



ELECTRONIC CIGARETTES: AN OVERVIEW OF KEY ISSUES

A significant number of adults and youth are using electronic cigarettes, which provide a relatively new way to deliver the addictive substance nicotine without burning tobacco. E-cigarettes are less harmful than cigarettes but are not risk-free or safe.¹ In a 2020 report, the Surgeon General found that “the long-term health effects of using these products remain unknown, and short-term risks are only slowly coming into focus.”²

Research is still needed to determine whether or not e-cigarettes will help people quit, discourage smokers from quitting completely, or lead to established tobacco use for new users, including kids, especially in an environment where the products continue to evolve. In December 2018, the Surgeon General issued an advisory on e-cigarette use among youth, “officially declaring e-cigarette use among youth an epidemic in the United States.” He called for “aggressive steps to protect our children from these highly potent products that risk exposing a new generation of young people to nicotine.”³

What are Electronic Cigarettes?

The term “electronic cigarettes” covers a wide variety of products now on the market, from those that look like cigarettes, pens or USB drives to somewhat larger products like “personal vaporizers” and “tank systems.” Instead of burning tobacco, e-cigarettes most often use a battery-powered coil to turn a liquid solution into an aerosol that is inhaled by the user. The design of e-cigarette devices have changed since they have been introduced, becoming more sleek and more concealable.



Sample of e-cigarette products. Images are not to scale.

There are a wide range of reusable e-cigarettes and “pods,” which enable users to replace a nicotine-containing cartridge (such as Juul) or refill a tank with a liquid solution (such as Suorin), and there are disposable e-cigarettes, which cannot be refilled (such as Elf Bar). There are also “mods,” which are units that users assemble themselves from separate component parts, to allow variation in battery power, style, and size.⁴ In total, there were nearly 270 different e-cigarette brands available as of December 2022, an increase of 46.2% from January 2020.⁵ As of September 2023, there were over 6,277 different e-cigarette products on the market, of which 90% were disposable e-cigarettes.⁶ As of September 2023, pre-filled cartridges or pods made up 42.8% of sales in traditional retail outlets,[†] while disposable e-cigarettes made

^{*} For the purposes of this factsheet, the term “e-cigarettes” will be used to represent the entire category of products.

[†] Convenience stores, gas stations, grocery stores, drugstores/pharmacies, mass merchandiser outlets, club stores, dollar stores, and military sales. Excludes Internet sales and sales from tobacco specialty stores like vape shops.

up 57.2%.⁷ At this time, the top-selling e-cigarette brands were (in descending order of dollar sales) Vuse, JUUL, Breeze Smoke, Elfbar2, NJOY, HQD, Lost Vape Orion, Loon Maxx, Mr Fog, and Esco Bars.⁸

The liquid solution used in e-cigarettes typically contains nicotine, propylene glycol, glycerin or some other solvent, and other additives. E-cigarettes and refill liquids or cartridges often contain flavorings, including fruit and candy flavorings that are not permitted in regular cigarettes. Many e-cigarettes and their refill liquids also come in sweet flavors, such as fruit punch, funnel cake, orange soda, and strawberry, which have long been considered attractive to kids. By 2017, researchers identified more than 15,500 unique e-cigarette flavors available online.⁹ In addition to the vast selection available online, refill liquids and disposables in a variety of flavors, and other e-cigarette products are available at vape shops.

Over time, the nicotine content in the liquids used in e-cigarettes has increased so that now the market is dominated by high-nicotine products. Retail data from IRI found that sales of e-cigarettes sold in tracked channels[‡] with 5% nicotine or higher increased from 5% of total sales in January 2017 to 81% by March 2022.¹⁰ Similarly, retail data from NielsenIQ showed that the monthly average nicotine strength of e-cigarette products increased from 2.5% nicotine concentration in January 2017 to 4.4% nicotine concentration in March 2022, with greater increases among disposable products compared to pre-filled pods/cartridges or refill e-liquids.¹¹ Large-format disposable e-cigarettes that allow for thousands of “puffs” are also widely available. One study aptly described current disposables on the market as “bigger, stronger and cheaper.” From January 2017 through September 2022, disposable e-cigarettes quintupled in e-liquid capacity and nearly tripled in average nicotine strength, while decreasing threefold in price per milliliter of e-liquid.¹²

Currently, no reliable estimate of the size of the overall e-cigarette market exists, but market sales data from traditional retail markets show that e-cigarette sales reached an all-time high in 2022, at 324.7 million units sold, a small increase from 2021 (322.3 million units).¹³ The three major U.S. tobacco companies – Altria/Philip Morris, Reynolds American/Lorillard, and ITG Brands – have all invested in the e-cigarette market with their own brands, though Altria no longer sells its own e-cigarette products. In 2018, Altria paid \$12.8 billion to invest in Juul Labs (for a 35% stake in the company),¹⁴ but in early 2023, it exchanged that share for a non-exclusive global license to certain JUUL heated tobacco product intellectual property¹⁵ and then acquired NJOY e-cigarettes for \$2.75 billion.¹⁶

There are hundreds of independent e-cigarette companies, thousands of “vape shops,” and many online retailers, leading to a wide variety of product characteristics, including ingredients and nicotine content. A large proportion of e-cigarettes in the U.S. market are imported. Between 2016 and 2018, nearly 100% of imported e-cigarette devices with and without nicotine came into the U.S. from China, but only about half of e-liquid products imported into the U.S. were from China.¹⁷

E-cigarettes must obtain a marketing order from FDA to be sold in the U.S. In April 2022, FDA reported that it has addressed 99% of the 6.7 million pre-market applications it received since September 9, 2020, including denying marketing orders for one million products.¹⁸ To date, FDA has authorized the marketing of 23 e-cigarettes and compatible e-liquid cartridges.¹⁹ Notably, these products have low market share;²⁰ for instance, Vuse Solo is the least popular of the Vuse line of products.²¹ FDA denied the marketing of thousands of flavored e-cigarettes, most notably some myblu e-cigarettes and several menthol e-cigarettes,²² and many recipients have challenged those denial orders in court. In its denial of Vuse Solo menthol products, FDA stated that flavored e-cigarettes, including menthol e-cigarettes, “have a known and substantial risk with regard to youth appeal, uptake and use,” and that, “evidence submitted by the applicant did not demonstrate that its menthol-flavored e-cigarettes provide an added benefit for adult smokers relative to tobacco-flavored e-cigarettes.”²³

[‡] Tracked data includes mass channel and convenience stores; does not include online sales or sales from tobacco and vape shops.

E-Cigarette Marketing

The 2016 Surgeon General's Report stated that, "E-cigarettes are marketed by promoting flavors and using a wide variety of media channels and approaches that have been used in the past for marketing conventional tobacco products to youth and young adults."²⁴ E-cigarette manufacturers resurrected the marketing practices used by tobacco companies for decades to attract kids to smoking – including some tactics that have been prohibited for tobacco companies precisely because they appealed to kids.²⁵

Types of E-Cigarette Marketing. Some e-cigarette marketing tactics have included ads that reach youth audiences; sponsorships and free samples at youth-oriented events such as auto races and music festivals; celebrity spokespeople who depict e-cigarette use as glamorous; social media marketing; and sweet, kid-friendly flavors.

The Federal Trade Commission (FTC) documented a more than five-fold increase in spending by the top e-cigarette companies to promote their products, from \$197.8 million in 2015 to a peak of \$1.0 billion in 2019, before declining to \$719.9 million in 2020 (most recent available).²⁶ The FTC previously noted that exposure to e-cigarette advertising is one of the "factors that has contributed to the surge in e-cigarette use among youth."²⁷ These findings align with early studies showing increases in marketing spending in the years that youth e-cigarette use also rose.²⁸ Separate ad-tracking data found that JUUL led the large increase in spending between 2018 and 2019, followed by BAT/Reynolds (makers of Vuse) and ITG Brands (makers of blu). By 2020, after JUUL stopped marketing in all print, broadcast, and digital product marketing, BAT/Reynolds accounted for 90 percent of all tracked ad spending.²⁹

Like cigarette and smokeless tobacco companies, e-cigarette companies spent the majority of their marketing expenditures on price-reducing strategies, including price discounts, retail value added, promotional allowances, coupons, and sampling. In 2020, they spent \$423.6 million, or nearly 60% of total marketing spending, on point-of-sale and pricing strategies, a four-fold increase since 2015. In addition, the FTC found that, following the FDA's ban on free e-cigarette samples, companies began offering their products for \$1 or less—a clear effort to evade a regulation aimed at limiting youth access. Between 2018 and 2020, spending in this category more than doubled to \$140.1 million, the second-largest spending category in 2020. FTC noted, "The increased spending occurred because following the ban on free e-cigarette samples, some companies began offering e-cigarette products for \$1 or a similar highly discounted price in order to evade the spirit, if not the letter, of the FDA's sampling ban."³⁰ The U.S. Surgeon General concluded in 2012 that the tobacco industry's price-reducing promotions are one of the factors that has led to higher tobacco use among youth.³¹

The FTC first recorded spending on company-controlled social media accounts in 2017, with an increase to \$1.2 million in 2020.³² In 2019, in addition to the \$1.3 million they spent on social media marketing, they also spent \$6.8 million on endorsements from celebrities, influencers, brand ambassadors, and others often appearing on social media, which was a massive increase from \$288,000 in 2015, before ending all spending in this category in 2020.³³ Celebrities and social media influencers were asked or paid to mention products on their social media pages, appear in TV or other sponsored ads, provide testimonials, write blog posts, and appear at events. In some cases, they were also provided with free products or discount codes. The FTC stated, "This increased expenditure suggests an attempt by some manufacturers to use newer media to secure lucrative, long-term customers addicted to their e-cigarette products."³⁴

Social media has helped to fuel the popularity of e-cigarettes, including one of the top-selling e-cigarette brands, Juul. A study analyzing Juul marketing noted that Juul was one of the first major e-cigarette brands to rely heavily on social media to market and promote its products. The study found that Juul's initial marketing expenditures in traditional channels were modest compared to competing brands, and that these expenditures decreased as the brand increased content and received more promotion on social media channels like Instagram and Twitter.³⁵

Impact of E-Cigarette Marketing on Youth.

These advertising efforts have effectively reached youth and young adults. The Surgeon General concluded that, “E-cigarettes are marketed in a wide variety of channels that have broad reach among youth and young adults.”³⁶ The 2021 National Youth Tobacco Survey (NYTS) found that 70.3% of middle and high school students – 17.77 million youth – had been exposed to e-cigarette advertisements from at least one source.³⁷

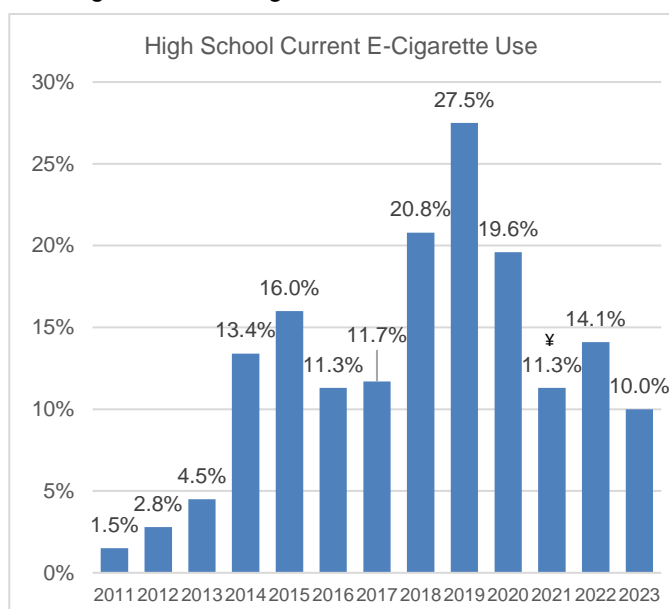
Studies using data from several national government surveys (PATH, NYTS) find that youth e-cigarette advertising exposure is significantly associated with e-cigarette use and greater exposure is associated with higher odds of use.³⁸

Use of E-Cigarettes Among Adults and Youth

E-cigarettes have been the most popular tobacco product among youth since 2014, and the number of youth using e-cigarettes is alarming and raises serious concerns. While e-cigarettes have become increasingly popular among youth and young adults, uptake has remained low among older adults.

Youth Use. According to the NYTS,[¥] e-cigarettes have been the most popular tobacco product among youth since 2014. In 2023, over 2.1 million youth, including 10% of US high schoolers, were current e-cigarette users.³⁹ Another national survey estimates that each day, more than 4,300 kids (under 18) try e-cigarettes for the first time.⁴⁰

Kids are not just experimenting with e-cigarettes, but are using them frequently, leading to an addiction that is difficult to break. In 2023, 39.7% of high school e-cigarette users reported vaping on 20 or more days/month, and 29.9% reported daily use. In total, over half a million middle and high school students are vaping every single day.⁴¹ According to the FDA, “Teens who vape may end up addicted to nicotine faster than teens who smoke cigarettes. This is because vapes may expose users to more nicotine and may be used more frequently. Plus, e-cigarettes may come in flavors that appeal to youth. Appealing flavors may cause teens to vape longer and more often, putting them at risk for nicotine addiction.”⁴²



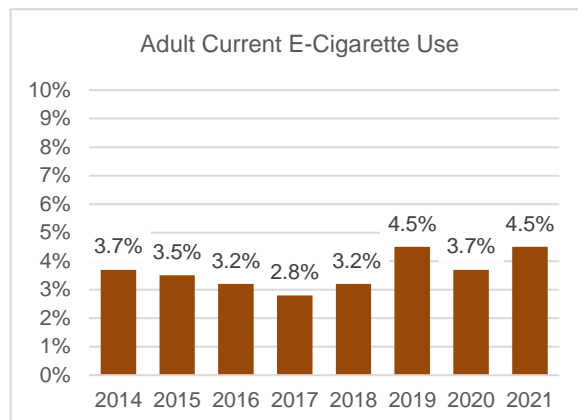
While cartridge (or “pod”) systems like Juul initially drove the youth e-cigarette epidemic, disposable e-cigarettes are now the most popular e-cigarette devices among youth. In 2023, 60.7% of youth e-cigarette users reported using disposable e-cigarettes. Elf Bar—a disposable e-cigarette preferred by more than half of youth e-cigarette users—is the most popular e-cigarette brand among youth, followed by Esco Bars, Vuse, JUUL and Mr. Fog.⁴³ Data the International Tobacco Control (ITC) Youth Survey, collected in August 2022, also found that Elf Bar was the top disposable brand reported among a sample of 16–19 year-olds in the United States.⁴⁴

[¥] 2021 NYTS data is not comparable to other years due to a methodology change.

Adult Use. Data from the National Health Interview Survey (NHIS) show that in 2021, 4.5% of adults currently used e-cigarettes every day or some days, a statistically significant increase from 3.7% in 2020. E-cigarette use is highest among younger adult populations: 11.0% of 18-24-year-olds use e-cigarettes every day or some days, compared to 6.5% of 25-44-year-olds, 2.7% of 45-64-year-olds and 0.9% of those aged 65 and over.⁴⁵

In 2021, 61.4% of 18-24 year-old current e-cigarette users had never been cigarette smokers, the highest proportion among the age groups and an increase from 2019 data showing that 56.0% of young adult current e-cigarette users had never been smokers. This youngest adult age group also had the lowest percentage of e-cigarette users who were former smokers.⁴⁶ Similarly, data from the Behavioral Risk Factor Surveillance System (BRFSS), show that the proportion of young adult never smokers using e-cigarette users roughly doubled between 2016 and 2018, while e-cigarette use rates among older adult never smokers changed very little.⁴⁷

The fairly stable e-cigarette use rates among adults have not tracked with the rising trend in e-cigarette sales. For instance, the FTC found a “dramatic growth in e-cigarette sales” from \$304.2 million in 2015 to \$2.7 billion in 2019⁴⁸ but during that time, adult use remained relatively stable, with only a small rise in 2019. In contrast, youth use increased significantly during this time.



Flavored E-Cigarettes

Research shows that the wide availability of flavored e-cigarettes has driven their popularity among youth. According to the FDA, “The evidence shows that the availability of a broad range of flavors is one of the primary reasons for the popularity of ENDS among youth. The majority of youth who use ENDS report using a flavored ENDS product, and the use of flavored ENDS has increased over time.”⁴⁹ The 2023 NYTS found that nearly 90% of youth e-cigarette users use flavored products. Among youth users of flavored e-cigarettes, the most commonly used flavor types were fruit (63.4%), candy/desserts/other sweets (35.0%), mint (27.8%) and menthol (20.1%).⁵⁰ Earlier data from the 2016-2017 wave of the Population Assessment of Tobacco and Health (PATH) study found that 70.3% of youth e-cigarette users say they use e-cigarettes “because they come in flavors I like.”⁵¹

The popularity of various flavors of e-cigarettes has changed over time. When e-cigarettes were first introduced in the U.S., only tobacco and menthol flavors were available, but very quickly, the number of flavors exploded. Beginning in 2017, as the popularity of Juul surged, other flavors like fruit, dessert and candy made up the largest portion of sales.⁵² However, sales of mint-flavored products grew when Juul removed its mango, cucumber, and crème flavors from the market in late 2018.⁵³ When Juul stopped sales of mint-flavored products in late 2019⁵⁴ and the FDA prohibited sale of cartridge-based products in flavors other than tobacco and menthol in February 2020, menthol-flavored e-cigarette sales grew dramatically. Sales of menthol-flavored e-cigarettes in traditional retail outlets increased by 24.9% between February 2020 and September 2023. As of September 10, 2023, menthol-flavored products made up 28.1% of all unit sales in traditional retail outlets and 60.9% of sales of cartridge-based products like Juul. However, due to the surge in sales of disposable e-cigarettes, flavors other than tobacco, mint and menthol—like fruit and candy—now comprise 44.9% of the market.⁵⁵

Youth use of certain flavored products has tracked these changes in the market. From 2018 to 2019, youth use of fruit flavors fell, while youth use of mint and menthol flavors increased by 50%.⁵⁶ In 2023, 20.1% of youth e-cigarette users reported using menthol-flavored products.⁵⁷ The FTC report detailing e-cigarette marketing spending and sales during 2015-2018 stated, “The dramatic increase in flavored products raises serious concerns that such products might have increased youth use of e-cigarette products and facilitated their continued use, resulting in addiction and other harmful effects.”⁵⁸

While data does show that flavored e-cigarettes are used by adults as well, according to the FDA, youth e-cigarette users are more likely to use flavored e-cigarettes compared to adult e-cigarette users.⁵⁹ As such, the dramatic increase in sales of flavored e-cigarettes has not yielded a similar uptake in adult use of e-cigarettes. Further, data from the PATH study has found that while the availability of flavors is the number one reason for use among youth (ages 12-17) and young adult (ages 18-24) e-cigarette users, but just the seventh most commonly reported reason for use among adults ages 25 and older.⁶⁰ While some adult users claim that they need flavored e-cigarettes to help them quit, public health authorities in the U.S., including the CDC, have found that there is not enough evidence to recommend e-cigarettes, including flavored e-cigarettes, for tobacco cessation.

For more information, see Campaign for Tobacco-Free Kids fact sheet, *Flavored E-Cigarettes Hook Kids*, <https://www.tobaccofreekids.org/assets/factsheets/0407.pdf>.

Health and Public Health Concerns

Under the right circumstances, e-cigarettes could benefit public health if they help significantly reduce the number of people who use combustible cigarettes and die of tobacco-related disease. However, these potential benefits must be weighed against the current epidemic of use among youth. As the Surgeon General stated in a 2020 report, “The potential benefit of e-cigarettes for cessation among adult smokers cannot come at the expense of escalating rates of use of these products by youth.”⁶¹

According to CDC, the Surgeon General, and the 2018 National Academies of Sciences, Engineering, and Medicine (NASEM) report on e-cigarettes, e-cigarettes are less harmful than combustible cigarettes, but that doesn’t mean that they are safe or without risk.⁶² The Surgeon General found that “the long-term health effects of using these products remain unknown, and short-term risks are only slowly coming into focus.”⁶³ While many questions still remain about the potential long-term risks to the public health posed by these products, emerging evidence suggests that using e-cigarettes can increase respiratory and cardiovascular risk.

For more information, see Campaign for Tobacco-Free Kids fact sheet, *Understanding the Health Risks of E-Cigarettes*, <https://www.tobaccofreekids.org/assets/factsheets/0418.pdf>.

Individual-Level Health Risks

E-cigarette ingredients and constituents. There is insufficient research on the long-term effects of using e-cigarettes, which involves regular inhalation of nicotine, glycerin or some other solvent, and other additives.⁶⁴ According to the Surgeon General, “E-cigarette aerosol is not harmless. It can contain harmful and potentially harmful constituents, including nicotine.”⁶⁵ The nicotine present in e-cigarette aerosol is absorbed by users and bystanders.⁶⁶ Studies have found other chemicals and toxins present in some e-cigarettes, including formaldehyde, acrolein, volatile organic compounds like toluene, tobacco-specific nitrosamines, and metals like nickel and lead.⁶⁷ These compounds are generally present at levels much lower than in cigarette smoke, although the compounds themselves are found on FDA’s list of harmful or potentially harmful substances.⁶⁸ Because FDA is still reviewing the wide variety of products on the market, there is no way for consumers to know for sure yet what is in specific products or the aerosol.

In addition, while some of the other substances, such as flavorings, used in e-cigarettes might be labeled as “generally recognized as safe,” some researchers as well as the organization primarily responsible for granting that designation⁶⁹ have noted that it applies to ingestion, not for other exposures such as inhalation. The NASEM report committee expressed concern about flavor additives because even to-date, they “have not been widely tested for sensitizing, toxic, or irritating potency.”⁷⁰ In its 2016 report, the Surgeon General stated that, “while some of the flavorings used in e-cigarettes are generally recognized as safe for ingestion as food, the health effects of their inhalation are generally unknown” and noted that some of the flavorings found in e-cigarettes have been shown to cause serious lung disease when inhaled.⁷¹ According to the FDA, “Flavorings that are safe for use in food may become toxic when these chemicals are heated and inhaled. Some have been shown to be harmful to the lungs.”⁷²

Impact of Nicotine. E-cigarettes and refill liquids contain widely varying levels of nicotine, and the nicotine delivered through the aerosol can also vary depending on the device characteristics and user practices.⁷³ Some e-liquids are formulated with nicotine salts, which, according to the Surgeon General, “allow particularly high levels of nicotine to be inhaled more easily and with less irritation than the free-base nicotine that has traditionally been used in tobacco products, including e-cigarettes.”⁷⁴ While e-cigarettes can be used for non-nicotine products, including marijuana, the vast majority of e-cigarette products sold in traditional retail stores contain nicotine,⁷⁵ and more than two-thirds of youth e-cigarette users report using e-cigarettes exclusively for nicotine-containing products.⁷⁶

Nicotine is a highly addictive drug that can have lasting damaging effects on adolescent brain development and has been linked to a variety of adverse health outcomes for the developing fetus.⁷⁷ The Surgeon General concluded that, “The use of products containing nicotine poses dangers to youth, pregnant women, and fetuses. The use of products containing nicotine in any form among youth, including in e-cigarettes, is unsafe.”⁷⁸

In general, nicotine has been found to impact the cardiovascular system.⁷⁹ The NASEM report found that the nicotine in e-cigarettes can increase heart rate and diastolic blood pressure in users shortly after use, but evidence was not available to determine an association between e-cigarette use and other cardiovascular outcomes such as heart disease and stroke. However, the NASEM report acknowledged that the nicotine in e-cigarettes could elevate cardiovascular disease risk in users with pre-existing cardiovascular disease.⁸⁰

Poisoning and Exposure to Liquid Nicotine. Delivered in high doses, nicotine can be lethal. The Surgeon General’s 2016 report and the NASEM report both found that contact with e-liquids can cause adverse health effects and ingesting e-liquids can lead to death.⁸¹ Exposure to liquid nicotine found in e-cigarettes has resulted in thousands of calls to poison control centers, according to the American Association of Poison Control Centers (AAPCC).⁸² To begin to address the poisoning risk that e-cigarettes and liquid nicotine pose to young children, in 2016 Congress passed the Child Nicotine Poisoning Prevention Act, which gave the Consumer Product Safety Commission authority to enforce child resistant packaging standards for e-cigarette products. This law went into effect in July 2016, yet e-cigarette-associated cases reported to U.S. poison centers have surged in recent years, reaching their highest level ever in 2022. From April 2022 to March 2023, 87.8% of e-cigarette-associated cases reported to U.S. poison centers occurred among children under age five.⁸³

Number of calls to poison control centers involving exposures to e-cigarette devices and liquid nicotine.*

2011	269
2012	459
2013	1,540
2014	4,011
2015	3,733
2016	2,899
2017	2,470
2018	3,139
2019	5,356
2020	3,832
2021	5,360
2022*	6,745
Through Oct 2023*	6,581

* Preliminary data, as poison centers continue to update their reports.

Population-Level Health Concerns

Youth and Young Adults. The number of youth using e-cigarettes raises serious concerns that e-cigarettes may function as a gateway to the use of more dangerous, combustible tobacco products.

- The Surgeon General found that while more research is needed, e-cigarette use is “strongly associated” with the use of other tobacco products among youth and young adults, including conventional cigarettes.⁸⁴
- The NASEM report concluded that “[t]here is substantial evidence that e-cigarette use increases risk of ever using combustible tobacco cigarettes among youth and young adults.”⁸⁵
- An analysis of data from the FDA’s nationally representative PATH study found that from 2013 to 2016, youth (ages 12-15) e-cigarette use was associated with more than four times the odds of trying cigarettes and nearly three times the odds of current cigarette use. The researchers

estimate that this translates to over 43,000 current youth cigarette smokers who might not have become smokers without e-cigarettes.⁸⁶

- New research shows that the latest generation of high nicotine e-cigarettes like Juul that have fueled the youth e-cigarette epidemic are also associated with subsequent smoking initiation. An analysis of 2017-2019 data from the Truth Longitudinal Cohort, a study of young and young adults (ages 15-27), found that compared with those who had never used an e-cigarette, those who reported ever use of any e-cigarette (Juul or other brands) in 2018 had significantly higher odds of ever cigarette use one year later, and those who reported ever use of Juul in 2018 had significantly higher odds of current e-cigarette use one year later.⁸⁷

Dual Use and Cessation. Data show that a significant number of e-cigarette users report using both e-cigarettes and conventional cigarettes, raising additional concerns beyond the potential health effects of e-cigarettes alone.

Many e-cigarette users report using both e-cigarettes and cigarettes. According to the 2021 NHIS, 29.4% of adult e-cigarette users are also current cigarette smokers (dual users) while 30.3% had never been smokers.⁸⁸ Research shows that, depending on the degree of continued smoking, dual users may not be exposed to lower levels of toxicants compared to exclusive cigarette smokers.⁸⁹ A study using 2013-2014 PATH data found that dual users had toxicant exposures that were similar to those who only smoked cigarettes.⁹⁰

Little data are available on what happens with dual users over time. Analysis of PATH data found that nearly 9 out of 10 early dual users were still smoking cigarettes at follow-up. Among adults who were dual users of e-cigarettes and cigarettes at Wave 1 (2013-2014), 44.3% maintained dual use, 43.5% discontinued e-cigarette use but maintained cigarette smoking, and only 12.1% discontinued cigarette use (5.1% discontinued cigarette use but continued e-cigarette use and 7.0% discontinued use of both products) at Wave 2 (2014-2015).⁹¹ Another study analyzing the same baseline PATH data (Wave 1) also found that three years later (Wave 4, 2016-2018) adult dual users were less likely to completely quit smoking cigarettes compared to those who hadn't used e-cigarettes.⁹²

Some e-cigarette users report that they believe that e-cigarettes will help them quit or reduce the number of cigarettes they smoke;⁹³ however, leading public health authorities have found that there is not enough evidence to conclude whether e-cigarettes are an effective smoking cessation device.⁹⁴ For example, the 2020 Surgeon General's Report on Smoking Cessation concluded that "there is presently inadequate evidence to conclude that e-cigarettes, in general, increase smoking cessation." The Surgeon General also cautions that because e-cigarettes are not a single product, but "a continually changing and heterogeneous group of products" that "are used in a variety of ways," it is difficult to make broad generalizations about the efficacy of e-cigarettes for smoking cessation based upon any one study or any one product.⁹⁵ The U.S. Preventive Services Task Force (USPSTF), which makes recommendations about the effectiveness of specific preventive care services after a thorough assessment of the science, concluded that "the current evidence is insufficient to assess the balance of benefits and harms of electronic cigarettes (e-cigarettes) for tobacco cessation in adults... The USPSTF recommends that clinicians direct patients who use tobacco to other tobacco cessation interventions with proven effectiveness and established safety."⁹⁶ A 2021 World Health Organization (WHO) report concluded that "evidence on the use of ENDS as a cessation aid is inconclusive".⁹⁷

Several studies have found that e-cigarette use is not associated with successful quitting. For example, a 2020 meta-analysis of 55 studies found that e-cigarette use was not significantly associated with smoking cessation.⁹⁸ A 2018 study by Weaver et al., did not find any evidence that ENDS help adult smokers quit at a higher rate than smokers who did not use these products despite ENDS users being more likely to make a quit attempt. In fact, the authors state that "findings indicate that, at the time of this study, ENDS under "real world" use and conditions may have suppressed or delayed quitting among some adult smokers."⁹⁹ More recent research has found that e-cigarette use increases the risk of relapse among former smokers. A 2022 study published in *Tobacco Control* analyzed FDA's PATH data (Waves 3-5, 2016-2019) and found that recent former smokers who'd used e-cigarettes to quit had a significantly lower rate of staying quit from cigarette smoking compared to those who'd used either no e-cigarette

products of specifically, used any NRT/pharmaceutical aid.¹⁰⁰ A 2022 meta-analysis that examined smoking relapse among former smokers found that the risk of smoking relapse was double among those who used e-cigarettes compared to those who did not.¹⁰¹

On the other hand, some studies do indicate that e-cigarettes could help smokers stop smoking, especially if used under certain conditions, such as every day or as part of a clinical intervention with behavioral support.¹⁰² For example, several studies have found that daily or frequent e-cigarette use is associated with increased smoking cessation. A 2021 study that assessed the efficacy of e-cigarettes for cessation in a “real-world” setting found daily e-cigarette use was significantly associated with increased cessation for at least one month at follow-up, while non-daily e-cigarette use was significantly associated with decreased cessation.¹⁰³ A 2020 meta-analysis found that daily e-cigarette use was associated with increased smoking cessation while less than daily e-cigarette use was associated with significantly less smoking cessation.¹⁰⁴ An earlier study using PATH data found that cigarette smokers who used e-cigarettes daily had significantly greater odds of quitting compared to non e-cigarette users.¹⁰⁵ Of concern, some research has found that non-daily use of e-cigarettes and dual use of e-cigarettes and cigarettes can reduce a smoker’s chance of quitting compared to not using e-cigarettes at all.¹⁰⁶ These findings have critical implications for public health since a significant percentage of e-cigarette users do not use e-cigarettes daily and a significant percentage are dual users, and thus, are unlikely to quit smoking using e-cigarettes.

Other studies have found that electronic cigarettes may be effective at helping smokers quit traditional cigarettes when combined with behavioral support or when used as part of a clinical program.¹⁰⁷ A 2020 study found that combining NRT with nicotine e-cigarettes can lead to a modest improvement in smoking cessation.¹⁰⁸ A 2018 study published in the *New England Journal of Medicine (NEJM)* found that smokers receiving behavioral support to stop smoking through the U.K. National Health Service, had a quit rate of 18%, at one year follow-up, compared to 9.9% in the nicotine-replacement group.¹⁰⁹

While existing research provides mixed results about the effectiveness of e-cigarettes in helping current smokers successfully quit, unfortunately, most of the research that finds that e-cigarettes are effective for cessation do not reflect how the products are actually being used in the real world. More research reflecting actual use patterns is needed to determine any role e-cigarettes may play in helping smokers to quit smoking.

Quitting cigarette smoking completely is the most important step smokers can take to improve their overall health. The 2018 NASEM report stated that a “reduction in rate of smoking does not ensure reduction in tobacco-related harm” and that, “there is no available evidence whether or not long-term e-cigarette use among smokers (dual use) changes morbidity and mortality compared with those who only smoke combustible tobacco cigarettes.”¹¹⁰ Furthermore, the CDC has highlighted the importance of quitting cigarettes completely, not just cutting down. According to the CDC, “If you only cut down the number of cigarettes you smoke by adding another tobacco product, like e-cigarettes, you still face serious health risks. Smokers must quit smoking completely to fully protect their health – even a few cigarettes a day are dangerous.”¹¹¹ Studies have found that smoking just one to four cigarettes a day increases the risk of developing or dying from heart diseases.¹¹² A recent review of 141 studies that examined the relationship between cigarette consumption and the risk for cardiovascular disease and stroke found that smoking even one cigarette per day carries a very high risk for developing cardiovascular disease and stroke. The authors concluded that, “Smokers need to quit completely rather than cut down if they wish to avoid most of the risk associated with heart disease and stroke.”¹¹³ Thus, prolonging smoking, despite smoking fewer cigarettes from using e-cigarettes, will continue to put that person’s health at greater risk than if he or she had quit smoking entirely.¹¹⁴

For more detail and sources, see Campaign for Tobacco-Free Kids fact sheet, *E-Cigarettes and Smoking Cessation: A Summary of the Evidence*, <https://www.tobaccofreekids.org/assets/factsheets/0414.pdf>.

Important ongoing questions:

- *What are the long-term health impacts of e-cigarette use?*

- *Do e-cigarettes help smokers quit more effectively than FDA-approved cessation products?*
- *Currently, six in ten adult e-cigarette users are either dual users (continue to smoke cigarettes) or had never smoked in the first place. Will most e-cigarette users continue to be dual-users or never users, and what are the health impacts of those patterns of use?*
- *Will e-cigarette marketing renormalize tobacco use?*
- *Research shows a strong association between e-cigarette use and subsequent combustible cigarette smoking among youth and young adults. Will that translate into increased smoking rates in the long-term?*
- *Do e-cigarettes draw former smokers back into nicotine addiction and potentially back to cigarette smoking?*

There are many important unanswered questions regarding the short and long-term impact that e-cigarettes may have on public health. Effective regulation is needed to minimize the potential harms of e-cigarettes and maximize any potential benefits.

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