

Vaping Linked to Brain, Artery and Lung Damage

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STORY AT-A-GLANCE

- › Using e-cigarettes, or vaping, is associated with significant health risks to your brain, arteries, lungs and more
- › Vaping poses risks throughout your body, including to your brain, where it may negatively impact neural health
- › Vaping also harms heart health and is linked to increases in blood pressure and arterial stiffness
- › The average vape pod contain as much nicotine as 20 cigarettes, and its e-liquid concoction is dissolved in an oily base, which poses additional risks when inhaled
- › The U.K. government introduced the Tobacco and Vapes Bill to significantly restrict the sale and use of tobacco and vaping products, aiming to create the first smoke-free generation

In the U.S., 4.5% of adults use electronic cigarettes (e-cigarettes) – otherwise known as vaping – putting their health at risk of serious damage. Usage is highest among youth aged 18 to 24 years. Among this population, 11% vape.¹

Among high school and middle school students, cigarette use is at an all-time low. Instead, e-cigarettes – also known as vapes, pod mods and vape pens – are the most commonly used tobacco product, with more than 1 in 4 using them daily and 1 in 3 using them at least 20 of the last 30 days.²

Unlike traditional smoking, vaping does not involve burning tobacco, leading many people to mistakenly believe that it's less harmful to your health. However, vaping is associated with significant health risks to your brain, arteries, lungs and more.

What Is Vaping – And Why Is It Dangerous?

Vaping refers to the act of inhaling and exhaling the aerosol produced by an e-cigarette or similar device. First-generation e-cigarettes, sometimes referred to as "cig-a-likes," are designed to look like traditional cigarettes. These devices are typically slim, small and have a glowing tip that mimics the appearance of a lit cigarette. They are usually disposable or feature replaceable cartridges that contain nicotine-laced liquid.

In contrast, newer versions of e-cigarettes, such as those resembling USB flash drives, represent a shift in both design and technology.³ These are often called "pod mods" and are more compact and discrete, with a USB-like design that makes them easy to carry and use. Unlike the first-generation cig-a-likes, pod mods usually come with prefilled or refillable pods and may include features like temperature control and variable voltage.

A popular example of this style is the Juul, which has become synonymous with the flash drive design in vaping devices. These modern devices are particularly appealing to younger users due to their sleek, discrete design. All of these devices heat a liquid – commonly called e-liquid or vape juice – that usually contains nicotine, flavorings and other chemicals to create a vapor that's inhaled.

A study by Johns Hopkins researchers found nearly 2,000 chemicals in e-cigarettes, many of which are unidentified.⁴ Among those that could be identified were caffeine, three industrial chemicals, including tributylphosphine oxide, a pesticide and two flavorings with the potential to cause toxic effects and irritation to the respiratory tract.⁵

"People just need to know that they're inhaling a very complex mixture of chemicals when they vape. And for a lot of these compounds, we have no idea what they actually are," senior author Carsten Prasse, an assistant professor of environmental health and

engineering at the Whiting School of Engineering and the Bloomberg School of Public Health, said in a news release.

"I have a problem with how vaping is being marketed as more healthy than smoking cigarettes. In my opinion we are just not at the point when we can really say that."⁶

Further, not only does the average vape pod contain as much nicotine as 20 cigarettes,⁷ but its e-liquid concoction is dissolved in an oily base, which poses additional risks. "We think that some of the vaporized elements of the oil are getting deep down into the lungs and causing an inflammatory response," says Johns Hopkins lung cancer surgeon Dr. Stephen Broderick.⁸

How Vaping Harms Your Brain

Vaping poses risks throughout your body, including to your brain, where it may negatively impact neural health. A study on mice looked into the toxic effects of short-term e-cigarette exposure on brain function and inflammatory responses.⁹ Results showed that both cigarette smoke and e-cigarette exposure delayed the mice's ability to locate food rewards, suggesting potential damage to their sense of smell and memory functions.

Further, mice exposed to e-cigarettes did not show improvement in memory tasks the following day, suggesting the exposure may have led to abnormalities in memory function. Examination of the mice's brains revealed signs of inflammation, and both groups also showed high levels of the inflammatory marker TNF- α .

The researchers concluded that e-cigarettes might have a toxicity profile similar to cigarette smoke, negatively affecting brain function. Early exposure to nicotine via vaping may also trigger long-term brain changes that influence attentional processes, potentially leading to attention deficit hyperactivity disorder (ADHD).¹⁰ As noted in a Surgeon General's Advisory on e-cigarette use among youth:¹¹

"E-cigarette aerosol is not harmless. Most e-cigarettes contain nicotine – the addictive drug in regular cigarettes, cigars, and other tobacco products.

Nicotine exposure during adolescence can harm the developing brain – which continues to develop until about age 25. Nicotine exposure during adolescence can impact learning, memory, and attention. Using nicotine in adolescence can also increase risk for future addiction to other drugs.”

E-Cigarettes May Cause Heart Problems

Vaping poses risks to heart health and is linked to increases in blood pressure and arterial stiffness.¹² With increased arterial stiffness, the heart must work harder to pump blood, since stiffer arteries do not expand as easily in response to blood flow. This can lead to heart muscle thickening (hypertrophy) and eventually heart failure.

In a study that used health data from the National Institutes of Health, researchers tracked 175,667 people with an average age of 52 for 45 months. Those who had used e-cigarettes at any point in their lifetime were 19% more likely to develop heart failure compared to those who never had.¹³ Overall, increased arterial stiffness is a significant risk factor for cardiovascular morbidity and mortality – and you’re also more likely to have a heart attack if you vape.

One study, presented at the 2019 American College of Cardiology’s Annual Scientific Session, found that adult e-cigarette smokers have a significantly higher risk of heart disease and mental health problems than nonsmokers, even after controlling for known risk factors such as body mass index and high blood pressure. Compared to nonsmokers, vapers were:¹⁴

- 34% more likely to have a heart attack
- 25% more likely to have coronary artery disease
- 55% more likely to suffer from depression or anxiety than nonsmokers with the same risk factors

Study author Dr. Mohinder Vindhyal, assistant professor at the University of Kansas School of Medicine Wichita, said in a news release:¹⁵

“When the risk of heart attack increases by as much as 55% among e-cigarettes users compared to nonsmokers, I wouldn’t want any of my patients nor my family members to vape. When we dug deeper, we found that regardless of how frequently someone uses e-cigarettes, daily or just on some days, they are still more likely to have a heart attack or coronary artery disease.”

E-Cigarettes Linked to Permanent Lung Damage

The ultrafine particles in e-cigarette vapors may be inhaled deep into the lungs. They also may contain chemical flavorants like diacetyl, which is linked to serious lung disease, as it may damage small passageways in the lungs.

This damage and inflammation can cause permanent scarring, leading to bronchiolitis obliterans, otherwise known as popcorn lung, which can lead to coughing, chest pain and shortness of breath.¹⁶

Inhaling the oily e-liquid from e-cigarettes may also lead to lipoid pneumonia, a specific type of lung inflammation that occurs when fats or oils enter the lungs. “There’s isn’t a good treatment for lipoid pneumonia, other than supportive care, while the lungs heal on their own,” says Broderick.

“The single-most important thing you can do is identify what is causing it – in this case vaping – and eliminate it.” Vaping may even increase the risk of primary spontaneous pneumothorax, or collapsed lung.¹⁷

E-cigarette or vaping use-associated lung injury, known as EVALI, is also possible. It refers to severe lung illness that occurs in those using e-cigarettes, possibly due to vitamin E acetate and other compounds in the products.¹⁸ In 2020, an outbreak of at least 2,807 EVALI cases occurred in the U.S., most requiring hospitalization, and deaths were reported.¹⁹

“At its core, EVALI is a serious disease that primarily affects the lungs and results in a substantial number of hospitalizations and deaths in a relatively young and otherwise healthy population across the United States,” Meghan Rebuli, assistant professor in the

Department of Pediatrics in the University of North Carolina School of Medicine, said in a news release.²⁰

Vaping Interferes With Your Immune System

Using e-cigarettes shouldn't be considered a "safe" form of smoking, as they may also put your immune system function at risk.²¹ "Vaping renders immune cells unable to move to meet threats," the University of Birmingham warned in a news release.²² The effect was seen with short, low-level exposure, suggesting that even occasional e-cigarette users may be at risk.

The effect is related to neutrophils, which are white blood cells that your immune system uses as a first line of defense.²³ They travel throughout your body, trapping and neutralizing bacteria or other pathogens that may cause disease.

Neutrophils exposed to vapor from e-cigarettes had high concentrations of the microfilament F-actin, which resulted in the cells being less able to move and function.²⁴ Conventional smoking is also known to affect neutrophils.

UK Introduces Bill to Create the First Smoke-Free Generation

On March 20, 2024, the U.K. government introduced the Tobacco and Vapes Bill to significantly restrict the sale and use of tobacco and vaping products, particularly among young people. Under the bill, it will be illegal to sell tobacco products to anyone born on or after January 1, 2009. This measure effectively aims to phase out smoking among future generations. According to the U.K. government:²⁵

"We will create the first smoke-free generation so children turning 15 this year or younger will never be legally sold tobacco. The age of sale will be raised by one year each year to prevent future generations from ever taking up smoking, as there is no safe age to smoke."

To reduce the appeal of vapes to children, we also announced that new powers will be introduced to restrict vape flavors and packaging. The powers will also allow government to change how vapes are displayed in shops.

To crack down on underage sales, the government will also bring in quicker and simpler £100 on the spot fines (fixed penalty fines) for shops in England and Wales which sell tobacco and vapes underage. Local authorities will retain 100% of the proceeds to reinvest into enforcement of this Bill and other existing tobacco and vaping controls. This builds on a maximum £2,500 fine that the courts can already impose.

Vaping alternatives – such as nicotine pouches – will also be outlawed for children who are increasingly turning to these highly addictive substitutes.”

If you're a parent, engaging in open discussions about the risks and realities of vaping can be an effective way to educate your children and teens about the many health risks. For those looking to quit smoking, don't turn to vaping as a "safer" alternative. Remember, e-cigarettes typically contain nicotine and are designed to get you to keep using them – much like cigarettes.

Engaging in physical activities, such as walking, can help distract you from cravings and reduce stress, which is often a trigger for smoking. Relaxation techniques, including yoga, meditation and the Emotional Freedom Techniques can also help you manage stress and reduce the psychological urge to smoke.

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