

Objective

- E-cigarettes are often marketed as a safer alternative to combustible cigarettes, however their health effects, especially those associated with long-term use, remain largely uncertain.
- We conduct an umbrella review of cardiopulmonary and carcinogenic risks of e-cigarette use, distinguishing between their short-term and long-term health effects and considering both the absolute harm of e-cigarettes and their harm/benefits relative to smoking.

Methods

- The search for systematic reviews examining cardiovascular, respiratory, pulmonary and carcinogenic effects of e-cigarettes was conducted across five electronic databases through January 25th 2022.
- Methodological quality of systematic reviews is assessed with the AMSTAR-2 quality appraisal tool.¹
- AMSTAR-2 critical domains:**
 - Protocol registered before commencement of the review (item 2)
 - Adequacy of the literature search (item 4)
 - Justification for excluding individual studies (item 7)
 - Risk of bias from individual studies being included in the review (item 9)
 - Appropriateness of meta-analytical methods (item 11)
 - Consideration of risk of bias when interpreting the results of the review (item 13)
 - Assessment of presence and likely impact of publication bias (item 15)

Results

- Seventeen systematic reviews were included in our review.
- Four reviews were of low, and thirteen of critically low methodological quality.
- There was clear underreporting of e-cigarette device types, duration of use, and smoking status of study participants across reviews.
- Short-term use of e-cigarettes may be associated with acute cardiopulmonary risks, although to a lesser extent compared to cigarette use.
- Long-term e-cigarette use may have cardiopulmonary benefits in those who switched from chronic cigarette smoking, in particular in individuals with asthma and COPD.
- Evidence on intermediate and long-term carcinogenic effects is lacking.

Conclusions

- The present umbrella review highlights important methodological weaknesses of existing secondary research
- It underlines the urgent need for systematic reviews with better adherence to established reporting guidelines, consistent definition of duration of e-cigarette use, focus on newer generation devices and accounting for the impact of former or current smoking.

References

¹Shea BJ et al., 2017, *BMJ*, doi: 10.1136/bmj.j4008

Funding

This research was funded by National Cancer Institute (NCI) and Food and Drug Administration (FDA) grant U54CA229974.

Disclosure

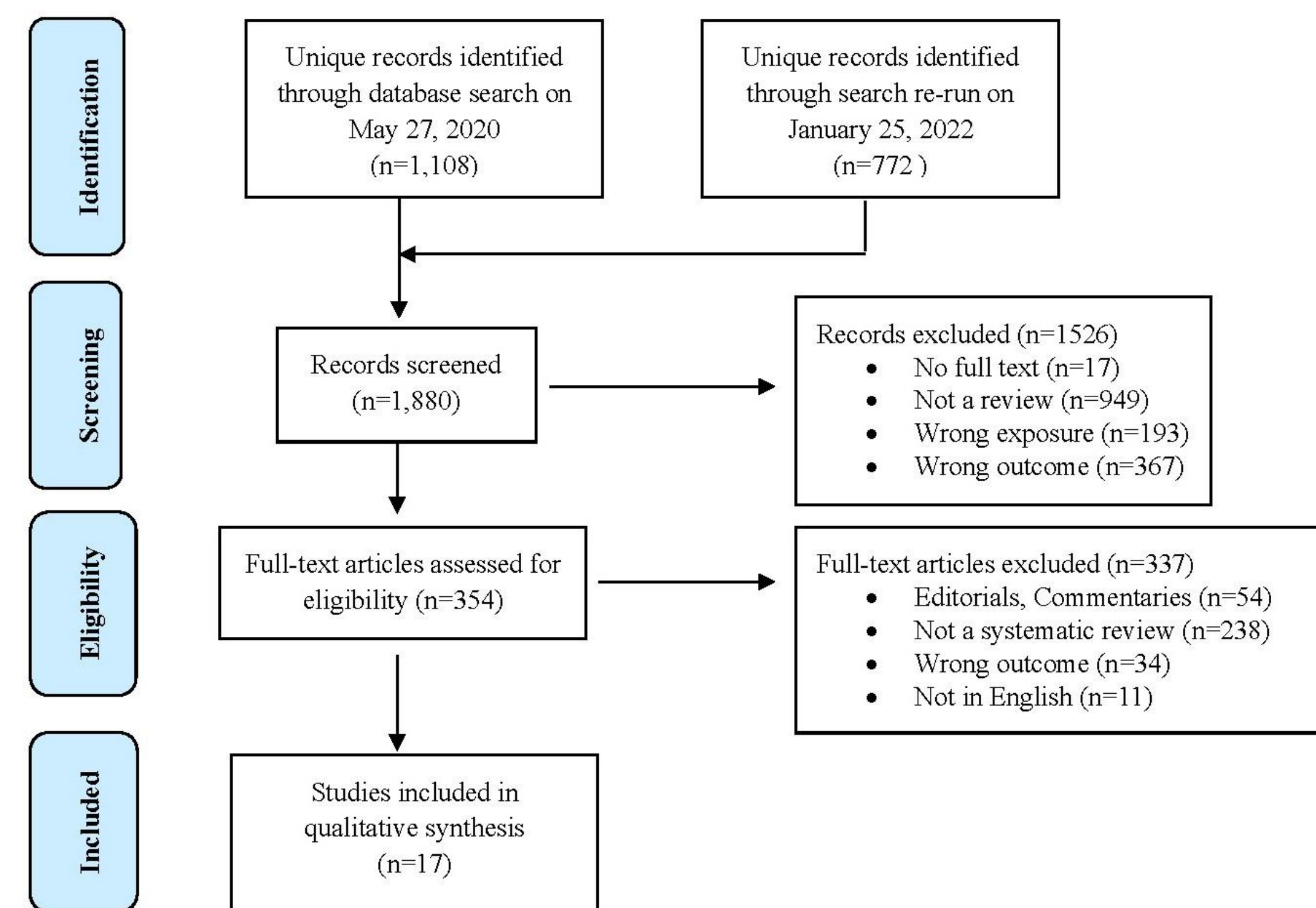
The authors declare that there is no conflict of interests.

Corresponding author

Nargiz Travis, MSPH
Lombardi Comprehensive
Cancer Center,
Georgetown University,
Washington D.C., USA
E-mail: nt526@georgetown.edu



Figure 1. PRISMA Flow diagram of the study selection process.



Source: <http://www.prisma-statement.org/>

Table 1. Appraisal of methodological quality of the included systematic reviews using AMSTAR-2 checklist.

| AMSTAR 2 Items | 1 | 2* | 3 | 4* | 5 | 6 | 7* | 8 | 9* | 10 | 11* | 12 | 13* | 14 | 15* | 16 | Overall Score |
|-----------------------------|---|----|---|----|---|---|----|---|----|----|-----|----|-----|----|-----|----|---------------|
| Kennedy et al. 2019 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | L |
| Goniewicz et al. 2020 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | L |
| Larue et al. 2021 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | L |
| Chand, Hosseinzadeh. 2021 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | L |
| NASEM | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Gualano et al. 2014 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Boiser et al. 2020 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Garcia et al. 2020 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Glässer et al. 2017 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Harrell et al. 2014 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Ioakimidis et al. 2016 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Pisinger, Dossing 2014 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Skotsimara et al. 2019 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Wills et al. 2021 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Xian, Chen 2021 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Martinez-Morata et al. 2021 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |
| Bravo-Gutierrez et al. 2021 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | CL |

●=yes, ●=partial yes, ●=no, NA=not applicable. *Critical domains. AMSTAR 2 overall confidence scores: High (H)-no or one non-critical weakness; Moderate (M)-more than one non-critical weakness; Low (L)-one critical flaw with or without non-critical weaknesses; Critically low (CL)-more than one critical flaw with or without non-critical weaknesses.