

# New report one of the most comprehensive studies on health effects of e-cigarettes

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A new congressionally mandated [report](#) from the National Academies of Sciences, Engineering, and Medicine takes a comprehensive look at evidence on the human health effects of e-cigarettes. Although the research base is limited given the relatively short time e-cigarettes have been used, the committee that conducted the study identified and examined over 800 peer-reviewed scientific studies, reaching dozens of conclusions about a range of health impacts.

Evidence suggests that while e-cigarettes are not without [health](#) risks, they are likely to be far less harmful than conventional cigarettes, the report says. They contain fewer numbers and lower levels of [toxic substances](#) than conventional cigarettes, and using e-cigarettes may help adults who smoke conventional cigarettes quit smoking. However, their long-term [health effects](#) are not yet clear. Among youth—who use e-cigarettes at higher rates than adults do—there is substantial [evidence](#) that [e-cigarette](#) use increases the risk of transitioning to smoking conventional cigarettes.

E-cigarettes are a diverse group of products containing a heating element that produces an aerosol from a liquid that users can inhale via a mouthpiece, and include a range of devices such as "cig-a-likes," vape tank systems, and vape mods. Millions of Americans use e-cigarettes, and e-cigarette use is generally greatest among [young adults](#) and decreases with age. Use varies substantially across demographic groups, including age, gender, race, and ethnicity. For example, among youth and adults, use is typically greater among males than females.

Whether e-cigarettes have an overall positive or negative impact on public health is currently unknown, the report says. More and better research on e-cigarettes' short- and long-term effects on health and on their relationship to conventional smoking is needed to answer that question with clarity.

"E-cigarettes cannot be simply categorized as either beneficial or harmful," said David Eaton, chair of the committee that wrote the report, and dean and vice provost of the Graduate School of the University of Washington, Seattle. "In some circumstances, such as their use by non-smoking adolescents and young adults, their adverse effects clearly warrant concern. In other cases, such as when adult smokers use them to quit smoking, they offer an opportunity to reduce smoking-related illness."

The report offers conclusions about e-cigarette use and a range of health impacts, including the following, and it notes the strength of the evidence for each conclusion.

## **Exposure to nicotine**

- There is conclusive evidence that exposure to nicotine from e-cigarettes is highly variable and depends on the characteristics of the device and the e-liquid, as well as on how the device is operated.
- There is substantial evidence that nicotine intake from e-cigarettes among experienced adult e-cigarette users can be comparable to that from conventional cigarettes.

## **Exposure to toxic substances**

- There is conclusive evidence that in addition to nicotine, most e-

cigarettes contain and emit numerous potentially toxic substances.

- There is substantial evidence that except for nicotine, exposure to potentially toxic substances from e-cigarettes (under typical conditions of use) is significantly lower compared with conventional cigarettes.

## **Dependence and abuse liability**

- There is substantial evidence that e-cigarette use results in symptoms of dependence on e-cigarettes.
- There is moderate evidence that risk and severity of dependence is lower for e-cigarettes than for conventional cigarettes.
- There is moderate evidence that variability in the characteristics of e-cigarette products (nicotine concentration, flavoring, device type, and brand) is an important determinant of the risk and severity of dependence on e-cigarettes.

## **Harm reduction**

- There is conclusive evidence that completely substituting e-cigarettes for conventional cigarettes reduces users' exposure to many toxicants and carcinogens present in conventional cigarettes.
- There is substantial evidence that completely switching from regular use of conventional cigarettes to e-cigarettes results in reduced short-term adverse health outcomes in several organ systems.

## **Use by youth and young adults**

- There is substantial evidence that e-cigarette use by youth and

young adults increases their risk of ever using conventional cigarettes.

## **Secondhand exposure**

- There is conclusive evidence that e-cigarette use increases airborne concentrations of particulate matter and nicotine in indoor environments compared with background levels.
- There is moderate evidence that second-hand exposure to nicotine and particulates is lower from e-cigarettes compared with conventional cigarettes.

## **Cancer**

- There is no available evidence whether or not e-cigarette use is associated with intermediate cancer endpoints in humans. (An intermediate cancer endpoint is a precursor to the possible development of cancer; for example, polyps are lesions that are intermediate cancer endpoints for colon cancer.)
- There is limited evidence from animal studies using intermediate biomarkers of cancer to support the hypothesis that long-term e-cigarette use could increase the risk of cancer.

## **Respiratory effects**

- There is no available evidence whether or not e-cigarettes cause respiratory diseases in humans.
- There is moderate evidence for increased cough and wheeze in adolescents who use e-cigarettes, and an increase in asthma exacerbations.

## **Injuries and poisonings**

- There is conclusive evidence that e-cigarettes can explode and cause burns and projectile injuries. Such risk is significantly increased when batteries are of poor quality, stored improperly, or are being modified by users.
- There is conclusive evidence that intentional or accidental exposure to e-liquids (from drinking, eye contact, or skin contact) can result in adverse health effects such as seizures, anoxic brain injury, vomiting, and lactic acidosis.
- There is conclusive evidence that intentionally or accidentally drinking or injecting e-liquids can be fatal.

## **Reproductive and developmental effects**

- There is no available evidence whether or not e-cigarettes affect pregnancy outcomes.
- There is insufficient evidence whether or not maternal e-cigarette use affects fetal development.

Until more definite scientific data are available, population modeling can help estimate the balance of potential benefits and harms. Under the assumption that e-cigarette use increases the rate at which adults quit conventional smoking, modeling projects that use of e-cigarettes will generate a net public health benefit, at least in the short run. The harms caused by the higher rate of conventional cigarette smoking among youth who had used e-cigarettes will take decades to appear. For long-range projections, the net public health benefit is substantially less, and under some scenarios the net impact is harmful.

Maximizing the potential health benefits associated with e-cigarettes, the report says, will require determining with more precision whether and under what conditions e-cigarettes help people quit smoking; discouraging e-cigarette use among youth through education and access

restrictions; and increasing the devices' safety through data-driven engineering and design.

Provided by National Academies of Sciences, Engineering, and Medicine

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