



E-cigs have similar risks to cigs for some diseases and nearly as high for others. Dual use is riskier than smoking alone.



It is commonly assumed that e-cigarettes are substantially less risky than cigarettes. This assumption is based on the fact that e-cigarettes do not burn tobacco, so avoid the toxic combustion products that cigarettes produce.

In recent years, however, evidence on the health risks of e-cigarettes has been rapidly accumulating on the associations between e-cigarette use and actual disease in the population. The 2024 *NEJM Evidence* paper “[Population-Based Disease Odds for E-Cigarettes and Dual Use versus Cigarettes](#)” uses these epidemiological studies to conclude that *for cardiovascular disease, stroke and metabolic dysfunction e-cigarette risks are similar to cigarettes and for respiratory and oral disease, while lower risk than cigarettes, the risks are still substantial. Dual use (using e-cigarettes and cigarettes at the same time) is riskier than smoking alone for all outcomes.*

In addition to comparing the risks of e-cigarettes with cigarettes – the comparison of most interest when thinking about adult “switching” – the paper also estimated the risks associated with e-cigarette use and dual use compared to non-use. All these risks are also elevated.

The finding of comparable or slightly lower risks for e-cigarettes undermines the argument that e-cigarettes are an effective tool for harm reduction for smokers, because the harms of e-cigarette use are not substantially below cigarettes.

Regarding dual use of e-cigarettes and cigarettes, the paper notes, “E-cigarettes expose users to a different toxic chemical mix than cigarettes, including compounds formed during heating and aerosolization that are not present in the e-liquid itself. Although there is some overlap, dual use of e-cigarettes and cigarettes together delivers a wider range of toxins than either does alone. These facts, combined with the observation that daily cigarette consumption among exclusive smokers and dual users was not different, may explain the higher odds ratios observed among dual users compared with cigarette smoking alone. *It is important to account for dual use when assessing population health impacts of e-cigarette use, because the increased odds ratios associated with dual use compared with just smoking applies among smokers who use e-cigarettes who do not ‘switch completely, raising the overall population impact associated with e-cigarette use.* [emphasis added]”

The paper concludes:

The findings of increased odds of several diseases for e-cigarettes compared with nonuse illustrates the substantial risks for people, particularly youth and young adults, who initiate nicotine use with e-cigarettes and former smokers who restart nicotine use with e-cigarettes. *Even without considering the millions of youth who initiate nicotine use with e-cigarettes, these results suggest a need for a careful reassessment of the assumption that e-cigarettes are a substantially less harmful alternative to cigarettes, particularly given the fact that, as consumer products, e-cigarettes are not associated with increased smoking cessation and, over the long run, are associated with less cessation and increased odds of becoming a dual user.* [emphasis added]

It is time for people – and regulatory agencies – to stop making decisions on the premise that e-cigarettes produce fewer combustion products than cigarettes and start using actual disease risks. This is particularly important because e-cigarettes produce a different mix of toxicants than cigarettes, many of which have not yet been specifically identified. *Based on actual disease risks and accounting for dual use, e-cigarettes may increase, not reduce, harm.*

Citation: Glantz SA, Nguyen N, Oliveira da Silva AL. Population-Based Disease Odds for E-Cigarettes and Dual Use versus Cigarettes. *NEJM Evidence* 2024; 3(3): DOI: 10.1056/EVIDoA2300229. It is available for free [here](#). The accompanying editorial is [here](#).

Q&A ABOUT THE STUDY

- **How was the study done?**

The authors searched the peer reviewed literature through October 1, 2023, yielding 107 papers. To be included analysis, a study had to control for cigarette smoking or be of never smokers. Risk estimates were pooled using a random effects meta-analysis for disease outcomes where there were at least 5 papers. There is also limited evidence for other diseases; those other diseases are listed without drawing conclusions.

- **How could the risks associated with e-cigarettes be similar to smoking when they don't produce combustion products like a cigarette?**

E-cigarettes are *different* from cigarettes. While they do not produce the combustion products that a cigarette does, they produce thousands of chemicals, many of which are toxic and harmful to human health. Both e-cigarettes and cigarettes deliver nicotine using an aerosol of ultrafine particles and breathing those particles carries substantial disease risk.

- **How do we know if the disease in e-cigarettes users is not just remaining damage from their smoking days, especially given that studies don't always know the sequencing between disease and e-cigarette adoption?**

The analysis is based on *current* use, usually the past 30 days. Some of the studies also controlled for former smoking in their analysis. Whether the study controlled for former use did not affect the odds ratio estimates. In addition, several studies limited themselves to never-smokers and still found risks associated with e-cigarette use. For many diseases, effects of smoking start to [reverse quickly](#)¹ when someone stops.

- **What about cancer?**

There was only one paper reporting cancer results, which is not enough to produce a quantitative estimate for risks of e-cigarette or dual use or comparisons with cigarette smoking. But, e-cigarette users and cigarette smokers experience [similar levels of DNA damage](#)²—more than twice the amount found in people who do not use either product. At least 543 cancer-related genes are [adversely affected](#) in people who use e-cigarettes, 44% of what cigarettes do.³ Breathing e-cigarette aerosol [causes lung cancer and bladder hyperplasia in mice](#).⁴ Cancer accounts for about one-third of smoking-caused deaths.

Abstract

BACKGROUND E-cigarettes are promoted as less harmful than cigarettes. There has not been a direct comparison of health effects of e-cigarettes or dual use (concurrently using e-cigarettes and cigarettes) with those of cigarettes in the general population.

METHODS Studies in PubMed, EMBASE, Web of Science, and PsychINFO published through October 1, 2023, were pooled in a random-effects meta-analysis if five or more studies were identified with a disease outcome. We assessed risk of bias with Risk Of Bias In Non-randomized Studies of Exposure and certainty with Grading of Recommendations, Assessment, Development, and Evaluations. Outcomes with fewer studies were summarized but not pooled.

RESULTS We identified 124 odds ratios (94 cross-sectional and 30 longitudinal) from 107 studies. Pooled odds ratios for current e-cigarette versus cigarette use were not different for cardiovascular disease (odds ratio, 0.81; 95% confidence interval, 0.58 to 1.14), stroke (0.73; 0.47 to 1.13), or metabolic dysfunction (0.99; 0.91 to 1.09) but were lower for asthma (0.84; 0.74 to 0.95), chronic obstructive pulmonary disease (0.53; 0.38 to 0.74), and oral disease (0.87; 0.76 to 1.00). Pooled odds ratios for dual use versus cigarettes were increased for all outcomes (range, 1.20 to 1.41). Pooled odds ratios for e-cigarettes and dual use compared with nonuse of either product were increased (e-cigarette range, 1.24 to 1.47; dual use, 1.49 to 3.29). All studies had low risk of bias. Results were generally not sensitive to study characteristics. Limited studies of other outcomes suggest that e-cigarette use is associated with additional diseases.

CONCLUSIONS There is a need to reassess the assumption that e-cigarette use provides substantial harm reduction across all cigarette-caused diseases, particularly accounting for dual use.

¹ CDC. Benefits of Quitting. https://www.cdc.gov/tobacco/quit_smoking/how_to_quit/benefits/index.htm.

² Tommasi et al. Vaping Dose, Device Type, and E-Liquid Flavor are Determinants of DNA Damage in Electronic Cigarette Users. *Nicotine Tob Res.* 2023 May 22;25(6):1145-1154. doi: 10.1093/ntr/ntad003. PMC10202635.

³ Tommasi et al. Vaping Dose, Device Type, and E-Liquid Flavor are Determinants of DNA Damage in Electronic Cigarette Users. *Nicotine Tob Res.* 2023 May 22;25(6):1145-1154. doi: 10.1093/ntr/ntad003. PMC10202635.

⁴ Tang et al. Electronic-cigarette smoke induces lung adenocarcinoma and bladder urothelial hyperplasia in mice. *Proc Natl Acad Sci U S A.* 2019 Oct 22;116(43):21727-21731. doi: 10.1073/pnas.1911321116. PMC6815158.