

## Planet of the Vapes

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## ABSTRACT

**Objective:** To review the prevalence and health risks of vaping among youth.

**Methods:** Conducted literature search in Google and PubMed and analyzed 25 reports on this subject.

**Results:** More than 1 in 20 middle schoolers and more than 1 in 5 high schoolers have used e-cigarettes within the last 30 days, and 24% of college students reporting vaping weekly. Health risks associated with vaping include mental health disorders, poor oral health, high blood pressure, acute and chronic lung injury, asthma, and higher risk of COVID-19 infection.

**Conclusion:** Vaping with e-cigarettes is prevalent among students in high school and universities and involves significant health risks.

## Keywords

E-cigarettes, Health risks, Students, Vaping.

## Planet of the Vapes

Vaping devices are now the most commonly used form of nicotine delivery among teens in the United States [1]. Vaping is the act of inhaling an aerosolized liquid created by an electronic cigarette (e-cigarette). When administered, nicotine activates the pleasure center of the brain, producing a slight, but brief feeling of euphoria.

There are four main types of vaping devices: cig-a-likes, vape pens, vape mods, and the most popular, pod mods. A pod mod is a rechargeable device with a disposable, snap-in "pod." These pods contain nicotine salts, which are designed to deliver greater concentrations of nicotine than a conventional cigarette [2]. The bestselling vape device has 5.2 times more nicotine in their product compared to a traditional cigarette [3]. The amount of nicotine in a vaping pod is equivalent to roughly 20 cigarettes [4]. Heavy vaping users can go through one of these cartridges in a single day. The leading brand of pod mods sells its vaping device for \$20 and an additional \$16 for a pack of pods. The average cost of a pack of cigarettes is \$7.

The legal age to buy a vaping device is 18 years old, but e-cigarette use is highest among younger adolescents [5]. Over the past two years, vaping has increased 218% among middle schoolers and 135% among high schoolers. The Centers for Disease Control and Prevention (CDC) found more than 1 in 20 middle schoolers and more than 1 in 5 high schoolers have used e-cigarettes within the last 30 days [6]. At the University of Iowa, 24% of undergraduate students reported vaping weekly [7]. Alluring online advertising and appealing flavors such as gummy bears and banana split are ways the vaping industry entices its young users.

Nicotine is an extremely addictive stimulant, ranked as one of the most addictive substances on the planet [8]. Nicotine's rewarding and reinforcing qualities are linked to its release of dopamine, the brain's pleasure chemical. When a user first begins to use nicotine, the nicotinic acetylcholine receptors are activated. With increased nicotine consumption, these receptors become desensitized and less responsive. The brain must produce more acetylcholine receptors to get that same desired response [9]. When a person tries to quit vaping, the brain detects a lack of nicotine and sends signals for more, making it harder to quit and fight off cravings.

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E-cigarettes are commonly portrayed as a safer alternative to conventional cigarettes. One of the main functional differences between the two smoking products is in the way the nicotine is generated. In cigarettes, tobacco is burned to deliver nicotine, whereas in vaping devices, the e-cigarette liquid is heated to deliver nicotine. When a cigarette is burned, the tar found in cigarettes produces more than 7,000 chemicals, some of which are toxic and carcinogenic and remain in the lungs indefinitely [10]. E-cigarette vapor does not contain any tar. However, e-cigarettes can still do damage. Many e-cigarettes contain cancer-causing chemicals including formaldehyde, diacetyl, heavy metals and microscopic particles that can also lodge in the lungs [11].

It is well-known that cigarette use increases the likelihood of lung cancer, but it is still unknown if such an association exists with e-cigarettes. Although, experts say anything other than clean air inhaled into the lungs can potentially be damaging [12]. Two primary chemicals found in e-cigarettes have been correlated with lung injury. Acrolein, a chemical used to kill weeds, found in e-cigarettes has been correlated to increase the odds of acute lung injury, asthma and chronic pulmonary disease [13]. A study found daily e-cigarette users were 73% more likely to report asthma and 75% more likely to report chronic pulmonary disease than non-users [14]. Vitamin E acetate is another chemical found in vaping devices and is a strong correlate for vaping related hospitalizations, according to the CDC. Vitamin E acetate is oil believed to coat the lungs, making oxygen exchange increasingly difficult. As the lungs attempt to remove the oil, they become inflamed, which further hampers breathing [15] As of February 2020, vaping devices and other e-cigarettes have been associated with 2,807 patient hospitalizations and deaths [16].

Although the long-term health effects of e-cigarettes are unknown, studies indicate vaping can produce adverse health effects. Nicotine raises blood pressure and spikes adrenaline, increasing a person's heart rate and therefore increasing their risk of a heart attack [17] Vaping has also been correlated with poor oral health, increasing the risk of periodontal diseases [18].

There have been studies that have found associations between vaping and the development of mental health disorders. In a study of roughly 890,000 adults, researchers found a strong correlation between vaping and depression. Those who use e-cigarettes were twice as likely to struggle with depression as those who have never vaped before. The study also found the odds of depression increased with the increased use of e-cigarettes [19]. Vaping has also been linked with harm to other aspects of brain health. Nicotine exposure alters functioning synapses in the developing, prefrontal cortex of adolescent brains. The prefrontal cortex is one of the last areas of the brain to develop and is responsible for decision making, attention, and behavior. This part of the brain is vulnerable to the influence of psychoactive substances, especially in developing teenage brains. Studies have found vaping increases anxiety, impulsivity, mood changes, and stress [20]. Vaping has also been shown to hinder learning, concentration and slow brain development compared to non-smokers [20,21].

Young people may believe their age provides protection from contracting COVID-19. However, a recent study by Stanford University reported data connecting vaping to an increased risk of getting COVID-19 in teenagers and young adults. The study found those who vaped were five to seven times more likely to be infected than those who do not vape [22].

Many companies producing e-cigarettes have faced heightened scrutiny for attracting and addicting adolescents to their products. In November, the most popular vaping company, Juul, voluntarily announced they would stop selling mint, their most popular flavor, in response to an enormous amount of public pressure. This flavor made up 70% of Juul's U.S. sales [23]. This response seemed like a step in the right direction by Juul to get adolescents hooked off vaping. However, experts have seen adolescents shift to buying Juul's menthol pods or other brands of mint e-cigarette devices instead [24].

The CDC has recently reported the number of U.S. youths who use e-cigarettes fell from 5.4 million in 2019 to 3.6 million in 2020 [25]. Although youth vaping is declining, it appears vaping is still prevalent among students in high school and universities and involves significant health risks.

## Funding

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