



## JUUL AND OTHER HIGH NICOTINE E-CIGARETTES ARE ADDICTING A NEW GENERATION OF YOUTH

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Launched in 2015, JUUL quickly disrupted the e-cigarette marketplace, popularizing e-cigarette devices that are sleek, discreet and have sweet flavors and a powerful nicotine hit. Nicotine is highly addictive, can negatively impact the development of the adolescent brain, and can harm the cardiovascular system.<sup>1</sup> Driven by the popularity of JUUL, by 2018 youth e-cigarette use in the United States had skyrocketed to what the U.S. Surgeon General and the FDA have called “epidemic” levels.<sup>2</sup> Former FDA Commissioner Scott Gottlieb has stated, “There’s no question the Juul product drove a lot of the youth use.”<sup>3</sup> The Surgeon General has called for “aggressive steps to protect our children from these highly potent products that risk exposing a new generation of young people to nicotine.”<sup>4</sup> Youth e-cigarette use still remains a serious public health concern, with over 2.1 million youth, including 10.0% of U.S. high schoolers reporting current e-cigarette use in 2023.<sup>5</sup> Each day, more than 4,300 kids (under 18) try e-cigarettes for the first time.<sup>6</sup> 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.”<sup>7</sup>

### **Kids are Not Just “Experimenting” with E-Cigarettes**

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, 740,000 million middle and high school students are vaping on a frequent basis, including 530,000 daily users.<sup>8</sup> Indicators of addiction have increased over time. From 2014 to 2021, median days of use increased from 3-5 days/month to 10-19 days/month in 2021.<sup>9</sup> In addition, the percentage of sole e-cigarette users who used e-cigarettes within 5 minutes of waking increased from less than 1% from 2014 to 2017 to 10.3% in 2021.<sup>10</sup> While data is not reported for e-cigarette users specifically, among youth who report current use of any tobacco products in 2021, 65.3% reported seriously thinking about quitting.<sup>11</sup> Data from the Monitoring the Future study found that 4.12% of youth e-cigarette users reported an unsuccessful quit attempt in 2020. In 2020, the prevalence of unsuccessful quit attempts among adolescents who had used either e-cigarettes or cigarettes was higher than the prevalence of unsuccessful cigarette quit attempts in each of the previous 13 years.<sup>12</sup>

Data from the International Tobacco Control Policy Evaluation Project (ITC) Youth Tobacco and Vaping Survey found that between in 2019, 53.1% of youth (aged 16-19) e-cigarette users reported they were either ‘a little’ or ‘very addicted’ to e-cigarettes.<sup>13</sup> The survey also found that youth who use higher nicotine concentrations report more intensive vaping behavior, including the number of days vaped in the past 30 days, the number of times vaping in an average day of use, the number of days ever vaped, experiencing frequent strong urges to vape and feeling ‘a little’ or ‘very addicted’ to vaping.<sup>14</sup> According to ITC data collected in August 2022, 61% of youth e-cigarette users used an e-cigarette within an hour of waking (including 25% of who used an e-cigarette within 5 minutes of waking and 25% who use an e-cigarette within 30 minutes of waking). This same survey showed that youth e-cigarette users are using the products intensely—45% of reported vaping more than 10 times per day, including one-third (33%) who reported vaping more than 20 times per day.<sup>15</sup>

Adolescents are more likely to experience nicotine dependence at lower levels of exposure than adults and can feel dependent after just minimal exposure and within a relatively short period of time.<sup>16</sup> A review of the evidence on the impacts of nicotine on the developing brain, published in the *American Journal of Preventive Medicine*, concluded that, “evidence is currently sufficient to warrant extreme caution regarding exposure of adolescents to exogenous nicotine.”<sup>17</sup> One study estimated that youth could meet the threshold for nicotine addiction by consuming just one quarter of a JUULpod per day.<sup>18</sup> A small study

of users of JUUL and other JUUL-like devices (including Bo, Phix and Sourin) ages 13-21 found that their urinary cotinine levels far exceeded that of youth cigarette smokers.<sup>19</sup>

News reports across the country have documented troubling stories of teens facing unexpected addiction to JUUL and other e-cigarettes:

**“The kids who did it for like a month because it was popular got addicted and couldn’t stop.”**

– high school junior, Massachusetts.<sup>20</sup>

**“I’ve tried to stop, and over the summer I stopped for a few weeks, but honestly, I’m addicted to nicotine. Like if I don’t have it, I think about it all the time.”**

– high school senior, Georgia.<sup>21</sup>

Whenever he put the Juul away, he says, the stress and negative feelings would return. **“I felt kind of trapped,”** he recalls. He would go back to it. **“I couldn’t stop,”** he says.

– high school freshman, North Carolina.<sup>22</sup>

**“I realized that I couldn’t stop...When I started hearing all the facts and everything bad about it, it was already too late. I was already hooked onto it.”**

– 8<sup>th</sup> grader, New York.<sup>23</sup>

**He would come to hate himself for being dependent on the tiny device, which he nicknamed his “11th finger.” Yet any thought of quitting made him crazy-anxious.**

– high school student, Massachusetts.<sup>24</sup>

**“It’s impossible to let go once you started using. I’ll tell you — after even an hour and a half or two, I am chomping at the bit to find my Juul.”**

– college student who started using as a high school sophomore, Colorado.<sup>25</sup>

Pediatricians across the country have echoed concerns about nicotine addiction in young patients who are using e-cigarettes:

**“Nicotine addiction can take hold in only a few days, especially in the developing adolescent brain that is particularly vulnerable to addiction to nicotine. My teenage patients who use JUUL are not merely engaging in harmless youthful experimentation. Many of them are using JUUL on a daily basis and show significant signs of nicotine addiction.”**

-Dr. Jonathan Winickoff, American Academy of Pediatrics<sup>26</sup>

**“With the Juuls, kids are able to get a much higher dose of nicotine — and dose matters. These kids have behaviors that we often see in patients who have opioid or marijuana addiction, but we didn’t typically see with kids who developed addiction to traditional tobacco cigarettes.”**

-Dr. Sharon Levy, Director of the Adolescent Substance Use and Addiction Program at Boston Children’s Hospital<sup>27</sup>

### **Use of Nicotine Salts Makes it Easier for New Users to Try E-Cigarettes**

Just like the tobacco industry has used additives and design changes to make cigarettes more addictive and appealing to new users (particularly youth),<sup>28</sup> JUUL pioneered a new e-liquid formulation that delivers nicotine more effectively and with less irritation than earlier e-cigarette models. According to the company, the nicotine in JUUL is made from “nicotine salts found in leaf tobacco, rather than free-base nicotine,” in order to “accommodate cigarette-like strength nicotine levels.”<sup>29</sup> JUUL’s original patent stated that, “certain nicotine salt formulations provide satisfaction in an individual superior to that of free base nicotine, and more comparable to the satisfaction in an individual smoking a traditional cigarette. The satisfaction effect is consistent with an efficient transfer of nicotine to the lungs of an individual and a rapid rise of nicotine absorption in the plasma,” and that, “a user of an e-cigarette comprising the nicotine

salt formulation will experience a comparable rate of physical and emotional satisfaction from using a formulation comprising a mixture of nicotine salts prepared with an appropriate acid at least 1.2X to 3X faster than using a formulation comprising a freebase nicotine.”<sup>30</sup>

According to a 2018 Surgeon General advisory on e-cigarette use among youth, nicotine salts allow users to inhale high levels of nicotine more easily and with less irritation than e-cigarettes that use free-base nicotine. As a result, it could be easier for young people to initiate the use of nicotine with these products.<sup>31</sup> Educating youth about the dangers of JUUL and nicotine use is critical—a study from Truth Initiative found that 63% of 15-24 year old JUUL users did not know the product always contains nicotine, even though all pods sold from JUUL do contain nicotine.<sup>32</sup> On the other hand, many youth are well aware of the powerful nicotine punch that JUUL delivers, seeking out what they call a “head rush.”<sup>33</sup> The 2021 National Youth Tobacco Survey (NYTS) found that among high school e-cigarette users, the most commonly reported reason for using e-cigarettes was “to get a high or buzz from the nicotine,” reported by 45.3% of users.<sup>34</sup> Similarly, a survey of Connecticut high school students found that 52% of high school Juul users reported liking Juul because it gives them a “buzz.”<sup>35</sup>

### **JUUL’s High Nicotine Content Disrupted the E-Cigarette Marketplace**

JUUL Labs claims that the nicotine in a JUULpod is equivalent to that of a pack of 20 cigarettes. Unlike most e-cigarettes, which had previously advertised their nicotine content by volume, JUUL advertised its nicotine content by weight when it entered the market in 2015. The advertised 5% nicotine level by weight would be the equivalent of 5.9% by volume, making JUUL three or more times as powerful as most e-cigarettes on the market prior to 2015, which had a nicotine content of 1-2% by volume.<sup>36</sup> One study found that the nicotine emissions from one puff of the JUUL device are equivalent to up to 10 puffs from closed system devices on the market prior to JUUL.<sup>37</sup> The 5% nicotine JUULpods sold in the U.S. exceed nicotine level limits set by many other countries. A lawsuit against JUUL from the state of North Carolina asserted that JUUL deceived consumers by understating the nicotine levels of its product and its addiction potential.<sup>38</sup> The lawsuit claimed that, “JUUL entered the e-cigarette market with among the highest nicotine potency of any product, a nicotine level so high that, in some countries, it is illegal for consumers of any age. JUUL has deceived consumers about that nicotine strength, has misrepresented the nicotine equivalency of its products to traditional cigarettes, and has understated the risks of addiction that occur with such powerful levels of nicotine.”

JUUL’s competitors, seeking to emulate the company’s success, subsequently flooded the U.S. market with similar pod-based e-cigarettes, including some that have nicotine levels even higher than 5%, resulting in what some researchers have referred to as a “nicotine arms race.” By September 2018, researchers had identified 14 brands offering “JUUL-compatible” pods and 39 JUUL knock-off devices that offered nicotine levels equal or higher to that of JUUL. Many of these companies offer the devices and pods for cheaper than JUUL and in a wider variety of kid-friendly flavors.<sup>39</sup> An analysis of e-cigarette sales in retail-tracked channels\* found that products with 5% nicotine or higher increased from 5% to 81% of sales between January 2017 and March 2022.<sup>40</sup>

Beginning February 6, 2020, FDA required the removal of pod-based e-cigarettes in flavors other than tobacco and menthol from the market unless they have received prior authorization. However, [disposable e-cigarettes](#) are still available in a wide array of flavors with the same high nicotine salt formulation that made pod-based products popular among kids. Unlike the “first generation” of disposable e-cigarettes that looked like cigarettes and had limited flavors, disposable e-cigarettes are now sleek, easily concealed, pre-charged, cheaper (some for less than \$5), available in a wide variety of flavors, and can even have higher nicotine concentrations than JUUL.<sup>41</sup> 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.<sup>42</sup> Disposable e-cigarettes like Puff Bar and Elf Bar have surged

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

in popularity among youth due to the wide array of flavors—like strawberry, cotton candy, and mint—that are now prohibited in cartridge systems. In 2023, 60.7% of youth e-cigarette users reported using disposable e-cigarettes.<sup>43</sup> From February 2, 2020, to December 31, 2023, sales of disposable e-cigarettes increased by 212.4% (4.1 million units to 12.7 million units). During this period, the market share of disposable devices increased from 26.2% to 57.2% of total e-cigarette sales. As of December 31, 2023, 77.3% of disposable sales were of flavors other than tobacco, mint, menthol, and clear/other cooling.<sup>44</sup>



**Stig Crisp Apple Disposable E-Cigarettes (6% nicotine); Mango Mojo Disposable E-Cigarette (5% nicotine); Puff Bar Disposable E-Cigarettes (5% nicotine); Blue Slushie Sea Stix Disposable E-Cigarette (5% nicotine)**

**Health Concerns for Youth Exposure to Nicotine**

According to the Surgeon General, “E-cigarette use poses a significant – and avoidable – health risk to young people in the United States. Besides increasing the possibility of addiction and long-term harm to brain development and respiratory health, e-cigarette use is associated with the use of other tobacco products that can do even more damage to the body.”<sup>45</sup> Nicotine is a highly addictive drug that can have lasting damaging effects on adolescent brain development—the brain keeps developing until about age 25. In particular, nicotine use can harm the parts of the adolescent brain responsible for attention, learning, mood and impulse control.<sup>46</sup> The Surgeon General concluded that, “The use of products containing nicotine in any form among youth, including in e-cigarettes, is unsafe.”<sup>47</sup>

In general, nicotine has been found to impact the cardiovascular system.<sup>48</sup> A 2018 report by the National Academies of Science, Engineering and Medicine (NASEM) found that the nicotine in e-cigarettes can increase heart rate and diastolic blood pressure in users shortly after use, but the long-term 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.<sup>49</sup>

Delivered in high doses, nicotine can be lethal. The Surgeon General’s 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.<sup>50</sup> 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).<sup>51</sup> The FDA had opened an investigation over 100 cases of reported seizures that may be linked to nicotine poisoning from e-cigarette use.<sup>52</sup> 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

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.

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.<sup>53</sup>

There is also concern that use of e-cigarettes may function as a gateway to the use of more dangerous, combustible tobacco products. In 2016, the Surgeon General concluded that e-cigarette use is “strongly associated” with the use of other tobacco products among youth and young adults, including conventional cigarettes.<sup>54</sup> The NASEM found a causal link between e-cigarette and cigarette smoking initiation, concluding that, “There is substantial evidence that e-cigarette use increases risk of ever using combustible tobacco cigarettes among youth and young adults.”<sup>55</sup> An analysis of data from the FDA’s nationally representative Population Assessment of Tobacco and Health (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.<sup>56</sup> In addition, several studies find that the link between e-cigarette use and smoking initiation was stronger for those who had *lower* risk factors for smoking at baseline.<sup>57</sup> 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.<sup>58</sup>

**For more information on JUUL, visit:**

<https://www.tobaccofreekids.org/what-we-do/industry-watch/e-cigarettes>

**Campaign for Tobacco-Free Kids, April 25, 2024 / Laura Bach**

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