

Action is needed to reduce e-cigarette use among adolescents to lower lifetime CVD risk

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E-cigarettes have become increasingly popular among adolescents, and the latest available scientific evidence suggests the use of these products leads to adverse health effects that may accrue over time, leading to an

increased risk of cardiovascular and pulmonary disease over the course of the life of people who use e-cigarettes, according to a new scientific statement from the American Heart Association published today in the Association's peer-reviewed journal, *Circulation: Research*.

A scientific statement is an expert analysis of current research and may inform future clinical practice guidelines. In this statement, "Cardiopulmonary Consequences of Vaping in Adolescents," experts in basic science, cellular and vascular biology, toxicology, pharmacology and epidemiology reviewed evidence-based studies focused on the cardiopulmonary effects of e-cigarette use in adolescents to inform on the short- and long-term risks of [vaping](#) and provide guidance to reduce vaping among adolescents.

"Most studies on the use of [e-cigarettes](#) have been conducted in adults or in animals," said Loren E. Wold, Ph.D., FAHA, chair of the writing group for the scientific statement and a professor and associate dean for research operations and compliance in the College of Medicine at The Ohio State University in Columbus, Ohio. "It's critical that we also understand how organ systems are affected in younger people who use e-cigarettes, and specifically, how these effects may persist into adulthood."

Electronic nicotine delivery systems (ENDS) contain a battery, an atomizer (or heating element) and a reservoir for e-liquid in the form of cartridges, tanks or pods. These devices deliver an aerosol (usually containing nicotine or THC, the main psychoactive compound in cannabis) to the user that is inhaled into the lungs. ENDS have been made to resemble pipes, hookah, cigars and cigarettes, with e-cigarettes being the most common. Among the latest iterations of e-cigarettes are devices that are small and often resemble a USB flash drive device. These devices contain e-liquids with high nicotine content in a salt form, combined with other chemicals.

Since e-cigarettes were introduced to the market in the early 2000s, their use has increased substantially, particularly among adolescents, reversing years of lower rates of tobacco use in youth and young adults and of declining nicotine dependency among users of standard, combustible cigarettes. In 2019, 27.5% of adolescents in grades 9-12 and 10.5% of younger adolescents in grades 6-8 reported vaping in the past month, according to the 2019 National Youth Tobacco Survey. The Association's scientific statement notes that although most new users of e-cigarettes have never smoked combustible cigarettes, adolescents who begin vaping now may become life-long nicotine or tobacco users and it is currently unknown what diseases may develop over a lifetime of vaping.

According to the statement, the [toxicity](#) of e-cigarettes remains poorly understood, in part because most e-cigarette manufacturers have not publicly disclosed the full list of ingredients of the many e-cigarette products. Since the exact composition of the products within the devices is not known, it is difficult to predict or determine the health effects on the lungs and heart. Other than nicotine, or THC, e-liquids contain vegetable glycerin and propylene glycol, which are on the U.S. Food and Drug Administration's (FDA) "generally regarded as safe" (GRAS) list. However, these compounds were not intended to be inhaled, and therefore, have not been tested in a way to determine how inhaling them may affect a person. When heated, these compounds often break down into other chemicals such as formaldehyde, which is a known carcinogen.

"Inhaling any foreign substance can have effects on the respiratory and cardiovascular systems," Wold said. "Furthermore, a person's lung development continues into the early 20s, so adolescents who vape are at risk for stunting or altering their lung development and may not reach full lung function."

Previous studies have found that people who use e-cigarettes have an increased risk for respiratory health issues, including:

- higher rates of wheezing and cough;
- greater prevalence of asthma;
- increased susceptibility to pulmonary (lung) infections; and
- increased incidence of respiratory disease.

Additionally, studies have found that young adults who use e-cigarettes experience arterial stiffness, impaired blood vessel function, and increased blood pressure and heart rate. This evidence suggests that acute cardiovascular effects of e-cigarettes may accrue over time with prolonged use, leading to increased risk of cardiovascular disease in people who use e-cigarettes over the long-term.

"While adolescents who use e-cigarettes may not feel that vaping is affecting them at the moment, it is increasingly clear that the chemicals contained in e-cigarette aerosols are harming cardiovascular cells, leading to changes that promote the development of heart disease over time," Wold said. "It usually takes decades before people who smoke combustible cigarettes develop [cardiovascular disease](#) and/or chronic-obstructive pulmonary disease, and the same may be true of vaping. A reduction in adolescent vaping rates likely may help to improve long-term cardiopulmonary outcomes among this group."

The statement writing committee noted that although the cardiopulmonary consequences of vaping are of central interest, vaping is already known to adversely affect important components of health. In particular, e-cigarette use impairs sleep quality, potentially affects mental health and leads to addiction through activation of certain brain pathways. Use of addictive substances such as nicotine during adolescence may influence addictive behaviors as an adult. This is highly concerning and may lead to lifelong addictions and unhealthy

interpersonal behavior or interaction in both social and occupational settings.

Studies have found that while some people may consider e-cigarettes as an aid to stop smoking combustible cigarettes, many people end up using both products regularly. The writing committee emphasized it is also important to distinguish between tobacco cessation and nicotine cessation. One study from the United Kingdom, where the amount of nicotine in e-cigarettes is much lower than in the U.S., found e-cigarettes may be more effective than nicotine patches at combustible tobacco cessation (18% vs. 10%, respectively); however, the study found e-cigarettes were only 20% successful in reducing nicotine consumption compared to 81% effectiveness for nicotine patches.

"The customizability of e-cigarettes, including power levels, e-liquid content and the abundance of flavors, appeals to young people, and it also makes regulation of these products difficult," Wold said. "While the FDA has issued a policy against mint and fruit flavors of e-liquids that are known to appeal to youth, for some product types, menthol-flavored products are still available. Additionally, there is no regulatory standard limiting the concentration of nicotine in e-liquids in the U.S. Some devices have been found to have nicotine levels of 59 mg/mL. In comparison, the European Union limits nicotine concentration in e-liquids to ≤ 20 mg/mL, which is comparable to the nicotine concentration in one standard combustible cigarette."

The statement suggests the following for reducing or preventing youth vaping:

- Remove from the market all flavored e-cigarettes, including menthol-flavored e-cigarettes;
- Provide more education for youth and their parents regarding the confirmed and potential health risks of e-cigarette use;

- Establish vaping curricula for medical students to inform the next generation of health care professionals;
- Ensure hospital-based, vaping-cessation programs for adolescents and adults;
- Regulate the marketing of e-cigarette products in traditional, online and social media platforms that are popular among [youth](#); and
- Incorporate e-cigarettes into smoke-free air laws.

More information: Cardiopulmonary Consequences of Vaping in Adolescents: A Scientific Statement From the American Heart Association, *Circulation Research* (2022). [DOI: 10.1161/RES.0000000000000544](#)

Provided by American Heart Association

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