

Supporting Information

Supplementary Table 1: Inclusion and exclusion criteria for umbrella review (of systematic reviews) and systematic review (of primary research)

PICO	Inclusion Criteria	Exclusion Criteria
Population	Non-tobacco smokers - includes never, former or ever users (this includes prior users who have tried smoking but have not used in the past 30 days) Humans, any age (youth, young adults and adults)	Current tobacco smokers (use within the past 30 days) Animal studies, in vitro studies
Intervention	Nicotine-containing or non-nicotine-containing e-cigarettes or e-liquid devices (also referred to as vaping products)	Studies with a focus on heat-not-burn or tobacco containing devices Studies with a focus on the uptake of marijuana, other illicit drugs and harmful substances (as in the CSIRO report [58])
Comparison	No nicotine-containing or non-nicotine containing e-cigarettes or e-liquid devices	
Outcomes	Ever smoking combustible tobacco cigarettes	Studies where smoking cigarettes is not the primary outcome variable
Study	Published, peer-reviewed literature For umbrella review <ul style="list-style-type: none"> - Systematic reviews and meta-analyses of randomised/non-randomised controlled trials, clinical trials and prospective cohort studies (if a systematic review/meta-analysis includes study designs other than cohort and randomised/ non-randomised controlled trials, the review will only be included if the analysis and/ or results are separated by study design) For systematic review <ul style="list-style-type: none"> - Randomised/ non-randomised controlled trials, clinical trials (although interventional studies are not expected) - Prospective cohort studies 	Systematic reviews that are superseded by a later review which include all studies from the earlier review. <ul style="list-style-type: none"> - Non-systematic -literature reviews - Intervention trial with no comparator (e.g. before and after study) - Qualitative studies - Retrospective cohort studies - Case-control studies - Cross-sectional (including repeated cross-sectional) - Case studies - Grey literature, conference abstracts, letters, editorials, correspondence, opinion pieces, government reports, position statements <p><i>Systematic reviews and meta-analyses will be excluded if they include only the above study designs.</i></p>
Follow-up	Minimum 6 months	
Setting	Any country	
Time period	All years	No exclusion
Other	<ul style="list-style-type: none"> - English - Full-text availability 	<ul style="list-style-type: none"> - Not available in English - Duplicated data

Supplementary Appendix: Search strategy

MEDLINE, PyschINFO, PubMed, Scopus, Web of Science and Cochrane Library were searched. Papers were imported into an Endnote library, exported to Covidence and duplicates removed. The titles and abstracts were screened by two reviewers (OB and LF) to isolate relevant publications. Full texts were then identified for the relevant publications by two reviewers (OB and LF) and independently assessed the publications against the selection criteria. Any conflicts were discussed and if no consensus was reached the publication was reviewed by a third reviewer (MH).

A forward and backward reference search was performed on the final articles completed using Web of Science and Scopus. After removing duplicates, titles, abstracts and then full texts were screened for any randomised controlled trials fulfilling our inclusion and exclusion criteria by two reviewers (OB and LF).

Data were systematically extracted from the publications using data extraction templates. The quality of the included studies was assessed independently by two reviewers (OB and LF), with discrepancies resolved by discussion and by adjudication of a third reviewer (EB). E-cigarette, cigarette smoking and uptake search terms will be combined with the Boolean operator 'AND' for the final search.

Supplementary Table 2: Search terms

E-cigarette related search terms (combined with Boolean operator 'OR')	Combustible cigarette smoking related search terms (combined with Boolean operator 'OR')	Uptake related search terms (combined with Boolean operator 'OR')
<u>Keywords</u>	<u>Keywords</u>	<u>Keywords</u>
<ol style="list-style-type: none"> 1. Electronic cigarette* 2. E-cigarette* 3. Electronic nicotine delivery system* 4. Electronic nicotine de* 5. Electronic non-nicotine de* 6. Vape 7. Vaping 8. Vapo* 9. E-hookah 10. Electronic inhalant device 11. E-liquid 	<ol style="list-style-type: none"> 1. Combustible cigarette 2. Tobacco smoking 3. Smoking 4. Cigarette 	<ol style="list-style-type: none"> 1. Initiat* 2. Uptak* 3. Subsequent* 4. Predict* 5. Onset
<u>MeSH terms</u>	<u>MeSH terms</u>	
<ol style="list-style-type: none"> 1. Electronic Nicotine Delivery Systems (ENDS) 	<ol style="list-style-type: none"> 1. Smokers 2. Non-smokers 	

Supplementary Table 3: Search histories

Database	Search	Studies and search date
PubMed	((Electronic cigarette* or E-cigarette* or Electronic nicotine delivery systems[Mesh] or Electronic non-nicotine delivery* or Electronic nicotine device* or Electronic non-nicotine device* or Vape or Vaping or Vapo* or E-hookah or Electronic inhalant device or E-liquid)) AND (Smoker*[Mesh] or non-smoker*[Mesh] or ex-smoker*[Mesh] or Combustible cigarette or Tobacco smoking or Smoking or Cigarette or Cigarette smoking or Cigar smoking)) AND (Initiat* OR Uptak* OR Subsequent* OR Predict* OR Onset)	1187 (01/04/2020)
Scopus	(TITLE-ABS-KEY (("Electronic cigarette*" OR "E-cigarette*" OR "Electronic nicotine delivery system*" OR "Electronic non-nicotine delivery*" OR "Electronic nicotine device*" OR "Electronic non-nicotine device*" OR "Vape" OR "Vaping" OR "Vapo*" OR "E-hookah")) AND TITLE-ABS-KEY (("Smoker*" OR "non-smoker*" OR "ex-smoker*" OR "Combustible cigarette" OR "Tobacco smoking" OR "Smoking" OR "Cigarette" OR "Cigarette smoking" OR "Cigar smoking")) AND TITLE-ABS-KEY (("Initiat*" OR "Uptak*" OR "Subsequent*" OR "Predict*" OR "Onset")))	1289 (01/04/2020)
Web of Science	ALL FIELDS: (("Electronic cigarette*" OR E-cigarette* OR "Electronic nicotine delivery system*" OR "Electronic non-nicotine delivery*" OR "Electronic nicotine device*" OR "Electronic non-nicotine device*" OR Vape OR Vaping OR Vapo* OR E-hookah OR "Electronic inhalant device")) AND ALL FIELDS: ((Smoker* OR non-smoker* OR ex-smoker* OR "Combustible cigarette" OR "Tobacco smoking" OR Smoking OR Cigarette OR "Cigarette smoking" OR "Cigar smoking")) AND ALL FIELDS: ((Initiat* OR Uptak* OR Subsequent* OR Predict* OR Onset))	1488 (01/04/2020)
PsychINFO (Ovid)	1. (Electronic cigarette* or E-cigarette* or Electronic nicotine delivery system* or Electronic non-nicotine delivery* or Electronic nicotine device* or Electronic non-nicotine device* or Vape or Vaping or Vapo* or E-hookah or Electronic inhalant device or E-liquid).af. 2. (Smoker* or non-smoker* or ex-smoker* or Combustible cigarette or Tobacco smoking or Smoking or Cigarette or Cigarette smoking or Cigar smoking).af. 3. (Initiat* or Uptak* or Subsequent* or Predict* or Onset).af. 4. 1 and 2 and 3	874 (01/04/2020)
Medline (Ovid)	1 (Electronic cigarette* or E-cigarette* or Electronic nicotine delivery system* or Electronic non-nicotine delivery* or Electronic nicotine device* or Electronic non-nicotine device* or Vape or Vaping or Vapo* or E-hookah or Electronic inhalant device or E-liquid).af. 2 (Smoker* or non-smoker* or ex-smoker* or Combustible cigarette or Tobacco smoking or Smoking or Cigarette or Cigarette smoking or Cigar smoking).af. 3 (Initiat* or Uptak* or Subsequent* or Predict* or Onset).af. 4 1 and 2 and 3	1168 (04/02/2020)
Cochrane	1. MeSH descriptor: [Electronic Nicotine Delivery Systems] explode all trees 2. ("Electronic cigarette" OR E-cigarette OR Vape OR Vaping OR E-hookah OR "Electronic inhalant device" OR E-liquid OR "Electronic Nicotine Delivery Systems"):ti,ab,kw 3. #1 OR #2 4. (Smoker* or non-smoker* or ex-smoker* or Combustible cigarette or Tobacco smoking or Smoking or Cigarette or Cigarette smoking or Cigar smoking):ti,ab,kw 5. #4 OR #5 6. (Initiat* OR Uptak* OR Subsequent* OR Progress* OR Predict* OR Duration OR Intens* OR Frequen* OR Onset):ti,ab,kw 7. #3 AND #6 AND #7	219 (01/04/2020)

Supplementary Table 4: AMSTAR2[17] rating of included systematic review studies

Criteria	Aladeokin & Haighton 2019[39]	Soneji et al. 2017[16]	Khouja et al. 2020[38]
1. Did the research questions and inclusion criteria for the review include the components of PICO?	Yes	Yes	Yes
2. Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?	Yes	No	Partial Yes
3. Did the review authors explain their selection of the study designs for inclusion in the review?	Yes	Yes	Yes
4. Did the review authors use a comprehensive literature search strategy?	Partial Yes	Partial Yes	Partial Yes
5. Did the review authors perform study selection in duplicate?	Yes	Yes	Yes
6. Did the review authors perform data extraction in duplicate?	No	No	Yes
7. Did the review authors provide a list of excluded studies and justify the exclusions?	No	No	No
8. Did the review authors describe the included studies in adequate detail?	Yes	Yes	Yes
9. Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?	Yes	Yes	Yes
10. Did the review authors report on the sources of funding for the studies included in the review?	No	No	No
11. If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?	Yes	Yes	Yes
12. If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?	Yes	Yes	Yes
13. Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review?	Yes	Yes	Yes
14. Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?	Yes	Yes	Yes
15. If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?	No	Yes	Yes
16. Did the review authors perform study selection in duplicate?	Yes	Yes	Yes
Rating overall confidence in the results of the review	Moderate	Moderate	Moderate

Supplementary Table 5: Primary research studies included in systematic reviews in the umbrella review that were included in the top-up systematic review

Authors/ Year	Title	Systematic review(s) included in	Country and data source(s)	Baseline cigarette use	E-cigarette use	Follow up cigarette use	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Barrington- Trimis et al., 2018[33]	E-cigarette Use and Subsequent Smoking Frequency Among Adolescents	Khouja et al., 2020	US (CA, CT): CHS, HH, YASS	Never	Ever	Ever	3.80 (3.10 – 4.66)	4.57 (3.56 – 5.87)
Best et al., 2018[35]	Relationship between trying an electronic cigarette and subsequent cigarette experimentation in Scottish adolescents: a cohort study	Aladeokin & Haighton 2019 Khouja et al., 2020	Scotland (UK): School-based	Never	Ever	Ever	4.62 (3.34 – 6.38)	2.42 (1.63 – 3.60)
East et al., 2018[34]	The Association Between Smoking and Electronic Cigarette Use in a Cohort of Young People	Aladeokin & Haighton 2019 Khouja et al., 2020	England (UK): AOSHGB	Never	Ever	Ever	12.31 (5.06 – 29.94)	10.57 (3.33 – 33.50)
Leventhal et al., 2015[32]	Association of Electronic Cigarette Use With Initiation of Combustible Tobacco Product Smoking in Early Adolescence	Khouja et al., 2020 Soneji et al., 2017	US (LA): YBRS - School-based	Never	Ever	Ever	2.95 (1.74 – 4.99)	1.75 (1.10 – 2.77)
Loukas et al., 2018[14]	Exclusive e-cigarette use predicts cigarette initiation among college students	Khouja et al., 2020	US (TX): M-PACT	Never	Ever	Ever	2.72 (2.10 – 3.53)	1.36 (1.01 – 1.83)
Lozano et al., 2017[36]	A longitudinal study of electronic cigarette use and onset of conventional cigarette smoking and marijuana use among Mexican adolescents	Khouja et al., 2020	Mexico: School-based	Never	Ever	Ever	2.46 (1.85 – 3.26)	1.60 (1.31 – 1.97)
Miech et al., 2017[31]	E-cigarette use as a predictor of cigarette smoking: results from a 1-year follow-up of a national sample of 12th grade students	Khouja et al., 2020 Soneji et al., 2017	US: MTD 2014-2015	Never	Ever	Ever	6.32 (1.73 – 23.10)	6.58 (2.04 – 57.88) [†]
Primack et al., 2015[29]	Progression to Traditional Cigarette Smoking After Electronic Cigarette Use Among US Adolescents and Young Adults	Khouja et al., 2020 Soneji et al., 2017	US: Dartmouth media survey 2012-2014	Never	Ever	Ever	5.66 (1.99 – 16.07)	8.3 (1.2 – 58.6)
Primack et al., 2018[30]	Initiation of Traditional Cigarette Smoking after Electronic Cigarette Use Among Tobacco-Naive US Young Adults	Khouja et al., 2020	US: Growth from Knowledge 2013-2014	Never	Ever	Ever	6.06 (2.15 – 17.10)	6.82 (1.65 – 28.25)
Spindle et al., 2017[28]	Electronic cigarette use and uptake of cigarette smoking: A longitudinal examination of U.S. college students	Khouja et al., 2020 Soneji et al., 2017	US: Mid-Atlantic university (S4S project)	Never	Ever	Ever	3.50 (2.41 – 5.09)	3.37 (1.91 – 5.94)
Treur et al., 2018[37]	E-cigarette and waterpipe use in two adolescent cohorts: cross-sectional and longitudinal associations with conventional cigarette smoking	Khouja et al., 2020	Netherlands	Never	Ever**	Ever	10.83 (8.87 – 13.22)	11.9 (3.36 – 42.11)

Unger et al., 2016[27]	E-cigarette use and subsequent cigarette and marijuana use among Hispanic young adults	Soneji et al., 2017	US (LA): Project RED	No current ^a	Current ^a	Current ^a	4.71 (2.27 – 9.77)	3.32 (1.55 – 7.11)
Wills et al., 2017[26]	Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii	Khouja et al., 2020 Soneji et al., 2017	US (HI): School-based	Never	Ever	Ever	4.25 (2.74 – 6.61)	2.87 (2.03 – 4.05)

Supplementary Table 6: Newcastle Ottawa Scale[18] (NOS) rating of newly-identified primary research studies

Study	Selection				Comparability	Outcome			Total
	Representativeness of the Exposed Cohort (★)	Selection of the Non-Exposed Cohort (★)	Ascertainment of Exposure (★)	Demonstration That Outcome of Interest Was Not Present at Start of Study (★)	Comparability of Cohorts on the Basis of the Design or Analysis (★★)	Assessment of Outcome (★)	Was Follow-Up Long Enough for Outcomes to Occur (★)*	Adequacy of Follow Up of Cohorts (★)‡	
Aleyan et al., 2019 [23]	★	★		★	★★		★		6
Barrington-Trimis et al., 2019 [43]	★	★		★	★★		★	★	7
Berry et al., 2019 [21]	★	★	★	★	★★		★	★	8
Bold et al., 2018 [40]	★	★		★	★		★		5
Brose et al., 2019 [25]	★	★		★	★★		★		6
Chien et al., 2019 [22]	★	★		★	★★		★	★	7
Conner et al., 2019 [42]	★	★		★	★★		★		6
Dai et al., 2019 [46]	★	★	★	★	★★		★	★	8
Kinnunen et al., 2019 [24]	★	★		★	★★		★		6
McMillen et al., 2019 [45]	★	★	★	★	★★		★	★	8
Osibogun et al., 2020[44]	★	★	★	★	★★		★	★	8
Pénzes et al., 2018 [41]	★	★		★	★★		★		6

* 6 months considered adequate follow-up time

‡ Studies with less than 30% loss to follow-up considered adequate

Supplementary Table 7: Study characteristics from newly-identified studies for the top-up systematic review

Study	Country and data source	Study design	Duration (follow up and date range)	Study population - sample size - baseline age/ grade - % female	Consideration of confounding	NOS ¹ score
Aleyan et al., 2019 [23]	Canada (COMPASS Waves 1-3)	Longitudinal cohort	36 months (2014 to 2017)	- 6,729 - 9 th or 10 th grade - 54.2% female	Gender, grade, ethnicity, friends that smoke, weekly spending money, current cannabis use, and current binge drinking at each wave	6
Barrington-Trimis et al., 2019 [43]	US (CT and CA); CHS; HH; YASS ¹	Longitudinal cohort	12 months (2013 to 2015)	- 6,258 - Grades 9 to 12 - 53.5% female	Gender, grade, and cohort (CHS, H&H, YASS), school (H&H/YASS) or community (CHS)	7
Berry et al., 2019 [21]	US (PATH ³ Waves 1-3)	Longitudinal cohort	24 months (2013 to 2016)	- 6,123 - 12-15 years old, mean 13.4 years (SD 1.2) - 49.5% female	Age, gender, income, race and ethnicity, parental education, urban residence, living with a tobacco user, frequency of noticing health warnings on cigarette packages, and ability to recall a favourite tobacco advertisement. Risk-taking behaviours, sensation-seeking personality traits, and cigarette susceptibility	8
Bold et al., 2018 [40]	US (CT)	Longitudinal cohort	36 months (2013 to 2015)	- 808 - Mean 15.04 years (SD 0.90) - 53% female	School, sociodemographic characteristics (sex, race/ethnicity, SES), and use of other tobacco products.	5
Brose et al., 2019 [25]	UK (National web-based survey 2012-2017)	Longitudinal cohort	12 months (2016 to 2017)	- 374 - Mean 49.2 years (SD 14.1) - 44% female	Time quit smoking, vaping status, gender, income and NRT use	6
Chien et al., 2019 [22]	Taiwan (TAALS ⁴ Waves 1-2)	Longitudinal cohort	24 months (2014 to 2016)	- 12,954 - 36.9% ever smokers female; 58.1% never smokers female	Smoking susceptibility at baseline, socio-demographic profile, psychological status, and peer support.	7
Conner et al., 2019 [42]	UK (England); RCT Waves 3 and 5	Post-hoc analysis of a cluster RCT	24 months (2014 – 2016)	- 3,994 - 13 to 14 years old - 52.3% female	Sociodemographic (gender, ethnicity, family affluence, percentage of children per school eligible for free school meals); friends' smoking status, family smoking, impulsiveness	6
Dai et al., 2019 [46]	US (PATH ³ Waves 1-2)	Longitudinal cohort	12 months (2013 to 2015)	- 4,094 - Adults (≥18 years) - 45.9% female	Sociodemographic (age, sex, race, education, poverty level, region, and health insurance) and tobacco use characteristics (smoking chronicity, typical number of combustible cigarettes smoked per day during the period of regular smoking, and length of time since quit smoking)	8
Kinnunen et al., 2019 [24]	Finland (MetLoFIN ⁵ (school-based))	Longitudinal cohort	18 months (2014 to 2016)	- 3,474 - Grade 9 (ages 15 to 16 years) - 51.8% female	Gender, socioeconomic background, parents' education, other tobacco product and drug use, school clustering. Crude and adjusted logistic regressions were also conducted with the Firth's bias-reduced logistic regression	6
McMillen et al., 2019 [45]	US (PATH ³ Waves 1-2)	Longitudinal cohort	12 months (2013 to 2015)	- 8,108 - Adults (≥18 years) - 54.4% distant former smoker female; 40.0% never smoker female	Sociodemographic (race/ethnicity, sex, age, education); psychosocial predictors of combustible cigarette smoking risk (household smoking rules and living with someone who smokes)	8
Osibogun et al., 2020 [44]	US (PATH ³ Waves 1-3)	Longitudinal cohort	36 months (2013 to 2016)	- 14,623 - Ages 12-17 years - 48% female	Sociodemographic and tobacco-related factors	8
Pénzes et al., 2018 [41]	Romania (ASPIRA ⁶ RCT)	Secondary analysis from data in cluster RCT	6 months (2014 to 2015)	- 1,369 - Grade 9, mean 14.88 (SD 0.48)	Intervention/control condition, gender, age, the design effect due to the cluster sampling and used schools as cluster units	6

¹ NOS: Newcastle-Ottawa Scale (out of a total of 10)

² CHS: Children's Health Study; HH: Happiness & Health Study; YASS: Yale Adolescent Survey Study

³ PATH: Population Assessment of Tobacco and Health Study

⁴ TAALS: The Taiwan Adolescent to Adult Longitudinal Study

⁵ MetLoFIN: Metropolitan Longitudinal Finland

⁶ ASPIRA: A Smoking Prevention Interactive Experience [Roman acronym for translation of ASPIRE]

Supplementary Figure 1: Funnel plots to assess the risk of bias across studies

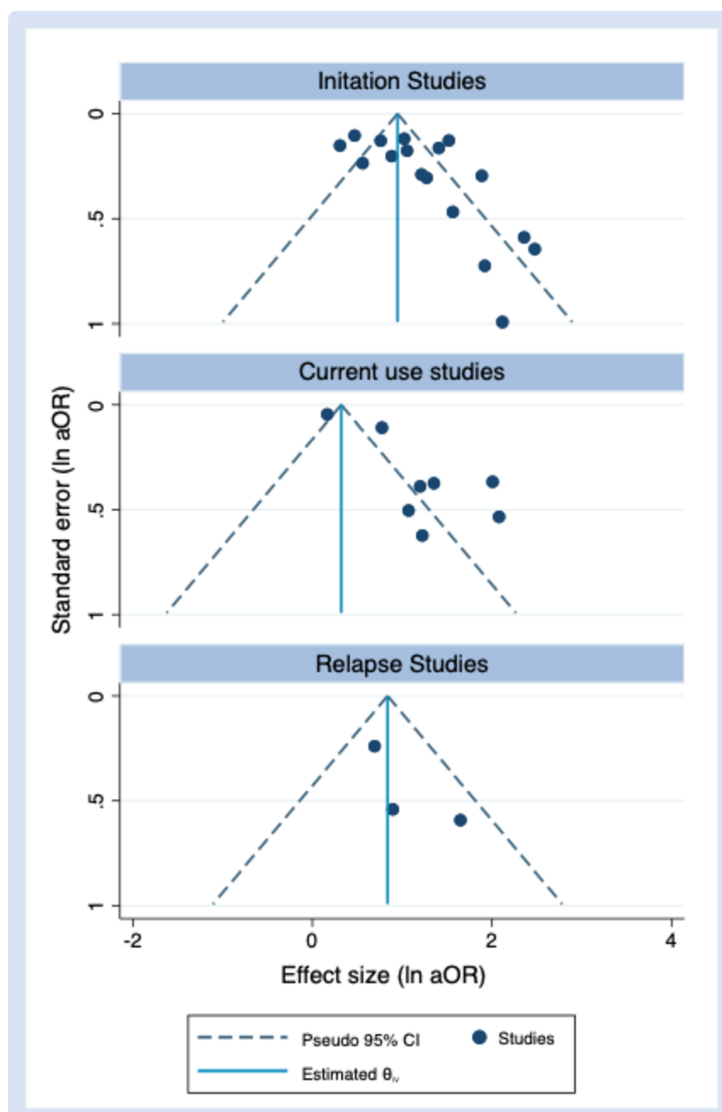


Figure: Funnel plots with pseudo 95% confidence limits