



SHAREABLE PDF

# E-cigarette use and respiratory disorders: an integrative review of converging evidence from epidemiological and laboratory studies

Thomas A. Wills<sup>1</sup>, Samir S. Soneji<sup>2</sup>, Kelvin Choi<sup>3</sup>, Ilona Jaspers<sup>4</sup> and Elizabeth K. Tam<sup>5</sup>

**Affiliations:** <sup>1</sup>Cancer Prevention Program, University of Hawaii Cancer Center, Honolulu, HI, USA. <sup>2</sup>Dartmouth Institute for Health Policy and Clinical Practice, Geisel School of Medicine at Dartmouth, Hanover, NH, USA. <sup>3</sup>Division of Intramural Research, National Institute on Minority Health and Health Disparities, Bethesda, MD, USA. <sup>4</sup>Center for Environmental Medicine, Asthma and Lung Biology, University of North Carolina School of Medicine, Chapel Hill, NC, USA. <sup>5</sup>Dept of Medicine, John A. Burns School of Medicine, Honolulu, HI, USA.

**Correspondence:** Thomas A. Wills, Cancer Prevention in the Pacific Program, University of Hawaii Cancer Center, 701 Ilalo Street, Honolulu, HI 96813, USA. E-mail: [twills@cc.hawaii.edu](mailto:twills@cc.hawaii.edu)

 @ERSpublications

**Epidemiological studies show a relationship of e-cigarette use with asthma and COPD, and laboratory studies show their adverse effects on four biological processes. It can be concluded that e-cigarette use is of significant concern for public health.** <https://bit.ly/3drH4pj>

**Cite this article as:** Wills TA, Soneji SS, Choi K, *et al.* E-cigarette use and respiratory disorders: an integrative review of converging evidence from epidemiological and laboratory studies. *Eur Respir J* 2021; 57: 1901815 [<https://doi.org/10.1183/13993003.01815-2019>].

This single-page version can be shared freely online.

## ABSTRACT

**Background:** Use of electronic cigarettes (e-cigarettes) is prevalent among adolescents and young adults, but there has been limited knowledge about health consequences in human populations. We conduct a systematic review and meta-analysis of results on respiratory disorders from studies of general-population samples and consider the mapping of these results to findings about biological processes linked to e-cigarettes in controlled laboratory studies.

**Method:** We conducted a literature search and meta-analysis of epidemiological studies on the association of e-cigarette use with asthma and with COPD. We discuss findings from laboratory studies about effects of e-cigarettes on four biological processes: cytotoxicity, oxidative stress/inflammation, susceptibility to infection and genetic expression.

**Results:** Epidemiological studies, both cross-sectional and longitudinal, show a significant association of e-cigarette use with asthma and COPD, controlling for cigarette smoking and other covariates. For asthma (n=15 studies), the pooled adjusted odds ratio (aOR) was 1.39 (95% CI 1.28–1.51); for COPD (n=9 studies) the aOR was 1.49 (95% CI 1.36–1.65). Laboratory studies consistently show an effect of e-cigarettes on biological processes related to respiratory harm and susceptibility to illness, with e-cigarette conditions differing significantly from clean-air controls, although sometimes less than for cigarettes.

**Conclusions:** The evidence from epidemiological studies meets established criteria for consistency, strength of effect, temporality, and in some cases a dose–response gradient. Biological plausibility is indicated by evidence from multiple laboratory studies. We conclude that e-cigarette use has consequences for asthma and COPD, which is of concern for respiratory and public health.

---

The content of this work is not subject to copyright. Design and branding are copyright ©ERS 2021. This version is distributed under the terms of the Creative Commons Attribution Non-Commercial Licence 4.0.