

E-CIGARETTES

BACKGROUND

E-cigarettes or electronic nicotine delivery systems (ENDS) go by many names – the most common name is “e-cigarette,” but other terms include e-cigs, vapes, vape pens, mods and tanks. For the purposes of this resource we refer to the entire category as “e-cigarettes.”

E-cigarette use among young people has skyrocketed in recent years and remains at epidemic levels: about **one in five high school students used e-cigarettes in 2020**, many of whom were not smokers in the first place.

WHAT IS AN E-CIGARETTE?

- E-cigarettes are devices that operate by heating a liquid solution to a high enough temperature so that it produces an aerosol that is inhaled.²
- Solutions, sometimes called **e-liquids**, almost always include **nicotine**, **flavoring** and a humectant, such as propylene glycol, to retain moisture and create the aerosol when heated.^{1,3}
- While many of the **flavorings** and humectants used in e-liquids have been approved by the Food and Drug Administration for oral consumption,² they **have not been approved for inhalation**. Thus, their health consequences are not well known when consumed in this manner [See “Health Effects” section].
 - » There is **growing evidence** that using e-cigarettes can harm lung health and puts users at greater risk of contracting COVID-19. **A recent study** found that e-cigarette users are five times more likely to test positive for COVID-19 than those who do not use tobacco products, and that dual users of cigarettes and e-cigarettes are nearly seven times more likely to test positive for the disease.



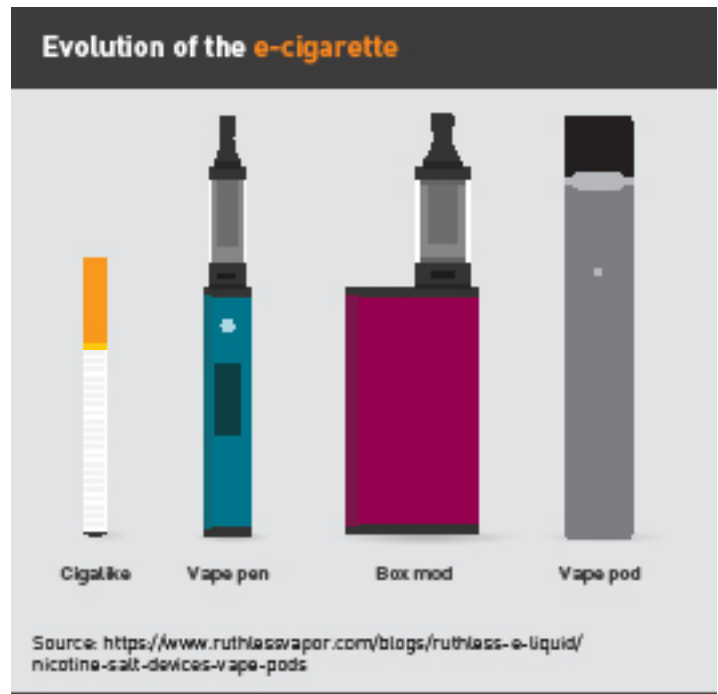
Nicotine salt formulas in the most recent generation of e-cigarettes allow for much higher levels and efficient delivery of nicotine.

- » In August 2019, cases of e-cigarette or vaping use-associated lung injury (EVALI) sharply increased, afflicting e-cigarette users with respiratory and other symptoms, peaking in September 2019.⁴ As of February 18, 2020, a total of 2,807 hospitalized EVALI cases had been reported to the CDC in the U.S. with 68 cases resulting in deaths.⁴
- » Data from a February 2020 study linked EVALI cases to vitamin E acetate, an additive in THC-containing vaping products. Vitamin E acetate was present in bronchoalveolar-lavage (BAL) fluid in 48 out of 51 EVALI patients from 16 states, but it was not found in BAL fluid from the comparison group of 99 healthy

individuals.⁵ Because 82% of the cases with specific substance use information available involved individuals who reported using THC-containing products, the FDA has recommended that consumers avoid purchasing vaping products of any kind on the street, using THC oil, or modifying store-bought products.⁶

» While cases of EVALI have decreased since the initial outbreak, the California Department of Public Health reported eight cases of EVALI in April 2020, the first cases reported to them since February 2020.⁷ The CDC states, “it is possible that more than one compound or ingredient could be a cause of lung injury, and evidence is not yet sufficient to rule out contribution of other toxicants.” It continues to advise non-smokers to avoid vaping of any variety and especially products purchased “off the street.”

- Older generations of e-cigarettes used a form of nicotine called free-base nicotine. The most recent generation of e-cigarettes on the market, which include pre-filled pod systems like JUUL, refillable systems like Suorin Drop and Kandypens, and disposable systems like Puff Bar, use nicotine salts in the e-liquids.
- » The nicotine salt formulas allow for much higher levels and efficient delivery of nicotine with less irritation compared to earlier generations of e-cigarettes — prompting questions about the use, purpose and safety of this novel form of nicotine.⁸
- » Higher nicotine e-cigarettes have driven the surge in e-cigarette sales in recent years, with those containing at least 4% nicotine comprising nearly three-quarters of the e-cigarette market in 2018.⁹ Unlike in Europe, where e-cigarette nicotine concentrations cannot exceed 2%, there are no nicotine concentration restrictions in the United States.¹⁰



THE EVOLUTION OF E-CIGARETTES

- E-cigarettes first entered the market in 2007 and have evolved many times since then, with older versions designed to resemble regular cigarettes, cigars, pipes, pens, and even USB flash drives.^{2,13}
- The latest generation of products feature a sleek, high-tech design and are disposable or use easily rechargeable batteries.
- The most popular, JUUL, is a pre-filled pod system containing nicotine salts that emerged in 2015 and quickly established itself as a leading e-cigarette product. JUUL remains the most popular reusable e-cigarette device, with 51.6% of the reusable market share in April 2021. JUUL's share of the whole e-cigarette market is 49.7%.¹⁵
- “Copycat” products, such as Suorin Drop, myblu, and Vuse Alto, followed JUUL's blueprint of high-tech design and high nicotine delivery through nicotine salt e-liquid formulations. These devices are all often referred to as “JUUL” due to the ubiquity of the brand, but they are also referred to as “pod mods” because the e-liquid is sold in self-contained disposable pods.

- JUUL also inspired copycat devices that are specifically compatible with JUUL, including Eonsmoke and Vapor4Life, that deliver similarly high amounts of nicotine in sleek, discreet devices or in devices that either use JUUL pods or have pods that can be used in JUUL devices.¹⁶

- While pre-filled pods or cartridges like JUUL remain the most popular device type, use of disposable e-cigarettes like Puff Bar, which heats up a cartridge containing e-liquid but is disposable and does not use pre-filled pods, are rapidly increasing in popularity.

- Use of disposable e-cigarettes increased about 1,000% (from 2.4% to 26.5%) among high school e-cigarette users and more than 400% (from 3% to 15.2%) among middle school e-cigarette users during 2019-2020.¹ E-cigarette sales data reflect these trends as well: sales of disposable products nearly doubled from 10.3% to 19.8% while prefilled cartridge product sales fell from 89.4% to 80.2% from August 2019 to May 2020.

- **Puff Bar** was the most popular disposable device, with 51.3% of the disposable market share in April 2021, followed by BIDI Stick with 24%.¹⁷

- Disposable e-cigarette products like Puff Bar can still be sold in flavors, an exemption that may be driving disposable e-cigarettes' increasing popularity.¹⁸ Because Puff Bar is a device built for single use, it is exempt from the FDA's enforcement guidance on flavored e-cigarette products. Puff Bar's website advertises up to 15 different flavors, including "Strawberry," "Blueberry Ice," and "Cool Mint" (see "Marketing" section).

- Recently, Puff Bar claims it started using **synthetic nicotine** in its products, causing uncertainty about its regulatory status.



Heated tobacco products


In addition to e-cigarette products, tobacco companies have introduced new products that work by heating tobacco instead of burning it. In 2019, IQOS — produced by Philip Morris International — became the first tobacco heating system authorized by the FDA to be marketed and sold in the U.S. Although manufacturers claim that heating tobacco is less harmful than traditional cigarettes, current data on health effects of these devices are sparse and most of what has been published has been by tobacco industry scientists.

For more information, read Truth Initiative's report on [**IQOS in the U.S.**](#)

HOW MUCH NICOTINE IS IN AN E-CIGARETTE?

Nicotine levels in e-cigarettes are highly **variable**, with some reaching or **exceeding** levels found in combustible **cigarettes**.^{3,21}

- **Labeling is not always a reliable indicator** of nicotine content, as studies have found mislabeling to be a common issue in the category.^{3,25}
- The way an e-cigarette is used or **modified** also affects the delivery of nicotine to an individual user.^{3,22}
- Some e-cigarette products deliver nicotine as efficiently as a cigarette. The use of nicotine salts also lowers the pH of e-liquids, which allows **higher concentrations of nicotine to be delivered with less irritation**.²³ For example, the maker of JUUL claims the product has a nicotine content like traditional cigarettes, and that it delivers the nicotine up to 2.7 times faster than other e-cigarettes.²⁴
- In the U.S., JUUL devices were originally introduced with a 5% nicotine salt pod.²⁵ Following suit, **JUUL competitors began offering nicotine salt concentrations as high as 7%** in what has been called a “nicotine arms race.”²⁹ However, in 2018, JUUL introduced a lower nicotine pod, with 3% nicotine strength.¹¹ Popular disposable devices such as Puff Bars use nicotine salts and are sold with nicotine strengths as high as 5%.²⁶



Recent reports of lung illnesses related to vaping have raised questions about both the long- and short-term effects of vaping.

- In addition to the rate of nicotine delivery, the nicotine content of products like JUUL also raises concerns about the potential for addiction. A 2018 Truth Initiative study published in Tobacco Control found that **among current youth and young adult JUUL users, the majority — 63% — did not know that the product always contains nicotine**.²⁷ Anecdotally, youth are reporting signs of **severe dependence**, such as inability to concentrate in class, using an e-cigarette upon waking, and using e-cigarettes at night after waking with a craving.^{28,29}

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