

Vaping Causes More DNA Damage Than Regular Cigarettes

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

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STORY AT-A-GLANCE

- › A 2023 study demonstrates that vaping triggers more DNA damage in the mouth than traditional cigarettes; those who used sweet, flavored pods had the highest DNA damage followed by those using fruit or mint flavors
- › Vaping affects multiple organ systems, including nearly immediate changes to endothelial cells, which is one of the first changes seen in developing heart disease. Other data show flavored pods may trigger changes in the brain, lungs, heart and colon
- › During the COVID-19 pandemic, young people who vaped had an increased risk of testing positive for SARS-CoV-2 and having symptoms of COVID-19. A 2022 study found those who vaped also had more severe complications, including death, than those who did not smoke or vape
- › Data also show that bystanders are affected by vape toxins, demonstrating an increase in bronchitis-type symptoms and shortness of breath; another study showed bystanders had similar levels of cotinine — a measure of the amount of nicotine the body absorbs — as people who are exposed to traditional secondhand cigarette smoke

Each puff of a conventional tobacco cigarette contains thousands of toxic chemicals that smokers inhale and are released into the surrounding air. The tobacco industry has advertised vaping as a healthier alternative to traditional cigarettes or as a strategy to help quit smoking. Yet, a 2023 study¹ demonstrates that vaping triggers more DNA damage in the mouth than traditional cigarettes.²

The Centers for Disease Control and Prevention³ calls tobacco use the "leading cause of preventable disease and death in the United States," killing more than 480,000 Americans every year. Secondhand exposure leads to disease and premature death in people who do not smoke.⁴

Additionally, smoking cost more than \$600 billion in 2018, including indirect and direct costs.⁵ In 2020, an estimated 30.8 million adults smoked cigarettes, defined as smoking at least 100 cigarettes during a lifetime and currently smoking every day or some days.

A 2016 U.S. Surgeon General⁶ report called the products unsafe and documented an alarming increasing use in young adults. That same report demonstrated vaping, using e-cigarettes or e-cigs, is associated with using other tobacco products as well as challenges with brain development affecting the health and mental health of young adults.

When the products first came on the market, they were not immediately regulated by the FDA, and it was not until 2016⁷ that they were added to the category of tobacco products. As a result, the industry grew at an alarming rate⁸ without any review process to assess safety. The 2019⁹ outbreak of a mysterious pulmonary disease that affected otherwise healthy individuals was linked to vaping.

Greater DNA Damage From Vaping Than Cigarettes

The featured study was the first instance in which researchers were able to demonstrate that the more people used e-cigarettes, the greater the DNA damage in their oral cells. This study builds on a previous study¹⁰ conducted by the same team that showed vaping was linked to genetic alterations and biological changes that could lead to disease. According to the team,¹¹ e-cigarettes are regularly used by more than 10% of teenagers and 3% of adults.

While they were once advertised as a healthy alternative, research has linked them to many of the same diseases triggered by traditional cigarettes. In this study,¹² the researchers engaged 72 healthy adults and split them into three groups that were

matched by gender, age and race. One group had never smoked or vaped, the second group had only vaped but never smoked and the third group had only smoked but never vaped.

In a University of Southern California press release,¹³ the researchers claim that this was the first study to "clearly distinguish between the DNA damage that occurs in exclusive vapers versus smokers" since "Vapers are difficult to study because they typically have a history of cigarette smoking or are dual users, who both vape and smoke tobacco cigarettes."

The researchers analyzed epithelial cells from the oral cavity in all three groups looking for evidence of DNA damage that could be attributed to either vaping or smoking. They found a similar level of DNA damage in both traditional cigarettes and e-cigarettes smokers, which was more than twice the amount of damage found in participants who had never used e-cigs or traditional cigarettes.¹⁴

The questionnaires asked how frequently and for how long participants had smoked or vaped. The participants who used e-cigarettes were also asked about the devices and flavors. Researchers found¹⁵ DNA damage was 2.6 times greater in those who vaped compared to those who never vaped or smoked. Interestingly, when traditional cigarette smokers were compared to the never smoked group, the DNA damage was slightly lower, measuring 2.2 times greater.

As reported by Study Finds, when the data were analyzed further, they found those who used pods had the highest level of DNA damage, followed by those who used mods. Additionally, the team also found that those who used sweet, flavored pods or mods had the highest level of DNA damage. This was followed by those who used fruit flavors or mint flavors.

Multiple Organ Systems Affected by Flavors and Vaping

A 2018 study¹⁶ from the Boston University School of Medicine analyzed the effect of liquid from flavored e-cig pods on endothelial cells and discovered it triggered nearly

immediate changes at the cellular level. One of the key factors in this study was the direct testing that flavoring had on cells using levels likely to be reached inside the body.

Lead researcher Jessica Fetterman, Ph.D., said the factors evaluated during the data collection were some of the first changes that are seen in developing heart disease.¹⁷ Endothelial cells were gathered from two groups of people, one who regularly used menthol-flavored traditional tobacco cigarettes and the other who used unflavored tobacco cigarettes. These were compared against non-smokers.

The endothelial cells were exposed to different levels of nine flavorings. They found that at the highest level of exposure, the chemicals triggered cell death and at the lowest level, it impaired nitric oxide production. Fetterman commented that the study demonstrated flavoring, with or without combustion products or components, may cause cardiovascular injury.

She also noted, "Increased inflammation and a loss of nitric oxide are some of the first changes to occur leading up to cardiovascular disease and events like heart attacks and stroke, so they are considered early predictors of heart disease."

In a 2022 study¹⁸ from the University of California, researchers sought to investigate the impact that aerosols from pod-based, flavored JUUL e-cigs smoked three times a day for three months could have on the brain, lungs, heart and colon.

Although there were changes in each of the four organ systems, they found the most striking changes occurred in the brain, which they thought "... may contribute to behavioral changes and mood disorders. In addition, e-cigarette use may cause gut inflammation, which has been tied to poor systemic health, and cardiac inflammation, which leads to cardiovascular disease."¹⁹

The team found changes in neuroinflammatory gene expression in an area of the brain vital to reward processing and motivation. These changes have been linked to depression, anxiety and addictive behavior, which may indicate that e-cigarettes promote further addiction. Crotty Alexander expressed the team's concern and that of many other health experts' when she said:²⁰

“Many JUUL users are adolescents or young adults whose brains are still developing, so it’s pretty terrifying to learn what may be happening in their brains considering how this could affect their mental health and behavior down the line.”

Vaping Raises Risk of Severe COVID-19 and Death

The changes to the endothelial cells and lung tissue may explain in part how vaping increases the risk of contracting COVID-19 in young people where an increased risk is not present in those who do not smoke. Researchers from Stanford University gathered data²¹ through online surveys and published the results in August 2020 in the Journal of Adolescent Health.

They found that teens and young adults who smoked conventional and/or e-cigs were 2.6 to nine times more likely to need testing for the virus. It’s important to note that testing positive does not mean you’re sick. A vast majority of people who tested positive remained asymptomatic. However, the data showed those who vaped were five times more likely to have COVID-19-related symptoms and receive a COVID-19 diagnosis than nonusers.

There were 4,351 participants between the ages of 13 and 24 who completed the surveys. Stanford University reported those who had smoked cigarettes or e-cigs in the past 30 days were seven times more likely to have COVID-19 symptoms than those who had never smoked or vaped. Interestingly, the results also showed no connection between a diagnosis of COVID-19 and smoking only conventional cigarettes.

It appears that vaping, but not conventional cigarette smoking, places an individual at greater risk of testing positive or having symptoms of a SARS-CoV-2 infection. More recently, a 2022 study²² used data from the American Heart Association COVID-19 CVD registry and found people who reported smoking or vaping were more likely to experience severe complications, including death, from SARS-CoV-2 infection than their counterparts who did not smoke or vape.

The data was gathered from January 2020 to March 2021 and the final analysis included 4,086 people. According to a press release²³ from the American Heart Association the study showed those who smoked or vaped were 45% more likely to die and 39% more likely to be placed on a ventilator than those who did not smoke.

Another 2022 study²⁴ compared symptoms of COVID-19 in those who vaped and those who did not. In 1,734 participants, they found people who vaped were more likely to have chest pain or tightness, chills, headaches, loss of smell or taste, diarrhea, nausea, vomiting, abdominal pain and muscle aches.

Data gathered during the COVID-19 pandemic is supported by past data²⁵ gathered from 21,618 adults between 2013 and 2018. The researchers sought to determine if e-cigs could increase the risk of respiratory disease. They found that “e-cigarette use was associated with an increased risk of developing respiratory disease independent of cigarette smoking. These findings add important evidence on the risk profile of novel tobacco products.”

Bystanders Also Affected by Vape Toxins

This short video describes the results of a study²⁶ in which researchers sought to determine the effect of secondhand nicotine from vape exposure on the development of bronchitis-type symptoms, shortness of breath and wheezing. Data were collected from 2,097 participants from 2014 to 2019. They found exposure to secondhand vaping increased from 11.7% to 15.6% during the study, which reflects an increase in use during that period.

The researchers also found there was an increase in bronchitis-type symptoms and shortness of breath even after controlling for active and passive exposure to tobacco or cannabis, and other demographic characteristics. When the data were restricted to participants who didn't smoke or vape but were exposed to secondhand vape, they found a stronger link.

People who were exposed to secondhand nicotine vaping were 40% more likely to report bronchitis-type symptoms and 53% more likely to experience shortness of breath.²⁷ The increased risk to bystanders may be related to how electronic cigarettes work.

Instead of using combustion to heat the tobacco, e-cigs use battery-generated heat. This creates an aerosol containing nicotine as opposed to smoke. Users get the same effect from nicotine in vape. While users do inhale most of the vapor and aerosolized toxins, some also enter the local environment, which can affect bystanders. One University of Southern California study²⁸ analyzed the air quality in offices where volunteers had smoked traditional cigarettes and e-cigarettes.

The researchers found that e-cigarettes decreased carcinogenic particulate matter tenfold but toxic metal levels were higher than regular cigarettes. Because the vapor often has little to no scent and appears to dissipate quickly, bystanders can be lulled into a false sense of security. But data²⁹ from the University of California San Francisco demonstrate that e-cigarettes pollute the air with nicotine and fine particulate matter that bystanders can easily inhale and absorb.

Despite a lower level of nicotine pollution, researchers found a significant discrepancy between bystander exposure to e-cigarettes and traditional cigarette smoke, the reason for which remains unclear. They found bystanders exposed to e-cigarette pollution have similar levels of cotinine – a measure of the amount of nicotine the body absorbs – as people who are exposed to traditional secondhand cigarette smoke.

Tips to Make Quitting Easier

Smokers are addicted to nicotine. When trying to stop smoking, nicotine withdrawal symptoms can trigger feelings of anger and irritation, trouble thinking and tobacco cravings. A 2011 study³⁰ evaluated how mindfulness training may help increase the potential success of smoking cessation.

After twice weekly mindfulness training treatments for four weeks, study participants had an increased rate of reduction in cigarettes compared to those who received the

American Lung Association's freedom from smoking program. This was maintained during a 17-week follow-up, which led the researchers to conclude that "Mindfulness training may confer benefits greater than those associated with current standard treatments for smoking cessation."

A second meta-analysis³¹ demonstrated that 25.2% of participants using mindfulness training remained smoke-free for more than four months as compared to 13.6% of those who used usual care therapy. Mindfulness training is like cognitive behavioral therapy (CBT) in terms of the underlying mechanism.

Yet, even when compared to CBT, participants using mindfulness training have reported³² lower anxiety, fewer concentration difficulties, less craving and dependence, and were better able to manage negative emotions without smoking.

In addition to practicing mindfulness, I believe that quitting becomes easier when you get healthy first. Exercise is an important part of the plan, as research³³ shows people who engage in regular strength training double their success rate at quitting smoking as compared to those who don't exercise.

Healthy eating is another crucial factor to improve your health and strengthen your ability to quit. Finally, find a healthy emotional outlet. Many people use exercise, meditation or relaxation techniques. I also recommend incorporating **Emotional Freedom Techniques (EFT)**. This can help clear emotional blockages, some of which you may not even realize are there. This helps restore your mind and body's balance and helps you avoid cravings.

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