

# Effects Of Vaping On Adolescence

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## Abstract

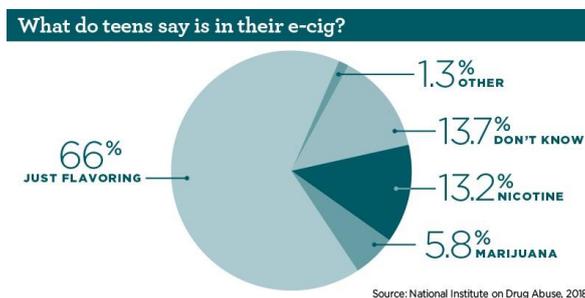
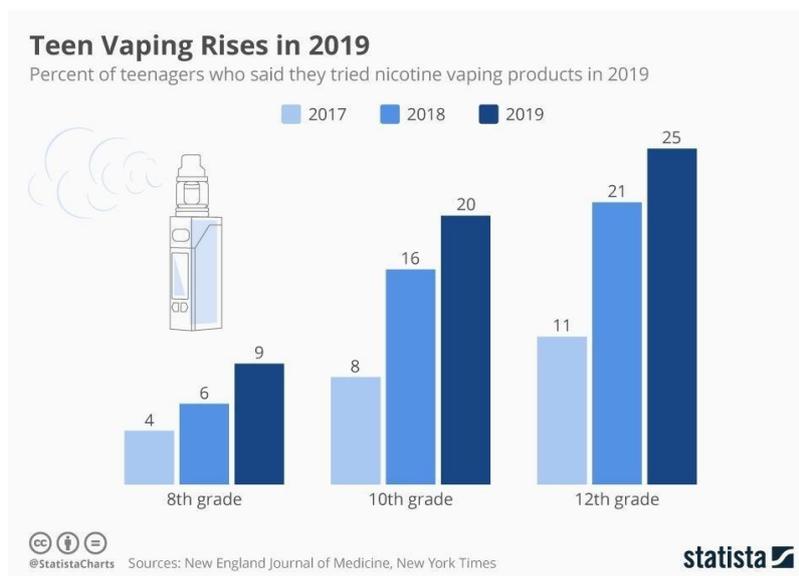
Vaping by definition refers to inhaling of a vapour created by an electronic cigarette. Both smoking and vaping deliver nicotine but the only difference is that vaping has been called a safer alternative. The safety of e-cigarettes consumption and its potential as a smoking cessation method is still questionable. While some studies do suggest that vaping may be less harmful than smoking traditional cigarettes, concerns remain about the potential risks associated with inhaling aerosol produced by e-cigarettes. Additionally, there is a growing concern about the harmful effects of vaping on adolescents.

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## I. Introduction

E-cigarettes have been growing in popularity in recent years, particularly among young adolescents. Youth e-cigarette use rose 1800% from 2011 to 2019. “Many people think of vaping as a “healthy alternative” to smoking, but this isn’t necessarily the case”. They might be healthier, but that doesn’t mean they’re healthy. There have been 2,807 hospitalised cases in the United States (singlecare team) of serious lung injury associated with vaping products, resulting in 68 deaths as of February 2020. E-cigarettes and other vaping products often come in appealing flavours and colourful packaging that may be particularly appealing to children and adolescents. Most of the adolescents are not even fully aware of the ingredients and chemicals contained in these products.



Even the reasons for vaping have changed. According to the NIH Monitoring the Future survey, the reasons used by adolescents are:

- “To experiment (60.9%)
- To have a good time with friends ( 37.9%)
- Boredom ( 28.7%)
- To help quit regular cigarettes (6.1%)
- Because they are ‘hooked’ (8.1%) which doubled from 2018 (3.6%)” (NationalInstitute of Drug Abuse)

**What is vaping?**

Vaping is the practice of inhaling and exhaling vapour containing nicotine and flavouring produced by a device, commonly known as ‘e - cigarettes’. Its appearance is similar to that of a small traditional cigarette and resembles a USB drive.

It is brought to the mouth with the press of a button a battery activated heating coil warms up a substance that then is aerosolized. The term aerosolised means made into tiny particles that you can inhale in. Going through the mouth, through the main airway down into the lungs where they can interact with oxygen and carbon dioxide present in the small air sacs of the lungs and then residual is exhaled.

Vaping is different from traditional smoking. Unlike a cigarette which burns tobacco and contains substances like nicotine, tar, carbon monoxide and formaldehyde and somewhere between 4000 to 7000 chemicals. Vaping is considered relatively safer.

The device comes out in different forms. First, there are disposable ones that can be used once. Then there are the types that resemble a cigarette but are battery operated and known as e-cigs. Thirdly there are vape mods, two piece devices, with battery and tank attached to one single body.

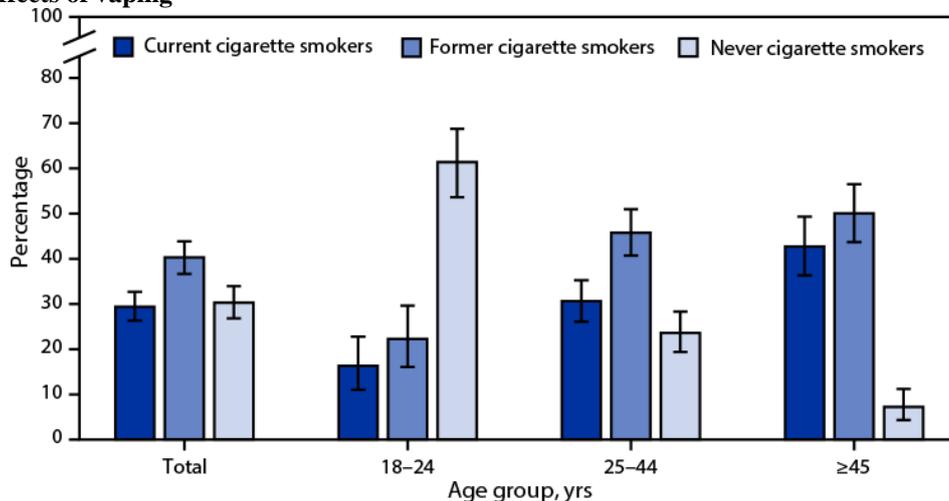
Nicotine only vapes, THC vapes, and dual vapes are three types of vaping devices that differ in the substances they deliver to the user.

Nicotine only vapes are designed to deliver nicotine, which is a highly addictive substance. They usually contain e-liquid that is made from a mixture of propylene glycol, vegetable glycerin, nicotine, and flavourings. These devices are often marketed as a safer alternative to smoking.

THC (tetrahydrocannabinol) vapes are designed to deliver the psychoactive compound found in marijuana, which produces a “high” or altered state of mind. THC vapes contain a concentrated form of THC oil, which is heated and inhaled by the user. (surgeongeneral.gov)

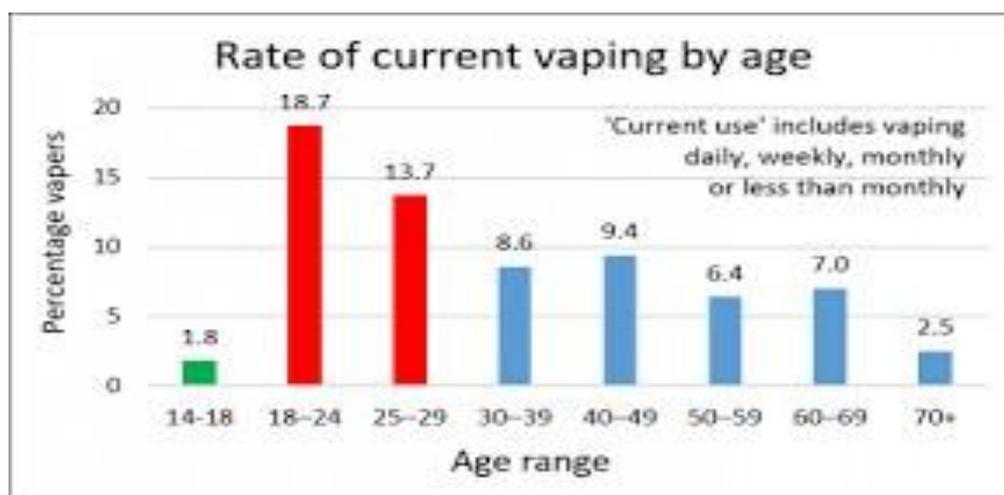
Dual vapers are vaping devices that are capable of delivering both nicotine and THC. These devices are sometimes marketed as a way to have the best of both worlds. (surgeongeneral.gov)

**General Effects of vaping**



In a normal X-ray, our lungs appear black because air is radiolucent. But people who have vaping induced lung injury have white on both sides of their lungs and are distal and far enough to have an effect like pneumonia, where there are inflammatory cells found in air sacs.

An experiment was conducted where mice were made to vape for almost a year. The mice developed lung cancer. They also developed precancerous changes in bladder tissue. Nicotine levels also lead to DNA damage. It also caused damage to the mice’s lungs, heart and bladder. Vaping is definitely not considered safe.



Effect of vaping on Brain  
(National Institute of Drug Abuse)

Vaping affects one's brain development directly. The nicotine present in vapes makes it harder to learn and concentrate. These brain changes are permanent and can affect your mood and ability to control your impulses as an adult. Nicotine is highly addictive and may lead to addiction to various other substances. As nicotine helps in providing the feel-good factor, you soon start associating vaping with a feeling of happiness, which makes it harder to quit and makes you crave nicotine more.

Nicotine has an impact on smokers' physical and emotional well-being, much like any other addiction. Concerns about physical health have taken precedence over the effects on mental health. Research on adolescents and young adults regarding their mental health has shown that dependence on nicotine has been associated with impulsivity, mood disorders, anxiety, suicidality, and depression. Moreover, nicotine changes the brain's coping mechanisms and makes people more sensitive to stress. These changes lead to an increase in symptoms with increased exposure to nicotine. It has been demonstrated that there is a positive correlation between vaping and depression, in particular.

Studies from the University of Rochester Medical Center (URMC) have uncovered an association between vaping and mental fog. Both adults and kids who vape were more likely to report difficulty concentrating, remembering, or making decisions than their non-vaping peers. It also appeared that kids were more likely to experience mental fog if they started vaping before the age of 14. Especially for higher-order mental functions, adolescence is a crucial period for brain development. This implies that tweens and teens may be more vulnerable to nicotine-induced brain changes. Although e-cigarettes lack many of the harmful substances present in tobacco cigarettes, they deliver equivalent, or perhaps higher, levels of nicotine.

Seizures have been observed in adults and kids who were found to consume liquid nicotine, including nicotine-containing e-liquids. Nicotine overdose can cause seizures, and lower doses of nicotine may have anticonvulsant activity in people. An anticonvulsant effect of transdermal nicotine has been reported in people with Autosomal Dominant Nocturnal Frontal Lobe Epilepsy (hereafter referred to as ADNFL) is an uncommon form of epilepsy that causes seizures that usually occur at night while the person is sleeping.

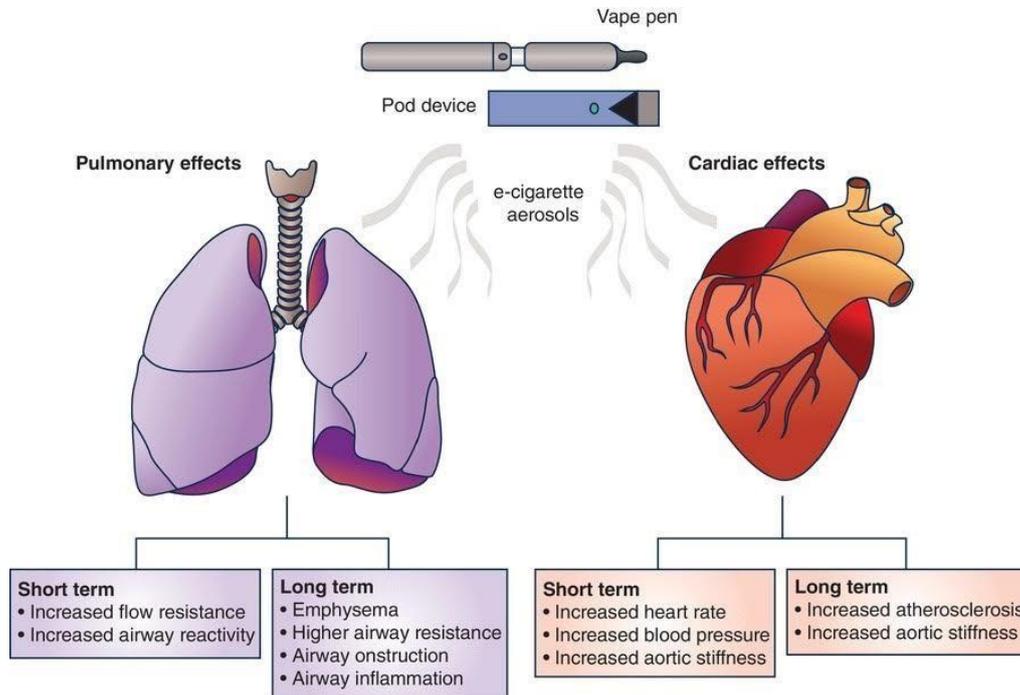
### **Effects of vaping on Heart**

Matthew L. Springer, PH.D, a professor of medicine in the Division of Cardiology at the University of California in San Francisco, (National institute of health) found that "chronic e-cigarette users had impaired blood vessel function, which may put them at increased risk for heart disease. This study suggested that chronic users of e-cigarettes may experience a risk of vascular disease similar to that of chronic smokers."

Blood vessel constriction caused by nicotine is known to raise heart rate and blood pressure. The chance of developing heart disease, having a heart attack, or having a stroke can rise as a result of this added stress on the heart. The flavourings and other compounds used in e-cigarettes can affect the cardiovascular system in addition to the negative effects of nicotine. According to some research, these compounds may erode the blood vessel lining, raising the risk of blood clots and other cardiovascular issues.

The findings, published today in JAMA Pediatrics, show that cellular oxidative stress is significantly increased during a single 30-minute vaping session, which occurs due to the imbalance between free radicals in the body. (Tobacco related disease research program). These molecules can cause damage to cells and antioxidants, which fight free radicals.

According to Elliot Antman, a professor of cardiovascular medicine at Harvard Medicine School in Boston, “exposure to nicotine could worsen the condition of individuals with coronary artery blockages or congestive heart failure, potentially leading to chest pain or increased symptoms of heart failure”. (everyday health) Additionally, Dr. Antman notes that individuals with arrhythmias, such as atrial fibrillation, may experience an episode triggered by nicotine.



The Journal of  
**Physiology**

### Effects of vaping on lungs

The use of electronic cigarettes has become increasingly popular in the last few years. However, the long-term effect of vaping on lung health has yet to be discovered. Research shows a range of conflicting ideas; some believe that it is a safer alternative to traditional tobacco smoking, while others believe that it is harmful for us. Some of the effects of vaping on our lung health include respiratory irritation. Users may experience respiratory irritation or inflammation, which can cause coughing, shortness of breath, and wheezing. This can be produced due to the flavour and chemicals that are present in an e-cigarette. Another reason can be reduced lung function. Vaping has proven to reduce our lung function, making it harder for our lungs to function up to their potential. It contributes to a number of respiratory infections. Due to respiratory infections, we can develop conditions like pneumonia and bronchitis, which weakens the immune system. It can cause lung damage, inflammation, and oxidative stress, which can contribute to the development of lung diseases such as chronic obstructive pulmonary disease (COPD).

E-cigarettes are considered to be less harmful than the traditional tobacco products, they still contain chemicals that can increase the likeliness of cancer, chemicals such as nicotine, formaldehyde, acetaldehyde that can be inhaled into lungs. These chemicals have shown to cause cellular damage which increases the risk of DNA damage. Heavy metals that are present and released such as lead, nickel, and chromium in the form of vapour. These metals can accumulate in lungs and other tissues potentially causing cancer. Vaping has proven to weaken the immune system, making it more difficult for the body to fight off cancer cells and other diseases.

### Vaping and popcorn lung

Bronchiolitis obliteran (BO), also known as popcorn lung, is a rare lung disease that is caused by exposure to certain chemicals such as diacetyl, a flavouring ingredient used in some e-liquids. The disease gets its nickname from when workers in a popcorn factory were exposed to high levels of diacetyl developed the condition from an outbreak in the early 2000s

Symptoms of popcorn lung include wheezing, coughing, shortness of breath, and fatigue. In severe cases, it may lead to permanent lung damage and even death. While the risk of developing popcorn lung from vaping is low, some studies have found that certain e-liquids contain diacetyl and other harmful chemicals that

could potentially increase the risk.

#### **Lipoid pneumonia**

Lipoid pneumonia is a rare type of pneumonia that occurs when fat particles enter the lungs and cause inflammation. It is typically caused by inhaling or aspirating oils or other fatty substances.

There have been several cases of lipoid pneumonia related to vaping, particularly in people who have used vaping products containing THC, the psychoactive compound in marijuana inhaling oils or other fatty substances that can cause a buildup of fat particles in the lungs, leading to inflammation and potentially causing lipoid pneumonia. Symptoms of lipoid pneumonia can include coughing, chest pain, difficulty breathing, and fever. The condition can be serious and requires medical treatment.

While lipoid pneumonia related to vaping appears to be rare, it is still a cause for concern. It is important for people who use vaping products to be aware of the potential risks and to only use products that are regulated and known to be safe. It is also important for healthcare providers to be aware of the potential link between vaping and lipoid pneumonia and to consider this possibility when evaluating patients with respiratory symptoms.

#### ***Effect of vaping on Liver***

A new study indicates that using e-cigarettes may lead to an accumulation of fat in the liver, which is associated with a higher risk of non-alcoholic fatty liver diseases. Therefore, it is recommended to stop using e-cigarettes to reduce the potential harm to your liver.

“The popularity of electronic cigarettes has been rapidly increasing, in part because of advertisements claiming that they are safer than conventional cigarettes. But because extra fat in the liver is likely to be detrimental to health, we conclude that e-cigarettes are not as safe as they have been promoted to consumers,” said lead author Theodore C. Friedman, M.D., PH.D., chairman of the department of internal medicine and endowed professor of cardio-metabolic medicine at Charles R. Drew University of Medicine and Science in Los Angeles, Calif. The findings of the study were based on research conducted on mice. (science daily)

CDC reports have reported that e-liquids without nicotine can cause hepatotoxicity by increasing liver enzyme biomarkers such as AST, ALT, and alkaline phosphatase while decreasing total liver protein, hepatic glycogen rate, and cholesterol in rats. Based on these findings, it is hypothesised that flavouring chemicals or other e-liquid constituents can also cause hepatotoxicity.

#### ***Effect of vaping on Reproductive Health***

Recent studies show that vaping has a serious impact on the male and female reproductive systems. Female lab rats were exposed to vape smoke, which showed lower fertility rates than those who were not exposed to this smoke. One major effect of vaping is that women experience reduced fertility function. Fertility and egg production may be delayed as a result of this. Not only this, but vaping while pregnant has adverse effects on fetal development and results in abnormalities in infants. (national institute of health)

E-cigarettes contain chemical compounds called propylene glycol and vegetable glycerin. Exposure to these chemicals has been linked to drastic female infertility and reproductive issues. Research indicates that even if the egg is fertilised and ready for implantation, the introduction and continued presence of these toxins in the system can drastically prevent implantation within the uterus. To top it all off, women who vape during pregnancy are most likely causing physical harm to the foetus developing in their uterus.

A study in 2017 on rats showed that exposure to nicotine was **correlated** with reduced sperm count, sperm motility, and sperm viability. Research done by University College London in 2017 linked flavoured-cigarettes with severe sperm damage. A study showed that even if a vape is nicotine-free, it may be harmful to fertility health. Regardless of whether the vape liquid contains nicotine or not, exposure was associated with decreased testosterone levels, sperm count, and sperm viability. (national institute of health)

#### ***Effect of vaping on kidneys***

Our kidneys contain Podocytes that play an important role in glomerular function. They are specialised epithelial cells that coat the outer walls of glomerular capillaries. Together with the endothelial cells of the glomerular capillary loop and the glomerular basement membrane, they form a filtration barrier. Cigarettes and e-cigarettes contain nicotine, which has a damaging effect on these podocytes and affects their role in the kidneys filtering function. Podocytes play a crucial role in filtering the proteins present in plasma from leaking into the urine. It is also believed that when one loses too many Podocytes, they are at greater risk for diabetic nephropathy and renal failure. About 40% of diabetics develop diabetic kidney disease, and previous research has shown that smoking is a significant risk factor.

The researchers performed the nicotine studies in both human podocytes and mouse models of diabetic nephropathy. They found a higher expression of the inflammatory enzyme COX2 and signs of oxidative

stress, which can contribute to cellular injury. Nicotine also led to a rise in cell death and decreased the levels of synaptopodin, a protein that helps prevent podocyte damage or death. (national institute of health) In diabetic mice, nicotine increased proteinuria and kidney damage, recognized markers of kidney disease progression.

### ***How does vaping affect our social and cultural world?***

Vaping does not only have an effect on one's mental and physical health, it also has an effect on one's social world. Vaping as a concept has been defined as something that only affects the individual, but according to the research conducted, it also has a huge effect on the family and people surrounding the individual.

Nicotine has a huge impact on an individual's mood swings, increased anxiety, and depression, and because of these changes in behaviour, the individual starts withdrawing from class, peers, family, and other social events and activities. A lot of times, parents miss out on these signs by thinking of these changes as normal teenage behaviour.

It has been found that teenagers and young people who have a good family attachment, a good sense of right and wrong, and opportunities for involvement are at a decreased risk of initiating e-cigarette use.

Recent research by European Respiratory Society International Congress in Barcelona, Spain suggests that teenagers whose parents are smokers are 55% more likely to try e-cigarettes. The more a parent smokes, the more their teenage children will be at risk, according to the American Journal of Public Health. This research has concluded that if parents stop smoking it would not only lower teen smoking but would also cater adolescent mental health. (European respiratory society)

Vaping also affects an individual's work performance overall. It has been found that vaping or smoking at home affects the health of the entire household and can increase claim costs for employees with families on health coverage offered by their employer.

Teen vaping can also affect an employee's work performance overall. Research given by Journal of Occupational and Environmental Medicine found that parents reported : (national institute of health)

- Nearly a third missed work as a consequence
- 29% said they are less productive
- 35% reported difficulty focusing on work
- 43% felt anxious or worried.

### ***Alternatives for vaping***

1. Alternative for vaping - There are several therapies and programs for nicotine addiction. For example patches, gums, peer groups etc. These resources can slowly and steadily help an individual reduce their addiction and dependency of nicotine,
2. Proper education - Several people lack information about the effects of vaping and how nicotine addiction damages your health. Hence, educating teens and adults on this topic is very important.
3. Peer support - having different groups and programs where people facing similar issues regarding vaping can connect and share their stories of recoveries and also empower others to do the same.
4. Support research - Vaping is something which hasn't been fully researched. So to support the ongoing research and making efforts to gather data can really help. This can contribute to making new decisions, and having a better understanding of what vaping holds.
5. Counselling - Many people vape as a defence mechanism as to what is really going on in their life. Offering them counselling will make them share their problems and issues and can make them less dependent on vaping and using harmful substances to escape.
6. Awareness - several people don't know that vaping causes damage to their heart, lung, kidneys, liver, reproductive health, brain etc. Making them aware about this is very important.

## **II. Conclusion**

Vaping, often seen as a smoking alternative intended to help consumers stop smoking, has become its own culture. Ongoing research on this topic shows how the nicotine present in vapes is responsible for cravings and withdrawal symptoms which make it harder to quit.

When inhaled, nicotine quickly infiltrates the whole body. It is absorbed through the lungs, and then moves quickly through the bloodstream, entering the brain and other organs of the body.

Adolescents and young adults are affected the most by the harmful effects of nicotine because brain development is continuous throughout adolescence and into early childhood. Once a young person shows symptoms of dependence and addiction to nicotine, it can be hard to stop vaping.