

# Thinking JUUL Is Cool?

*The Real Truth About  
E-Cigarettes & Vaping*

By Julia Green



Over the past decade, electronic cigarettes (e-cigs) have sparked a new health debate in the United States. At first, these e-cigs were hailed as a great alternative to regular cigarettes. E-cigs were seen as a possible way for smokers to quit smoking tobacco cigars & cigarettes. Then came the big problem: people started getting sick, some even died. How are e-cigs affecting smokers, both old and new?

## The Beginning

Originally, e-cigs became commercially available in the United States in 2006 as an alternative to typical tobacco cigarettes.<sup>5</sup> However, it was not until 2015, when the third generation of customized e-cigarettes — with their personal settings and cartridge varieties — that e-cigs became wide-spread.<sup>2</sup> In 2015, popular e-cig manufacturer JUUL began marketing a novel type of e-cigarette with a nicotine salt preparation.<sup>11</sup> More commonly referred to as “nic salts”, this preparation style decreases the overall harshness & acidity of the cartridge, or “pod”, while keeping the amount of nicotine the same; leading to users inhaling much higher concentrations without being aware of it.<sup>7</sup> Nic salts allow users to take more hits from their e-cigs without their throats hurting. JUUL’s innovative preparation, along with flavored pods and ads targeting youths, took the fledgling e-cig market by storm.<sup>12</sup> By September 2018, JUUL commanded over two thirds of the e-cigarette market in the United States,<sup>6</sup> and is beginning to make smoking cool and commonplace to a new generation of consumers.

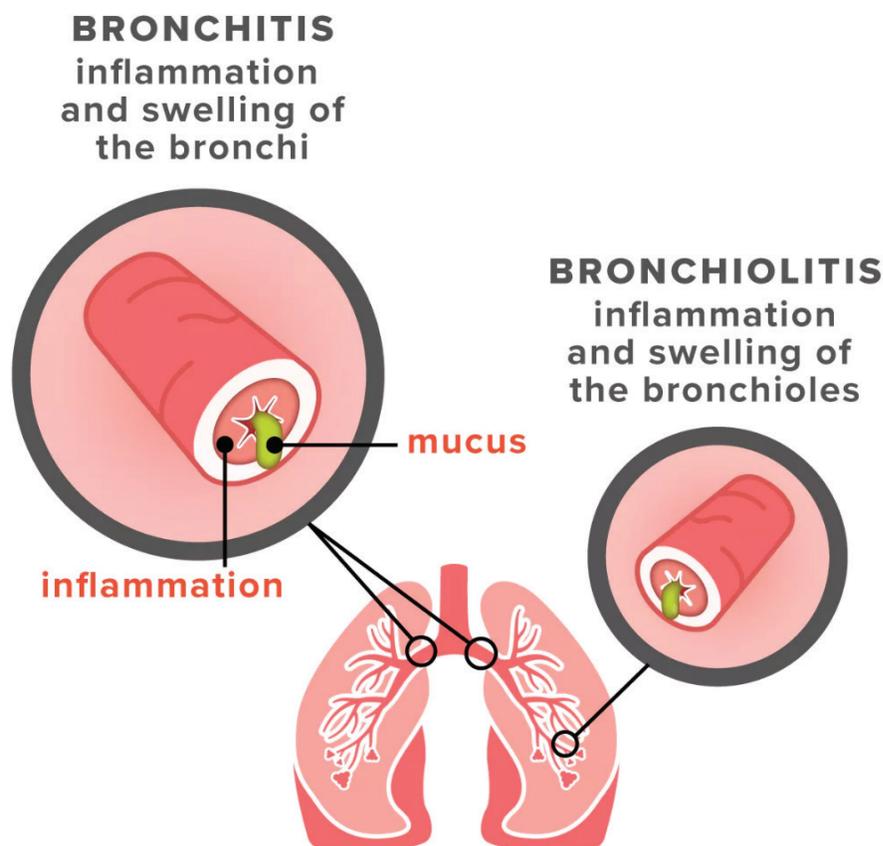
The bulk of the e-cigarette market, and certainly JUUL’s usage, is amongst teenagers and young adults, and the popularity of e-cigs and vapes has been skyrocketing

since 2015. In 2019 alone, 1 in 4 high school seniors vaped in the month prior to being surveyed, while almost half of them had vaped at some point in their lives.<sup>10</sup> These numbers are rising quickly! The number of teenage users has more than doubled from the first time this data was collected in 2017, when only 11% of high school seniors had vaped in the month before taking the survey. When asked, these teenagers and young adults said they started vaping for many reasons. Some started because they thought it was less harmful than tobacco products, others because they like the flavors of the pods, but the primary reason people begin using e-cigs is because a family member or friend vaped as well.<sup>10</sup> A truth that is coming to light is that e-cigarettes are as addictive or more so than the cigarettes they were meant to replace.

## The Unknowns

Since e-cigs are a relatively new phenomenon there are many problems that have arisen, but the most prominent one is that scientists do not know the long-term effects of vaping and using e-cigs can have on the body and the brain. Scientific information is only starting to be generated, as e-cig users start falling ill and/or dying. A theory as to why e-cig users are becoming ill is due to the introduction of flavored pods. In 2016, a report was published describing how over 75% of the flavored pods they tested had a chemical called diacetyl which was causing bronchiolitis obliterans and other severe respiratory diseases.<sup>1</sup>

Diacetyl, the chemical that helps cause these respiratory diseases, tastes buttery and adds to the flavor of the pod. It is a hazard that there are no FDA rules or regulations to prevent this



Bronchitis (left) causes inflammation, swelling, & mucus production in the top branches of the lungs, while bronchiolitis (right) leads to the exact same symptoms (inflammation, swelling, & mucus) deep within the lungs. From [www.healthline.com](http://www.healthline.com).

harmful chemical from being added to all these pods and it was only when users of popcorn flavored pods began to develop "Popcorn Lung", that the e-cig companies recalled the popcorn flavored pod. It is highly probable the popcorn pods were recalled solely due to the name association, because other products with diacetyl are still sold, even with the known risk of respiratory disease.

## Addiction: Is It Just Physical?

Today, scientists report that nicotine is addictive regardless of how it is ingested and is recorded as more addictive than cocaine to the nervous system.<sup>14</sup> Part of the reason for this is when nicotine is ingested the chemical dopamine is released in the brain. Dopamine, along with serotonin, oxytocin, and other neurotransmitters, are sometimes referred to as the "happy chemicals", because they activate neurons in the brain that lead to feelings of happiness and

contentment. Brains are very smart and repeat actions that generate any of these "happy chemicals". While this is evolutionarily beneficial, it also sets the stage for addiction. If doing something makes a person feel good (because of the dopamine released in their brain), then they will likely want to continue doing that thing. In this case, since smoking nicotine releases dopamine in a person's brain, it is more probable they will want to smoke again... and again... until they are addicted.

Primarily there are only nicotine studies which focus on cigarette doses, recent news reports suggest that vaping is a special case of nicotine addiction. The technology has only been on the market for little over ten years and users are already dying!<sup>4,9</sup> The first teenager to die passed away in early October of 2019, and unless he started vaping when he was in elementary school, it was clear that a big problem is about to hit e-cig users worldwide. A single regular strength vape pod is advertised as the equivalent to one pack of cigarettes. However, very few cigarette smokers will smoke a complete cigarette without pausing, which lets up to a third of the cigarette burn while not actively smoking it. Examined lungs of e-cig users looked like the lungs were chemically burned suggesting either dangerously high usage levels of e-cigs and the chemistry of these e-cigarettes are not well understood.<sup>13</sup>

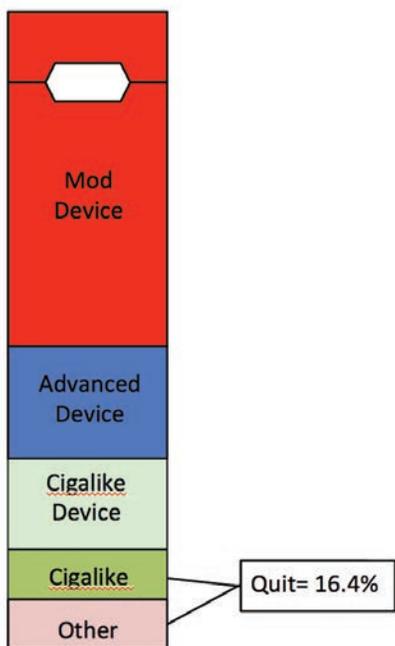
In 2017, Penn State contacted people from a study five years previous and asked how many of them still used e-cigs. Most of them replied they still used some form of e-cig. From the small minority of those who quit, many of them had primarily smoked cigarette-like (or cigalike) e-cigs. They transitioned back to using tobacco cigarettes. The people who continued using e-cigarettes typically upgraded

their e-cig battery life or made some other change to their cigarette technology.<sup>15</sup> For example, advanced devices are larger than a typical cigarette and have a button that must be pressed before taking a hit, they are pen-shaped and commonly referred to as a "vape pen". A modified (mod) device is a type of e-cig that is neither pen-shaped or cigarette-shaped; this is typically done to allow for longer battery life or better wattage. JUULs are examples of mod devices.

Over the past few years, e-cigarettes have become more aesthetically pleasing, helping to drive their sales and popularity. Not only does this design make vape pens more attractive, it also makes them easier to hide. The perfect storm occurred: many of these users were teenagers who realized e-cigarettes were relatively easy to hide and they were easier to smuggle into school, parties, or festivals than a pack of cigarettes to get the same kick; leading to a whole new market being created to help users hide their e-cig usage in public or in school.

## Dependent on Others

The hardest thing for a person with an addiction is to stop. As mentioned above, it appears that the addiction to vaping may be more intense than an addiction to cigarettes. This may have to do with dosages, flavors, and the chemistry of e-cigs, but it also can tie into the social aspect of using e-cigarettes and other vape products. Smoking is historically a social activity.<sup>8</sup> When one thinks of smoking or a "smoke break", it's typically people spending time together while smoking, which makes sense since humans are extremely social creatures. However, there's an issue with the combination of smoking and spending time with friends: both activate the dopamine pathways in the brain.



Of the 16% of e-cigarette users who quit, half of them still used a cigalike device (like a typical tobacco cigarette). The majority of continued e-cigarettes users transitioned to a mod device (like a JUUL)<sup>15</sup>. Original image by Julia Green

While this might seem beneficial at first glance, the problem lies in the fact that the brain is unable to separate the two. Nicotine releases dopamine and makes the brain feel good, as does hanging out with people you enjoy, so when the two are combined and lots of “happy chemicals” are being released in the brain, the brain is not aware enough to differentiate between the distinct dopamine triggers.

The dopamine pathway in the brain runs through the Prefrontal Cortex (PFC). This is in the very front of the brain, right behind one’s forehead, and it is where functions like memory, reward processing, and logic take place. There are a lot of neurons that release dopamine in the PFC which manages the reward processing that takes place there, and is one of the last places in the human brain to fully develop (usually around the age of 25). It is the main reason why teenagers and young adults are known for making horrendously detrimental judgement calls, or why they are über impulsive. These are all known and accepted concepts, but what is not known is how a young adult’s brain will be affected if they ingest a lot of nicotine before their brain is fully finished developing. It is

likely their brain development will be stunted, and possibly suffer nicotine poisoning. The danger of an unusually high percentage of current and future users having stunted brain development is real. However, the scary thing is how scientists and e-cigarette users *do not know* about their future health both physically and neurologically.

## So What’s Next?

There are no current FDA rules and regulations to monitor e-cigarette production and usage, and states are only starting to come up with legislation to track e-cigs as well. Beyond e-cig users, there is also collateral damage for family and friends who have to deal with these struggles and outcomes; it can already be seen in families and friends of people who struggle with alcoholism and drug addiction. Substance abuse harms families and friendships, and can cause dysfunction across all areas of one’s life. The damage is often both psychological and financial, which often branches into stunted social growth. What is clear from many of the crises found in the U.S.A in the past 50 years, is that when an issue is not addressed the result

injures a generation. Hopefully this time round, the issue of e-cigarette and vaping addiction can be tackled by non-partisan policy-makers applying science instead of politics and creating policies that help people overcome addictions and dependencies. Hopefully this will happen before irreversible neurological, physical, and social damage is done to all current and future users of e-cigarettes.

## Note from the Author:

This article was written in mid-November 2019. The author understands that this topic is very much a current one and new information & reports are coming out everyday.

If you, or someone you know is struggling with addiction please contact one of the addiction hotlines near you. Addiction hotlines recommend following the same procedures for quitting both cigarettes and vaping. If you are uncertain where to start, the National Institute of Health has suggestions specified to the type of addiction (<https://www.drugabuse.gov/>). ■

## REFERENCES

1. Allen J. G. et al. Flavoring Chemicals in E-Cigarettes: Diacetyl, 2,3-Pentanedione, and Acetoin in a Sample of 51 Products, Including Fruit-, Candy-, and Cocktail-Flavored E-Cigarettes. *Environmental Health Perspectives*, 124(6) (2016).
2. Bhatnagar, A. et al. Electronic Cigarettes. *Circulation*, 130(16), 1418-1436 (2014).
3. Center for Advancing Health. Smoking Relapse Rates Drop Off Sharply After Two Years. *EurekaAlert!: American Association for the Advancement of Science* (2002).
4. Corum, J. Vaping Illness Tracker: 2172 Cases and 43 Deaths. *The New York Times* (2019).
5. Historical Timeline of Electronic Cigarettes. CASAA (2019).
6. Craver, R. JUUL Expands e-Cig Market Share Gap with Reynolds’ Vuse. *Winston-Salem Journal* (2018).
7. Duell, A. K., Pankow, J. F. & Peyton, D. H. Free-Base Nicotine Determination in Electronic Cigarette Liquids by 1-H NMR Spectroscopy. *Chemical Research in Toxicology*, 31, 431-434 (2018).
8. Gilliland, K. Drug Addiction & Chemical Dependency. *INNOVATION360* (2019).
9. Knowles, H., & Sun, L. H. What We Know About the Mysterious Vaping-Linked Illness and Death. *The Washington Post* (2019).
10. Miech, R., Johnston, L., O’Malley, P. M., Bachman, J. G., & Patrick, M. E. Trends in Adolescent Vaping, 2017-2019. *The New England Journal of Medicine* (2019).
11. Thomas, S. PAX Secures Patent for “Nicotine Salt e-Cigarette”. *Slanted* (2015).
12. Tolentino, J. The Promise of Vaping and the Rise of JUUL. *The New Yorker* (2018).
13. Veldheer, S. et al. Pulmonary and other health effects of electronic cigarette use among adult smokers participating in a randomized controlled smoking reduction trial. *Journal of Addictive Behaviors*, 91, 95-101 (2019).
14. Volkow, N. D. Epigenetics of Nicotine: Another Nail in the Coughing. *Science Translation Medicine*, 3(107) (2011).
15. Yingst, J., Foulds, J., Veldheer, S., & Du, P. Device Characteristics of Long-Term Electronic Cigarette Users: A Follow-Up Study. *Addictive Behaviors*, 91, 238-243 (2019).