

# How E-cigs Can Alter Your Brain, Heart, Lungs and Colon

Analysis by [Dr. Joseph Mercola](#)

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## STORY AT-A-GLANCE

- › An animal study shows that daily vaping with flavored pods can increase the inflammatory process through multiple organ systems, with the most striking changes happening in the brain, which may contribute to behavior changes and mood disorders
- › Past research also showed flavor pods damage endothelial cells that line your arteries, which may cause a reduction in nitric oxide production and cardiovascular injury
- › E-cigarettes are advertised as a traditional cigarette alternative, which many mistakenly believe makes them “healthier” because the vapor has little odor and dissipates rapidly. One in every 5 high school students vapes, and experts believe e-cigs will keep young people addicted for years
- › Bystanders are not immune from the dangers as data show the devices release toxic chemicals and metals, which bystanders appear to absorb as much cotinine – a measure of the amount of nicotine the body absorbs – as people who are exposed to traditional secondhand cigarette smoke

Research from the University of California San Diego School of Medicine shows that daily vaping can increase your body’s inflammatory process through multiple organ systems. Interestingly, they also found that the action on inflammation depended on the e-cigarette flavor being smoked.<sup>1</sup>

E-cigarettes are not like traditional, combustible cigarettes. They don't emit smoke or an offensive smoke odor, so they are usually misperceived as being harmless to your health. It's been nearly eight years since I began warning of the dangerous effects that

vaping has on human health. Yet, E-cigarette companies continue to advertise their product as an option for those who want to quit traditional combustible cigarettes or as a “satisfying alternative to smoking cigarettes.”<sup>2</sup>

Smoking traditional cigarettes damages nearly every organ in your body and triggers many different diseases. These include many types of cancer, chronic obstructive lung disease, reduced lung function and coronary artery disease.<sup>3</sup> And, as more people quit smoking combustible cigarettes, the market for them has declined; e-cigarette companies have seen a rise in popularity of their products.

Yet, the move to e-cigarettes is not the healthy alternative that advertising companies would like you to believe. Research published in *Environmental Health Perspectives*<sup>4</sup> demonstrated that the vapor and aerosol samples from e-cigarette liquid may release heavy metals dangerous to human health. Plus, these heavy metals may potentially influence the inflammatory response in the brain, heart and colon.<sup>5</sup>

## **E-Cigs Can Raise Inflammatory Levels in Brain, Heart and Colon**

Past studies looking at e-cigarettes have demonstrated that they cause inflammatory and cardiopulmonary physiological changes. Yet, while there have been multiple studies on conventional combustible cigarettes, the data on e-cigarette devices are less established.<sup>6</sup> Several studies have shown that smoking e-cigarettes, also called vaping, triggers neurotransmitter alterations.

According to UC San Diego, more than 12 million adults in the U.S. currently smoke e-cigarettes and the highest rate of use is found in people from age 18 to 24. In one study, the researchers sought to investigate the impact that the aerosols from a pod-based, flavored JUUL smoked three times a day for three months would have on the brain, lungs, heart and colon.<sup>7</sup>

The team used “the most prominent e-cigarette brand, JUUL, and its most popular flavors: mint and mango.” Researchers used an animal model, exposing mice to JUUL

aerosol three times a day for three months. They found the most striking changes in the brain, which they thought:<sup>8</sup>

*"... 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."*

Dr. Laura Crotty Alexander is an associate professor of medicine at UC San Diego School of Medicine and senior researcher on the study. She said in a press release, "These pod-based e-cigarettes have only become popular in the last five or so years, so we don't know much about their long-term effects on health."<sup>9</sup>

The team found changes in neuroinflammatory gene expression in an area of the brain vital to reward processing and motivation. The concern is that these changes have been linked to depression, anxiety and addictive behavior. This may push users further into an addiction to e-cigarettes. Crotty Alexander expressed the team's concern and of many other health experts' when she said:<sup>10</sup>

*"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."*

## **Flavored E-Cigs Damage Endothelial Cells**

According to a study<sup>11</sup> from Boston University School of Medicine, the liquid used to flavor e-cigarette pods may introduce early signs of cardiovascular disease, which can lead to heart attack, stroke and even death. The scientist discovered that changes in the endothelial cells appeared almost immediately on the cellular level.

One of the key factors in this study was the direct testing the scientists used of the effect that just the flavoring had, using levels that were likely to be reached inside the body. Lead researcher Jessica Fetterman, Ph.D., said the measures evaluated during the

data collection were some of the first changes that are seen in the development of heart disease.<sup>12</sup>

The researchers used endothelial cells, which are the cells that make up the lining of blood vessels. They gathered cells from two groups of people. One group regularly used menthol-flavored traditional tobacco cigarettes and the other used unflavored tobacco cigarettes. They compared these cells against those of nonsmokers. The cells from both types of smokers were able to perform key functions in the same way that nonsmoker cells were.

This included the production of nitric oxide, which is a colorless gas the body uses to dilate blood vessels. When the nonsmoker cells were directly exposed to menthol, the same thing happened. The researchers used this as a baseline against which they compared flavoring additives that are commonly found in e-cigarettes. In this study, the researchers tested nine chemical flavorings, which included mint, clove, vanilla, cinnamon, strawberry and banana.

They expose the endothelial cells to different levels of the nine flavorings. Before exposure, the chemicals were heated to the same temperature that a device would normally create. At the highest level of exposure, the chemicals triggered cell death. At lower levels, the researchers found it impaired nitric oxide production. Fetterman commented on the importance of the study:<sup>13</sup>

*"Our study suggests that the flavoring additives used in tobacco products like e-cigarettes, on their own or in the absence of the other combustion products or components, may cause cardiovascular injury. [That] could have serious implications, as flavored tobacco products are the most popularly used products, especially among youth."*

She added:<sup>14</sup>

*"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. Our findings suggest that these flavoring additives may have serious health consequences."*

## **Teen Vaping Continues To Be a Challenge**

One paper in the Journal of the American Medical Association<sup>15</sup> reports that approximately 1 in every 5 high school students is vaping. While some adults claim to use vaping to break their nicotine addiction, young people often start with vaping and move on to traditional combustible cigarettes. Experts believe that vaping is likely to start an addiction that will keep young people hooked for years.

It's also noteworthy that, like regularly cigarettes, e-cigarettes also contain the highly addictive substance nicotine. As a reminder, according to the CDC, nicotine can harm brain development<sup>16</sup> in an adolescent brain that continues to develop well into the mid-twenties.

The CDC also finds that young people who use e-cigarettes are more likely to graduate to traditional combustible cigarettes as they age. Despite this, the Food and Drug Administration approved e-cigarettes for sale, which the BBC reports<sup>17</sup> was done after they "decided that the benefit to adults trying to quit smoking outweighs the risk of teenagers becoming hooked."

In 2021, the BBC reported a study released by the FDA<sup>18</sup> and the CDC estimated that more than 2 million students reportedly used e-cigarettes that year and 80% of those have used flavored products. The decision to approve e-cigarettes was only for tobacco-flavored products, which the FDA reasoned could "benefit addicted adult smokers who switch."<sup>19</sup>

According to data published in March 2022 by the FDA,<sup>20</sup> JUUL is no longer the top-selling product in the student market. Instead, 26.8% smoke Puff Bar followed by 10.5% who use Vuse and 6.8% who use JUUL. According to those surveyed, the most common reason for trying an e-cigarette was that a friend asked them to try one.

Current users cited using e-cigarettes when they felt anxious, stressed or depressed and nearly an equal number said they used e-cigarettes “to get a high or buzz from nicotine.” True to addictive behavior, nearly half of students surveyed from 15 to 24 years said they were considering trying to quit vaping in the new year, according to a survey<sup>21</sup> published in January 2022 by Truth Initiative.

This is consistent with past research from Truth Initiative that indicated there are widespread intentions to quit, and some findings show that many have tried and failed. According to the paper in JAMA, parents can look for signs that their child is vaping, including:

Increased thirst	Nosebleeds	Throat-clearing
Increased irritability	Mood swings	Mouth sores
Trouble breathing	Unexplained cough	Fruit or candy-like smells

## **Bystanders Affected by Vape Toxins Too**

Electronic cigarettes do not work in the same way that traditional cigarettes function. Instead of combustion used to heat the tobacco, e-cigarettes use battery-generated heat. This creates an aerosol containing nicotine, which the user inhales. Users get the same effect from nicotine in vaping as in cigarettes without the high levels of polycyclic aromatic hydrocarbons that are associated with smoking traditional cigarettes.

Although manufacturers have developed e-cigarettes and vaping pens in a variety of sizes and shapes, they all deliver the same composition of chemicals and in the same way. While the user inhales most of the vapor and aerosolized toxins, some of the aerosolized particles also enter the environment. This can affect bystanders.

One study from the University of Southern California<sup>22</sup> evaluated air quality in offices where volunteers had smoked traditional cigarettes and e-cigarettes. They used air sample analysis and found that smoking e-cigarettes resulted in a tenfold decrease in

carcinogenic particulate matter, but toxic metal levels were much higher than from regular cigarette smoke.

Another study<sup>23</sup> looked at how the e-cigarette devices were built and tested whether aerosolized metal was derived from the fluid or the components. They found components were sometimes missing or there was evidence of use before the device was packaged. They discovered when burned, the devices produced aerosolized particles of tin, silver, aluminum, nickel, iron and chromium, many of which are known to cause respiratory distress and disease.

Bystanders may be lulled into a false sense of security since the vapor often has little to no scent and appears to dissipate quickly. Yet, data from the University of California San Francisco<sup>24</sup> demonstrates that e-cigarettes pollute the air with nicotine and fine particulate matter that bystanders can easily inhale and absorb.

Despite e-cigarettes producing lower levels of nicotine pollution, researchers found there is 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.

## **How to Make Quitting Easier**

I believe the "secret" to quitting smoking is to get healthy first, which will make quitting mentally and physically easier. Exercising is an important part of this plan, as research shows people who engage in regular strength training double their success rate at quitting smoking compared to those who don't exercise.<sup>25</sup>

Healthy eating is another crucial factor in improving your health and strengthening your ability to quit. In short, if you want to quit, here are three basic tips to get started:

- Adopt a cyclical ketogenic diet plan that incorporates intermittent fasting to improve your metabolic flexibility.

- Develop a well-rounded exercise regimen. This is your ally to fighting disease and to quitting smoking. Strength training is an important part, but also remember to incorporate high-intensity interval exercises, core-strengthening exercises, stretching and regular non-exercise movement (like walking and cutting back on sitting).
- Find a healthy emotional outlet. Many use exercise, meditation or relaxation techniques, and these are all great. I also recommend incorporating Emotional Freedom Techniques (EFT). This can help clear out emotional blockages from your system (some of which you might not even realize are there), thus restoring your mind and body's balance and helping you break the addiction and avoid cravings.

Once you are regularly doing these three things, begin to think about quitting smoking. At this point, many are ready to try quitting "cold turkey." Finally, if you're a parent, talk with your children about the risks of smoking, smokeless tobacco and e-cigarettes. The easiest pathway to not smoking is to avoid starting in the first place.

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