



Evidence on the Health Impacts of E-Cigarettes and Vaping

Unless noted, information in this document is from the National Academies of Sciences, Engineering and Medicine (NASEM) 2018 report *Public Health Consequences of E-Cigarettes*, the most rigorous and comprehensive review of the science to date. In this report, “conclusive evidence” was the strongest level of evidence, indicating multiple high-quality studies supported the finding. “Substantial evidence” means that existing studies support a firm conclusion, but not enough evidence exists to completely rule out some limitations like chance or bias.

Short and Long-term Health Effects of E-Cigarettes

The NASEM review found some novel adverse health effects from e-cigarettes as well as some similarities to health outcomes from smoking, such as addiction and vascular cell damage. Overall, the health effects of e-cigarettes are less severe than smoking in the short-term. Evidence for long-term harm does not exist, though mechanisms for long-term harm, such as the presence of chemicals that can damage DNA, are present in e-cigarettes. Specifically, NASEM found conclusive evidence that:

- Electronic nicotine delivery devices can explode, causing burns and other injuries.
- Exposure to e-liquids through skin, eyes and mouth can result in poisoning.

NASEM found substantial evidence that:

- Use of e-cigarettes can result in symptoms of dependence.
- Heart rate increases in the short-term after taking in nicotine from e-cigarettes.
- Exposure to aerosols from e-cigarettes can cause dysfunction in the thin layer of cells that line blood vessels (endothelial cells). Such dysfunction is related to development of cardiovascular disease and is seen in exposure to tobacco smoke. However, there is not yet clear evidence about the effects of long-term exposure as there is with tobacco smoke.
- Exposure to some components of e-cigarette aerosols can produce oxidative stress, which is linked to many inflammatory diseases. Existing evidence shows that oxidative stress from e-cigarettes is generally lower than that from combustible tobacco and the consequences of long-term exposure are unknown.
- A complete switch from regular smoking to e-cigarettes reduces adverse health outcomes in the short-term.

Youth Use and Risk for Smoking

Beyond the health effects above, youth and young adults are at additional risk from e-cigarettes that contain nicotine. According to the 2016 Surgeon General report *E-Cigarette Use Among Youth and Young Adults*, nicotine consumption is not safe for youth, pregnant women and fetuses. In adolescents, nicotine can harm brain development.

While older adults who use e-cigarettes have typically started after regular smoking, youth and young adults use e-cigarettes as a first tobacco product. A large population of non-smoking young people have tried e-cigarettes. Because of the addictiveness of nicotine, public health professionals are concerned about the potential transition from vaping to cigarettes, products that kill about half of users. Reviewing studies available at the time of the report, NASEM found substantial evidence that e-cigarette use increases the risk of smoking among youth and young adults.

Nicotine salt products like Juul are very new to the market, and their health impacts are even less tested than older products. According to the Surgeon General's 2018 *advisory*, nicotine salt devices deliver a higher volume of nicotine more smoothly than combustible tobacco or other vaping products. Regarding the new surge of use caused by nicotine salt products, the Surgeon General warns, "we must take action now to protect the health of our nation's young people."

Use by Adults Who Smoke

The NASEM found conclusive evidence that completely substituting e-cigarettes for combustible tobacco cigarettes reduces users' exposure to numerous toxicants and carcinogens present in combustible tobacco cigarettes. Trials of e-cigarettes for cessation have shown mixed outcomes, as have studies that look at cessation in the adult smoking population since the introduction of e-cigarettes. NASEM notes that completely switching from combustible products to e-cigarettes is likely to confer health benefits, but reducing the amount of combustible tobacco use by using e-products (i.e., dual use) likely does not confer a substantial benefit because even low exposure to smoking toxicants leads to cardiovascular disease.

Challenges to Establishing Evidence

Several important barriers prevent public health from presenting conclusive evidence on e-cigarettes:

- Electronic nicotine delivery devices are very new; establishing the evidence of harm from smoking took decades.
- Variability of devices and between constituents of e-liquids means that toxicants and risks are not equally present in all exposures to aerosols. There is likely a harm continuum within the range of available e-cigarettes.
- Evidence from countries with different tobacco norms and regulatory frameworks may not be applicable to the US and Washington context. For instance, an increase in the vaping rate by Canadian youth was several years delayed from the US increase, and the UK bans online promotion of e-cigarettes.
- Lastly, research funding from the e-cigarette and greater tobacco industries has a likelihood of biasing published results from those studies.

Sources:

1. National Academies of Sciences, Engineering, and Medicine, 2018. *Public health consequences of e-cigarettes*. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/24952>
2. U.S. Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults. A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Promotion, Office on Smoking and Health, 2016.
3. Surgeon General's Advisory on E-Cigarette Use Among Youth, 2018. <https://e-cigarettes.surgeongeneral.gov/documents/surgeon-generals-advisory-on-e-cigarette-use-among-youth-2018.pdf>.

Research compiled and summarized by the University of Washington Tobacco Studies Program

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