2 cells	Noël, J.C., Rainer, D., Gstir, R., Rainer, M. and Bonn, G.	Biomedical Chromatography	2020	34	3	-	Experimental (cell study)	Toxicant identification & quantification	**Population:** HUVEC/Tert2 cells **Exposure:** e-liquids and e-concentrates **Comparator:** exposure vs no exposure **Modifying factors:** different flavours of e-lquids and e-concentrates

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Comparative effects of parent and heated cinnamaldehyde on the function of human iPSC-derived cardiac myocytes	Nystoriak, M.A., Kilfoil, P.J., Lorkiewicz, P.K., Ramesh, B., Kuehl, P.J., McDonald, J., Bhatnagar, A. and Conklin, D.J.	Toxicology in Vitro	2019	61	-	-	Experimental (cell study)	Cardiotoxicity	**Population:** human induced pluripotent stem cell-derived cardiac myocytes **Exposure:** cinnamaldehyde **Comparator:** exposure vs no exposure **Modifying factors:** heating at low (200 ± 50 °C) and high temperatures (700 ± 50 °C)
E-cigarettes induce toxicity comparable to tobacco cigarettes in airway epithelium from patients with COPD	O'Farrell, H.E., Brown, R., Brown, Z., Milijevic, B., Ristovski, Z.D., Bowman, R.V., Fong, K.M., Vaughan, A. and Yang, I.A	Toxicology in Vitro	2021	75	-	-	Experimental (cell study)	Cytotoxicity	**Population:** bronchial epithelial cells (BECs) from patients with chronic obsrtuctive pulmonary disease **Exposure:** aerosols from a fourth-generation e-cigarette **Comparator:** exposure to e-aerosol vs cigarette smoker **Modifying factors:** n/a
Transcriptomic response of primary human airway epithelial cells to flavoring chemicals in electronic cigarettes	Park, H.R., O'Sullivan, M., Vallarino, J., Shumyatcher, M., Himes, B.E., Park, J.A., Christiani, D.C., Allen, J. and Lu, Q.	Scientific reports	2019	9	1	1-Nov	Experimental (cell study)	Cytotoxicity	**Population:** human bronchial epithelial cells **Exposure:** diacetyl; 2,3-pentanedione **Comparator:** diacetyl exposure vs 2,3-pentanedione exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Toxicological analysis of aerosols derived from three electronic nicotine delivery systems using normal human bronchial epithelial cells	Pearce, K., Gray, N., Gaur, P., Jeon, J., Suarez, A., Shannahan, J., Pappas, R.S. and Watson-Wright, C.	Toxicology in Vitro	2021	69	-	-	Experimental (cell study)	General toxicity	**Population:** human bronchial epithelial cells **Exposure:** e-aerosols, specifically Juul Fruit Medley (5% nicotine), Logic Power (2.4% nicotine), and Mistic (1.8% nicotine) **Comparator:** Juul Fruit exposure vs Medley exposure vs Logic Power exposure **Modifying factors:** n/a
Cell-specific toxicity of short-term JUUL aerosol exposure to human bronchial epithelial cells and murine macrophages exposed at the air-liquid interface	Pinkston, R., Zaman, H., Hossain, E., Penn, A.L. and Noël, A.	Respiratory Research	2020	21	1	Jan-15	Experimental (cell study)	Cytotoxicity	**Population:** human lung epithelial cells and murine macrophages **Exposure:** JUUL crème brûlée-flavored aerosols **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** n/a
The toxic potential of a fourth-generation E-cigarette on human lung cell lines and tissue explants	Rankin, G.D., Wingfors, H., Uski, O., Hedman, L., Ekstrand-Hammarström, B., Bosson, J. and Lundbäck, M	Journal of Applied Toxicology	2019	39	8	1143-1154	Experimental (cell study)	General toxicity	**Population:** human lung epithelial cell lines; distal lung tissue explants **Exposure:** e-cigarette vapour extract from fourth-generation e-cigarette devices **Comparator:** **Modifying factors:** n/a

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Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Cigarette Smoke and E-Cigarette Vapor Dysregulate Osteoblast Interaction With Titanium Dental Implant Surface	Rouabhia, M., Alanazi, H., Park, H. J. and Goncalves, R. B.	The Journal of oral implantology	2019	45	1	2-Nov	Experimental (cell study)	Cytotoxicity	**Population:** osteoblasts **Exposure:** nicotine-rich e-vapour; nicotine-free e-vapour; cigarette smoke **Comparator:** nicotine-rich e-vapour vs nicotine-free e-vapour vs cigarette smoke **Modifying factors:** n/a
Effect of e-cigarettes on nasal epithelial cell growth, Ki67 expression, and pro-inflammatory cytokine secretion	Rouabhia, M., Piche, M., Corriveau, M. N. and Chakir, J.	American Journal of Otolaryngology	2020	41	6	-	Experimental (cell study)	Cytotoxicity	**Population:** human primary nasal epithelial cells and engineered 3D nasal mucosa tissues **Exposure:** e-aerosol; cigarette smoke **Comparator:** e-aerosol exposure vs cigarette smoke exposure vs no exposure (pre/post) **Modifying factors:** n/a
Chemical Composition and in Vitro Toxicity Profile of a Pod-Based E-Cigarette Aerosol Compared to Cigarette Smoke	Rudd, K., Stevenson, M., Wieczorek, R., Pani, J., Trelles-Sticken, E., Dethloff, O., Czekala, L., Simms, L., Buchanan, F., O'Connell, G. and Walele, T.	Applied In Vitro Toxicology	2020	6	1	15281	Experimental (cell study)	General toxicity	**Population:** in vitro micronuceous assays **Exposure:** e-cigarette aerosol; cigarette smoke **Comparator:** e-aerosol exposure vs cigarette-exposure **Modifying factors:** n/a

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Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
E-cigarette aerosol condensate enhances metabolism of benzo(A)pyrene to genotoxic products, and induces CYP1A1 and CYP1B1, likely by activation of the aryl hydrocarbon receptor	Sun, Y.W., Kosinska, W. and Guttenplan, J.B.	International Journal of Environmental Research and Public Health	2019	16	14	2468	Experimental (cell study)	Genotoxicity	**Population:** human oral keratinocyte cell line **Exposure:** condensate of e-cigarette aerosol **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Cytotoxicity and genotoxicity of E-cigarette generated aerosols containing diverse flavoring products and nicotine in oral epithelial cell lines	Tellez, C.S., Juri, D.E., Phillips, L.M., Do, K., Yingling, C.M., Thomas, C.L., Dye, W.W., Wu, G., Kishida, S., Kiyono, T. and Belinsky, S.A.	Toxicological Sciences	2021	179	2	220-228	Experimental (cell study)	Cytotoxicity; Genotoxicity	**Population:** oral epithelial cell lines **Exposure:** e-liquid products with and without nicotine **Comparator:** exposure vs no exposure; with vs without nicotine **Modifying factors:** n/a
Impact of Atomizer Age and Flavor on in Vitro Toxicity of Aerosols from a Third-Generation Electronic Cigarette against Human Oral Cells	Ureña, J.F., Ebersol, L.A., Silakov, A., Elias, R.J. and Lambert, J.D.	Chemical Research in Toxicology	2020	33	10	2527-2537	Experimental (cell study)	Cytotoxicity	**Population:** human oral cells **Exposure:** e-aerosols from third-generation e-cigarette devices **Comparator:** e-aerosol flavour; age of device atomiser **Modifying factors:** n/a
A comparative in vitro toxicity assessment of electronic vaping product e-liquids and aerosols with tobacco cigarette smoke	Wieczorek, R., Phillips, G., Czekala, L., Sticken, E.T., O'Connell, G., Simms, L., Rudd, K., Stevenson, M. and Walele, T	Toxicology in Vitro	2020	66	-	-	Experimental (cell study)	General toxicity	**Population:** bacterial reverse mutation and in vitro micronucleus assays **Exposure:** electronic vaping product aerosols; e-liquids **Comparator:** cigarette smoke **Modifying factors:**

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Chemical Elements in Electronic Cigarette Solvents and Aerosols Inhibit Mitochondrial Reductases and Induce Oxidative Stress	Williams, M., Ventura, J., Loza, A., Wang, Y. and Talbot, P	Nicotine & Tobacco Research	2020	22	Supp1	S14-S24	Experimental (cell study)	Toxicant identification & quantification; General toxicity	**Population:** human bronchial epithelial cells **Exposure:** propylene glycol, glycerin, popular e-cigarette refills in aerosol form **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** n/a
Acute Effects of Electronic Cigarette Inhalation on the Vasculature and the Conducting Airways	Antoniewicz, L. and Brynedal, A. and Hedman, L. and Lundback, M. and Bosson, J. A.	Cardiovascular toxicology	2019	19	5	441-450	Prospective cohort study	Vascular function; Acute toxicity; Pulmonary function	**Population:** humans (adults) **Exposure:** ENDS and ENNDS **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Biomarkers of Exposure Among "Dual Users" of Tobacco Cigarettes and Electronic Cigarettes in Canada	Czoli, C.D., Fong, G.T., Goniewicz, M.L. and Hammond, D.	Nicotine & Tobacco Research	2019	21	9	1259-1266	Prospective cohort study	Biomarkers of exposure among dual users	**Population:** adult dual users of e-cigarettes and convention cigarettes **Exposure:** e-cigarettes; conventional cigarettes **Comparator:** e-cigarette exposure vs cigarette exposure vs dual exposure vs no exposure **Modifying factors:** n/a
A Longitudinal Study of Exposure to Tobacco-Related Toxicants and Subsequent Respiratory Symptoms Among U.S. Adults with Varying E-cigarette Use Status	Dai, H. and Khan, A.S.	Nicotine & Tobacco Research	2020	22	Supp1	S61-S69	Prospective cohort study	Biomarkers of exposure to tobacco-related toxicants in e-cig users	**Population:** humans (adults) **Exposure:** e-cigarettes; conventional cigarettes **Comparator:** e-cigarette exposure vs dual exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
An epidemiologic and clinical description of e-cigarette toxicity	Hughes, A. and Hendrickson, R. G.	Clinical Toxicology	2019	57	4	287-293	Prospective cohort study	General toxicity	**Population:** humans (adults and children) **Exposure:** e-liquid refill containers or fluid (adults); ingestion of refill liquid (children) **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Acute exposures to e-cigarettes and heat-not-burn products reported to the Czech Toxicological Information Centre over a 7-year period (2012-2018)	Obertova, N., Navratil, T., Zak, I., and Zakharov, S.	Basic and Clinical Pharmacology and Toxicology	2020	127	1	39-46	Prospective cohort study	General toxicity	**Population:** adolescents and children **Exposure:** e-liquid cartridge, refillable tank, and heat-not-burn product refills **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** n/a
Ascorbic acid prevents vascular endothelial dysfunction induced by electronic hookah (Waterpipe) vaping	Rezk-Hanna, M., Seals, D.R., Rossman, M.J., Gupta, R., Nettle, C.O., Means, A., Dobrin, D., Cheng, C.W., Brecht, M.L., Mosenifar, Z., Araujo, J.A. and Benowitz, N. L.	Journal of the American Heart Association	2021	10	5	-	Prospective cohort study	General toxicity	**Population:** young adult habitual hookah smokers **Exposure:** e-hookah vapour **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** ascorbic acid

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Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Exposure to Nicotine and Toxicants Among Dual Users of Tobacco Cigarettes and E-Cigarettes: Population Assessment of Tobacco and Health (PATH) Study, 2013-2014	Smith, D.M., Christensen, C., van Bemmel, D., Borek, N., Ambrose, B., Erives, G., Niaura, R., Edwards, K.C., Stanton, C.A., Blount, B.C. and Wang, L., Feng, J., Jarrett, J.M., Ward, C.D., Hatsukami, D., Hecht, S.S., Kimmel, H.L., Travers, M., Hyland A. and Goniewicz, M.L.	Nicotine & Tobacco Research	2021	23	5	790-797	Prospective cohort study	Biomarkers of exposure among dual users	**Population:** adult dual users of e-cigarettes and combustible cigarettes **Exposure:** e-cigarettes and combustible cigarettes **Comparator:** dual users vs exclusive e-cigarette users vs exclusive combustible cigarette users **Modifying factors:** n/a
Acute Effects of Heat-Not-Burn, Electronic Vaping, and Traditional Tobacco Combustion Cigarettes: the Sapienza University of Rome-Vascular Assessment of Proatherosclerotic Effects of Smoking (SUR - VAPES) 2 Randomized Trial	Biondi-Zoccai, G. and Sciarretta, S. and Bullen, C. and Nocella, C. and Violi, F. and Loffredo, L. and Pignatelli, P. and Perri, L. and Peruzzi, M. and Marullo, A. G. M. and et al.	Journal of the american heart association	2019	8	6	e010455	Randomised control trial	Cardiotoxicity	**Population:** healthy smokers **Exposure:** e-cigarettes **Comparator:** heat-not-burn cigarettes and traditional tobacco combustion cigarettes **Modifying factors:** n/a
Short-term high wattage e-cigarette cessation improves cardiorespiratory outcomes in regular users: a randomized crossover trial	Chaumont, M. and El Channan, M. and Bernard, A. and Lesage, A. and Deprez, G. and Van Muylem, A. and Schaefer, T. and Faoro, V. and Van De Borne, P.	Journal of Hypertension	2019	37	-	e8-e9	Randomised control trial	Cardiorespiratory toxicity	**Population:** e-cigarette users **Exposure:** e-cigarettes **Comparator:** nicotine containing vs nictotine-free vs no exposure **Modifying factors:** n/a

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Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Short halt in vaping modifies cardiorespiratory parameters and urine metabolome: a randomized trial	Chaumont, M. and Tagliatti, V. and Channan, E. M. and Colet, J. M. and Bernard, A. and Morra, S. and Deprez, G. and Van Muylem, A. and Debbas, N. and Schaefer, T. and et al.	American Journal of Physiology	2020	318	2	L331-L344	Randomised control trial	Cardiorespiratory toxicity	**Population:** e-cigarette users **Exposure:** e-cigarettes **Comparator:** nicotine containing vs nictotine-free vs no exposure **Modifying factors:** n/a
A randomized controlled study in healthy participants to explore the exposure continuum when smokers switch to a tobacco heating product or an E-cigarette relative to cessation	McEwan, M., Gale, N., Ebajemito, J.K., Camacho, O.M., Hardie, G., Proctor, C.J. and Murphy, J	Toxicology reports	2021	8	-	994-1001	Randomised control trial	Changes to levels of tobacco-related biomarkers when switching to e-cigarettes	**Population:** healthy smokers **Exposure:** e-cigarettes, heated tobacco products **Comparator:** e-cigarette exposure vs heated tobacco exposure vs no exposure **Modifying factors:** n/a
Effects of Electronic Cigarette Constituents on the Human Lung: a Pilot Clinical Trial	Song MA, Reisinger SA, Freudenheim JL, Brasky TM, Mathé EA, McElroy JP, Nickerson QA, Weng DY, Wewers MD, Shields PG.	Cancer prevention research	2020	13	2	145-152	Randomised control trial	Cardiorespiratory toxicity; Pulmonary toxicity	**Population:** never smokers (adults) **Exposure:** e-cigs containing only 50% propylene glycol (PG) and 50% vegetable glycerin **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Systematic review of biomarker findings from clinical studies of electronic cigarettes and heated tobacco products	Akiyama, Y. and Sherwood, N.	Toxicology Reports	2021	8	-	282-294	Systematic review	Changes to levels of tobacco-related biomarkers when switching to e-cigarettes	**Population:** humans (adults) **Exposure:** e-cigarettes and heated tobacco products **Comparator:** combustible cigarettes **Modifying factors:** n/a

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Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Correction to: The oral health impact of electronic cigarette use: a systematic review	Yang, I., Sandeep S., and Rodriguez, J.	Critical Reviews in Toxicology	2020	50	2	97-127	Systematic review	Oral health impact	**Population:** humans (adults) **Exposure:** e-cigarettes **Comparator:** exposure vs no exposure; combustible cigarettes **Modifying factors:** n/a
Genotoxic and Carcinogenic Potential of Compounds Associated with Electronic Cigarettes: A Systematic Review	Armendáriz-Castillo I, Guerrero S, Vera-Guapi A, Cevallos-Vilatuña T, García-Cárdenas JM, Guevara-Ramírez P, López-Cortés A, Pérez-Villa A, Yumiceba V, Zambrano AK, Leone PE.	BioMed Research International	2019	-	-	-	Systematic review	Genotoxicity; Carcinogenic potential	**Population:** humans, animals, in vitro **Exposure:** 50 individual chemical constituents **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Carcinogen Biomarkers in the Urine of Electronic Cigarette Users and Implications for the Development of Bladder Cancer: A Systematic Review	Bjurlin, M. A. and Matulewicz, R. S. and Roberts, T. R. and Dearing, B. A. and Schatz, D. and Sherman, S. and Gordon, T. and Shahawy, O. E.	European urology oncology	2020	7	-	30029-8	Systematic review	Carcinogenic potential	**Population:** humans (adults) **Exposure:** e-cigarettes **Comparator:** exposure vs no expsoure **Modifying factors:** n/a
The Evolving Landscape of e-Cigarettes: A Systematic Review of Recent Evidence	Bozier, J. and Chivers, E. K. and Chapman, D. G. and Larcombe, A. N. and Bastian, N. A. and Masso-Silva, J. A. and Byun, M. K. and McDonald, C. F. and Crotty Alex and er, L. E. and Ween, M. P.	Chest	2020	157	5	1362-1390	Systematic review	General toxicity	**Population:** humans (adults) **Exposure:** e-cigarettes **Comparator:** exposure vs no exposure; traditional combustible cigarettes **Modifying factors:** including/excluding nicotine

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
Lung damage caused by heated tobacco products and electronic nicotine delivery systems: A systematic review	Bravo-Gutierrez, O. A. and Falfan-Valencia, R. and Ramirez-Venegas, A. and Sansores, R. H. and Ponciano-Rodriguez, G. and Perez-Rubio, G.	International Journal of Environmental Research and Public Health	2021	18	8	4079	Systematic review	Cytotoxicity	**Population:** humans (adults) **Exposure:** ENDS **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Metal/Metalloid Levels in Electronic Cigarette Liquids, Aerosols, and Human Biosamples: A Systematic Review	Zhao, D., Aravindakshan, A., Hilpert, M., Olmedo, P., Rule, A.M., Navas-Acien, A. and Aherrera, A.	Environmental Health Perspectives	2020	128	3	-	Systematic review	Toxicant identification & quantification; Biomarkers of exposure to tobacco-related toxicants in e-cig users	**Population:** e-cigarette users **Exposure:** metal/metalloid **Comparator:** conventional cigarette users; cigar users **Modifying factors:** n/a
Exposure of vapers to formaldehyde and acrolein: A systematic review	Dupont, P. and Aubin, H. J.	Revue des Maladies Respiratoires	2019	36	7	752-800	Systematic review	Toxicant identification & quantification	**Population:** e-cigarette users **Exposure:** formaldehyde and acrolein **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Health Effects of Trace Metals in Electronic Cigarette Aerosols- a Systematic Review	Gaur, S. and Agnihotri, R.	Biological Trace Element Research	2019	188	2	295-315	Systematic review	Carcinogenic potential	**Population:** animals; in vitro **Exposure:** trace metals via e-aerosols **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Vaping-Related Acute Parenchymal Lung Injury: A Systematic Review	Jonas, A. M. and Raj, R.	Chest	2020	158	4	1555-1565	Systematic review	Pulmonary toxicity	**Population:** humans, animals, in vitro **Exposure:** e-aerosol **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
The cardiovascular effects of electronic cigarettes: A systematic review of experimental studies	Kennedy, C.D., van Schalkwyk, M.C., McKee, M. and Pisinger, C	Preventive Medicine	2019	127	-	-	Systematic review	Cardiotoxicity	**Population:** humans, animals, in vitro **Exposure:** e-cigarettes **Comparator:** exposure vs no exposure **Modifying factors:** n/a
Environmental contaminants exposure and preterm birth: A systematic review	Porpora, M.G., Piacenti, I., Scaramuzzino, S., Masciullo, L., Rech, F. and Benedetti Panici, P	Toxics	2019	7	1	11	Systematic review	Developmental toxicity	**Population:** pre-term babies **Exposure:** exposure to environmental toxic compounds (including e-aerosols) in the mother or gestational compartment (e.g., amniotic fluid, umbilical cord blood, or placental tissue) during pregnancy **Comparator:** pre-term babies vs full-term babies **Modifying factors:** n/a
Vaping'- a trojan horse against fight toward tobacco use and cancer: A systematic review of the existing evidence	Sharma, H. and Verma, S.	Indian Journal of Medical and Paediatric Oncology	2020	41	3	-	Systematic review	General toxicity	**Population:** humans **Exposure:** e-cigarettes **Comparator:** exposure vs no exposure **Modifying factors:** n/a
The effects of e-cigarette vapor components on the morphology and function of the male and female reproductive systems: A systematic review	Szumilas, K., Szumilas, P., Grzywacz, A. and Wilk, A.	International Journal of Environmental Research and Public Health	2020	17	17	6152	Systematic review	Reproductive toxicity	**Population:** animals; in vitro **Exposure:** e-cigarette vapour **Comparator:** exposure vs no exposure **Modifying factors:** n/a

Table 5 continued

Title	Authors	Journal	Year	Volume	Issue	Pages	Study design	Outcome(s) of interest	Study PECO question
A systematic literature review of E-cigarette-related illness and injury: Not just for the respirologist	Tzortzi, A., Kapetanstrataki, M., Evangelopoulou, V. and Behrakis, P.	International Journal of Environmental Research and Public Health	2020	17	7	2248	Systematic review	General toxicity	**Population:** patients admitted as a result of e-cigarette-related injury **Exposure:** e-cigarettes **Comparator:** exposure vs no exposure (pre/post) **Modifying factors:** n/a
The role of vitamin E acetate (VEA) and its derivatives in the vaping associated lung injury: systematic review of evidence	Xantus, G., Anna Gyarmathy, V., Johnson, C.A., Sanghera, P., Zavori, L. and Kanizsai, P.L.	Critical Reviews in Toxicology	2021	51	1	15-23	Systematic review	Pulmonary toxicity	**Population:** humans **Exposure:** vitamin E acetate **Comparator:** exposure vs no exposure **Modifying factors:** n/a
The oral health impact of electronic cigarette use: a systematic review	Yang, I., Sandeep, S. and Rodriguez, J	Critical Reviews in Toxicology	2020	50	2	97-127	Systematic review	General toxicity	**Population:** e-cigarette users; users of traditional cigarettes **Exposure:** e-cigarette vapour **Comparator:** exposure vs no exposure; traditional cigarettes **Modifying factors:** n/a

Appendix F: Plain-English summary

Box 1: Plain-English summary

What are electronic cigarettes?

- Electronic cigarettes (e-cigarettes), commonly known as vapes, are devices that electronically heat liquids, known as e-liquids, which turn into a mist (aerosol) that is then breathed into the lungs.
- E-liquids can contain nicotine and a large number other chemicals. There have been reports of over 200 chemicals that are used in e-liquids.

Why did we do this report?

- There are a lot of chemicals in e-cigarettes but we do not know if they are safe or if they can harm your health.

What did we do?

- We looked at what information was available on chemicals used in e-cigarettes from:
  - *Scientific studies*; and
  - *Chemical assessment data* which looks at hazards and risks to health and the environment.

What did we find?

- There was limited information available about if the chemicals used in e-cigarettes are harmful to health. There was no information about if long-term use of these chemicals in e-cigarettes were safe or harmful to health.
- Some chemicals, for example, some flavours, are approved for use in foods or medicine, but are not safe to inhale.
- Missing data or limited information does not mean that the chemicals used in e-cigarettes are safe to inhale.
- More information and data on the short and long term effects of inhaling these chemicals is needed to know if they are safe or if they harm your health.

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