

Vaping and E-cigarettes

Presented By:

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Licking Memorial Health Systems



Learning Objectives

- Identify various electronic cigarette delivery devices
- Discuss the known and potential risks of e-cigarettes, vape devices and pod systems (i.e. JUUL)
- Identify resources for clinicians, families and adolescents



Truth or Myth?

- E-cigs only produce vapor
- The vapor from e-cigs contain nicotine, flavor-containing chemicals and a chemical that creates the mist you exhale
- Some flavor chemicals, when inhaled, have been known to cause scarring in the lungs – a condition known as “popcorn lungs”



Truth or Myth?

- When using e-cigs, there is a risk of explosions of electronics and batteries.
- The FDA currently regulates the chemical ingredients in e-cigs and what is listed on the labels.
- The heat generated in an e-cig can create formaldehyde from the liquid, and rip metals from the side of the device. This is delivered to the lungs.



Quick Facts

- E-cigarettes are the most commonly used tobacco products among youth, and use is rising at an alarming rate.
- Youth who use e-cigarettes are more likely to use cigarettes or other tobacco products.
- E-cigarettes contain a liquid solution that is usually flavored. Flavors, which are appealing to youth, can include fruit flavors, candy, coffee, piña colada, peppermint, bubble gum or chocolate.
- E-cigarette solution has chemicals (i.e., anti-freeze, diethylene glycol, and carcinogens such as nitrosamines).



Quick Facts (cont.)

- E-cigarette devices mimic conventional cigarette use and help re-normalize smoking behaviors.
- E-cigarettes **are not** approved for smoking cessation, and the long-term health effects to users and bystanders are still unknown.
- E-liquid from e-cigarettes and refill packs can contaminate skin, leading to nicotine poisoning. Symptoms of nicotine poisoning include vomiting, sweating, dizziness, increased heart rate, lethargy, seizures and difficulty breathing.
- In 2014, poison centers in the U.S. reported 3,783 exposures to e-cigarette devices and nicotine liquid, compared to only 1,543 exposures in 2013. In 2015, 3,073 exposures were reported.

<https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Richmond-Center/Pages?Electronic-Nicotine-Delivery-Systems.aspx>

<https://www.aapcc.org/track/ecigarettes-liquid-nicotine>





Electronic Vaping Associated Lung Injury (EVALI)



- What is new
- What we know
- What we do not know
- Symptoms

<https://www.cdc.gov/lunginjury>

<https://www.cdc.gov/mmwr/volumes/68/wr/mm6841e3.htm>

Update: Interim Guidance for Health Care Providers Evaluating and Caring for Patients with Suspected E-cigarette, or Vaping, Product Use Associated Lung Injury, United States, October 2019 *Weekly* / October 18, 2019 / 68(41); 919–927



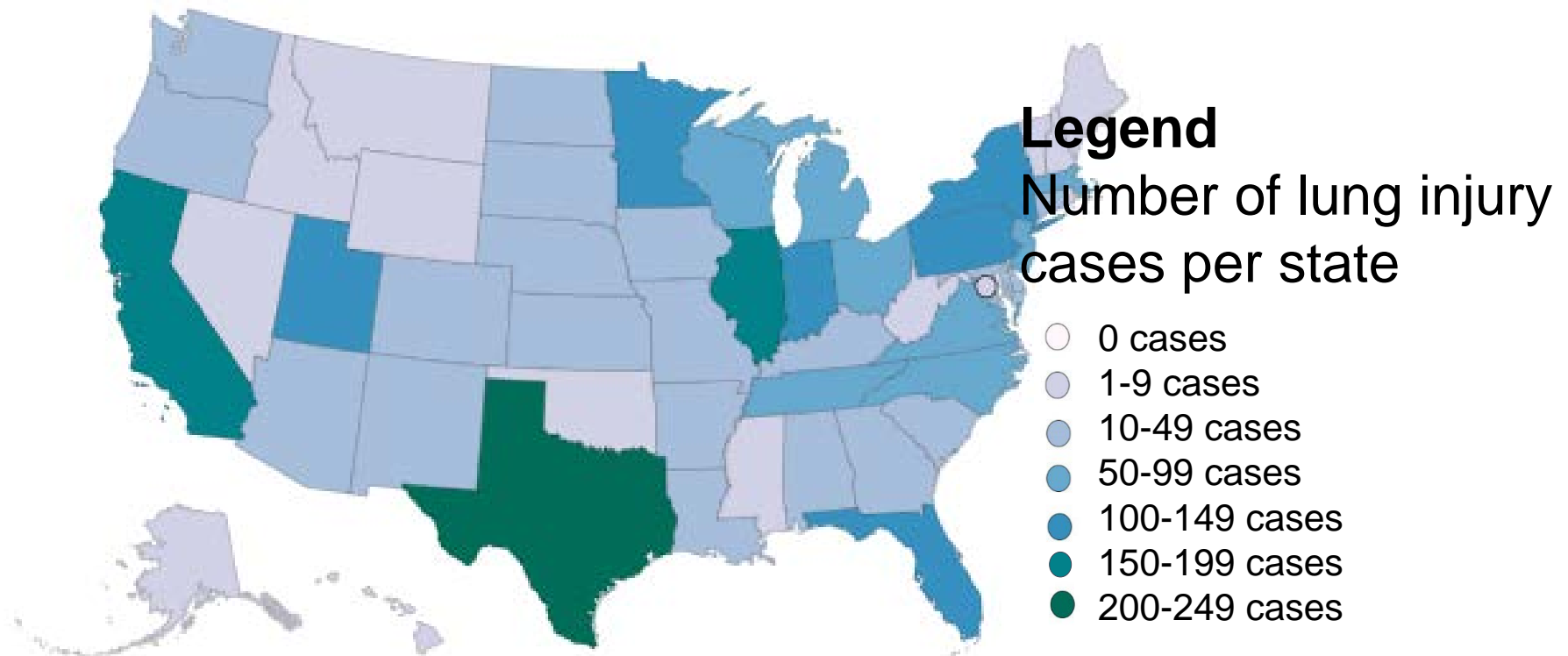


What is New

- CDC has identified vitamin E acetate as a chemical of concern among people with e-cigarette, or vaping, product use associated lung injury (EVALI).
- Recent CDC laboratory testing of broncho-alveolar lavage (BAL) fluid samples from 29 patients with EVALI submitted to CDC from 10 states found vitamin E acetate in **all** of the samples.
- Vitamin E acetate might be used as an additive, most notably as a thickening agent in THC-containing e-cigarette, or vaping products.



What We Know



As of December 10, 2019, a total of 2,409 hospitalized EVALI cases have been reported to CDC from all 50 states, the District of Columbia, and two U.S. territories (Puerto Rico and U.S. Virgin Islands). Fifty-two deaths have been confirmed in 26 states and the District of Columbia.



What We Do Not Know

- While it appears that vitamin E acetate is associated with EVALI, evidence is not yet sufficient to rule out contribution of other chemicals of concern to EVALI.
- Many different substances and product sources are still under investigation, and it may be that there is more than one cause of this outbreak.



Ohio Data

Information updated as of 2:00 pm December 12, 2019

- Number of cases: 87
- Age range: 15-65 years (median age: 25 years)
- Gender: 26 Female, 61 Male (70% Male)
- Number of hospitalizations: 80 (92%)
- Number of deaths: 0
- Counties: Ashtabula, Belmont, Brown, Butler (2), Champaign, Clark, Clermont (3), Cuyahoga (12), Darke, Fairfield, Franklin (12), Greene, Hamilton (3), Hancock, Jefferson, Lake (2), Lucas (4), Mahoning (2), Marion, Medina (3), Miami (2), Montgomery (5), Paulding, Portage (2), Preble, Richland (2), Ross, Seneca (2), Stark, Summit (7), Trumbull, Tuscarawas, Union (2), Warren (2), Wayne (2), Wood
- Additional illness reports under investigation: 12

<https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/tobacco-use-prevention-and-cessation/news-and-events/>



Symptoms

- Patients in this investigation have reported symptoms such as:
 - cough, shortness of breath or chest pain
 - nausea, vomiting, abdominal pain or diarrhea
 - fever, chills or weight loss
- Some patients have reported that their symptoms developed over a few days, while others have reported that their symptoms developed over several weeks.
- A lung infection does not appear to be causing the symptoms.



Electronic Cigarettes

- Vape devices and pens
- Personal vaporizers
- Electronic nicotine delivery systems (ENDS)
- Alternative nicotine delivery systems (ANDS)
- Electronic cigars or e-cigars
- E-hookah or hookah
- sticks/pens
- Mechanical tanks



E-Cigarettes & Vape Pens Generations



Cig-a-Like

E-cigarettes came onto the market around 2007.

Most delivered nicotine and were disposable.



Variations

Variations on the first e-cigarettes included products like e-hookah and rechargeable versions.



Vape Pens

These have batteries that can reach higher temperatures, have refillable e-liquid cartridges, and allow users to regulate the frequency of inhalations.



Mods

Large size, modifiable e-cigarettes allow for more aerosol, nicotine, and other chemicals to be breathed into the lungs, at a faster rate.



Pod-Based

These e-cigarettes are shaped like USBs and contain pods with higher amounts of nicotine than previous generations.

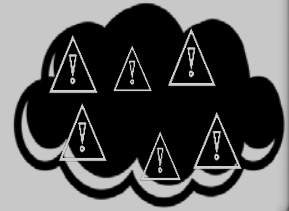
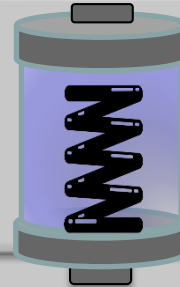
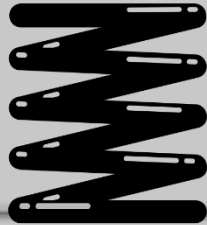


Tobacco Prevention Toolkit
Division of Adolescent Medicine, Stanford University
For more information go to: www.tobaccopreventiontoolkit.stanford.edu

E-cigarettes & Vape Pens Generations, Stanford University, (2018)



E-Cigarettes & Vape Pens Components



Battery

The battery is the energy source of the device and powers the atomizer

Atomizer

The atomizer is the heating element that heats the e-liquid and is often coil shaped

E-Liquid

Sometimes called e-juice, this is put into the device and often contains flavors and nicotine

Cartridge

The cartridge (tank) holds the e-liquid and may also hold the atomizer

Aerosol

Heating e-liquid inside the device creates an aerosol that is inhaled into the body and out into the

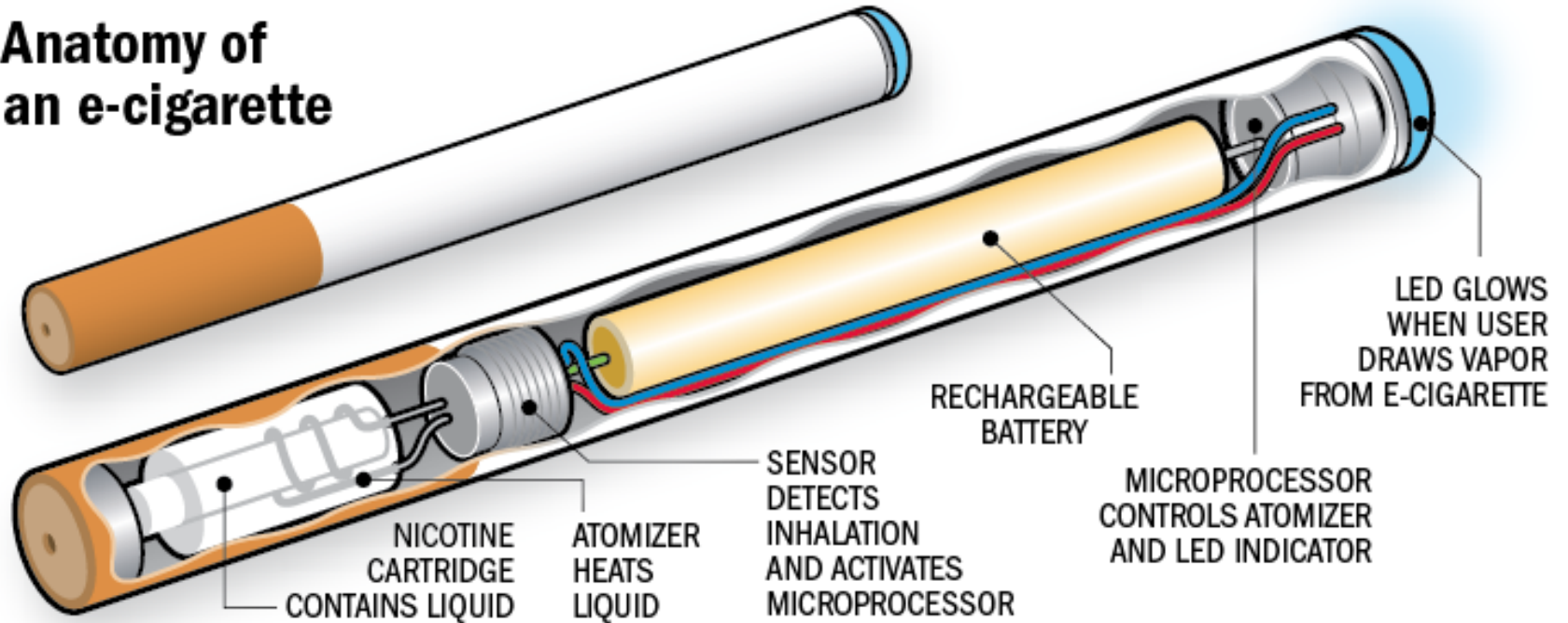
air

Tobacco Prevention Toolkit, Division of Adolescent Medicine, Stanford University,
For more information go to: www.tobaccopreventiontoolkit.stanford.edu



Anatomy of An E- Cigarette

Anatomy of an e-cigarette

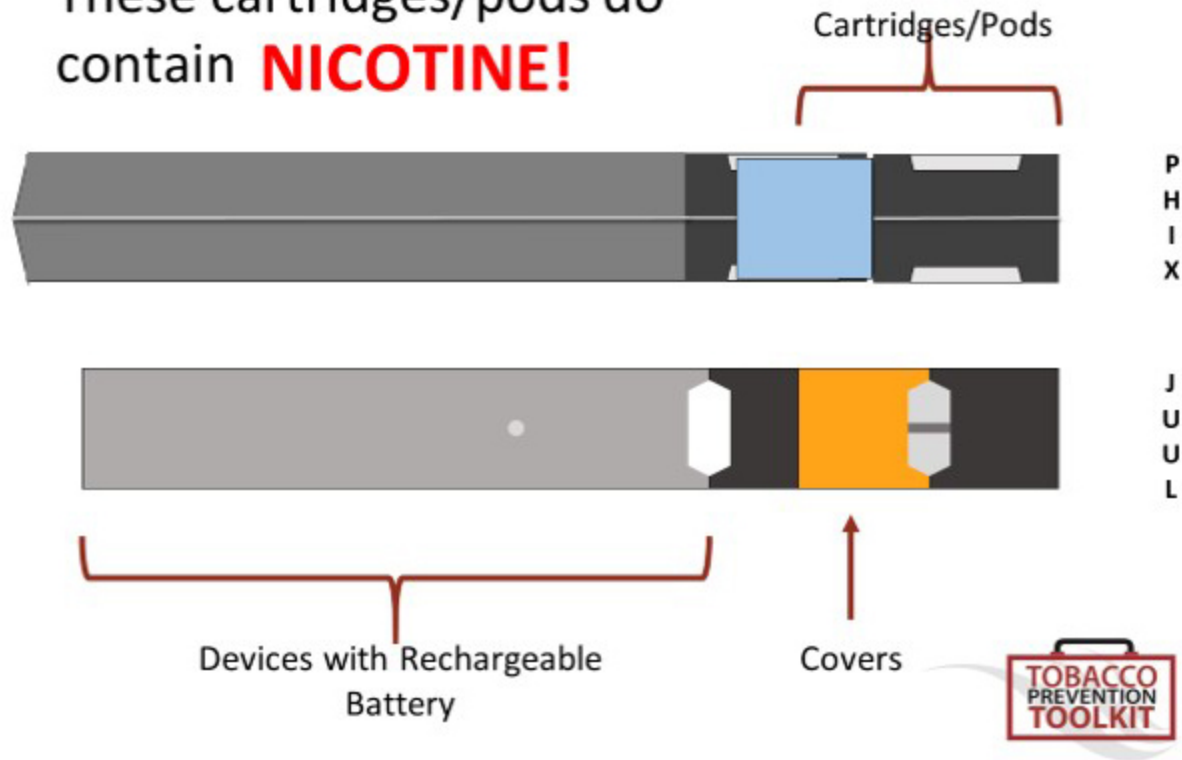


<https://bestvapestarterkitblog.portfoliobox.net/how-do-ecigarettes-work>



Anatomy of a Pod-Based System

These cartridges/pods do
contain **NICOTINE!**



The FDA does not currently regulate the chemical ingredients and labels.

- In fact, the FDA also does not regulate:
 - The amount of different chemicals that can be used to make e-juice
 - The cleanliness of facilities that produce e-juice



What is in that Pod?

tobaccopreventiontoolkit.stanford.edu



NICOTINE



- **Nicotine** Thymol Ally Hexanoate α -Pinene β -Pinene
Limonene Caffeine 2-methoxyphenol 2,3,5-Trimethyl pyrazine
- **Benzoic Acid** 2,5-dimethyl pyrazine Isopulegol Ethyl Maltol
Benzaldehyde 4-Terpineol Maltol Hydrocoumarin Vanillin
- **Glycerol** Phenethyl Alcohol P-Cymene Corylone Ethyl Vanillin
p-Anisaldehyde Eucalyptol Piperitone Piperonal Linalool
- **Propylene Glycol** β -Damascone Benzaldehyde PG acetal Pulegone
Ethyl anthranilate α -Terpineol δ -Decalactone γ -Octalactone
- **Natural Oils** 3-Hexen-1-ol β -Myrcene δ -Dodecalactone
Ethyl lactate γ -Decalactone Ethyl Acetate Ethyl butanoate
- **Extracts and Flavors** δ -Undecalatone Hexyl acetate
Ethyl hexanoate Ethyl 2-methylbutanoate Acetylpyrazine
- **???** Menthol Triacetin Carvone Neomenthol Benzyl Alcohol
p-Methone Hydroxyacetone Styralyl Acetate Menthyl Acetate
Strawberry Glycidate_A Heliotropine PG acetal Benzyl DMC butyrate
 γ -Terpinene Methyl Anthranilate Ethyl Isovalerate





Stronger E-cigarette/Vape

Salt-based nicotine



41.3
milligrams
of nicotine

Pods not
made to
be refilled

Freebase nicotine



25
milligrams
of nicotine

Refillable
tank



Using JUUL

Start with your JUUL pod

Remove colored cap and insert cartridge end into device.
Viola – it becomes your mouthpiece as well as the flavorful engine that powers JUUL.

No buttons or switches, just draw to get it going – carefully at first. It may seem strong to first-timers.

Charge it

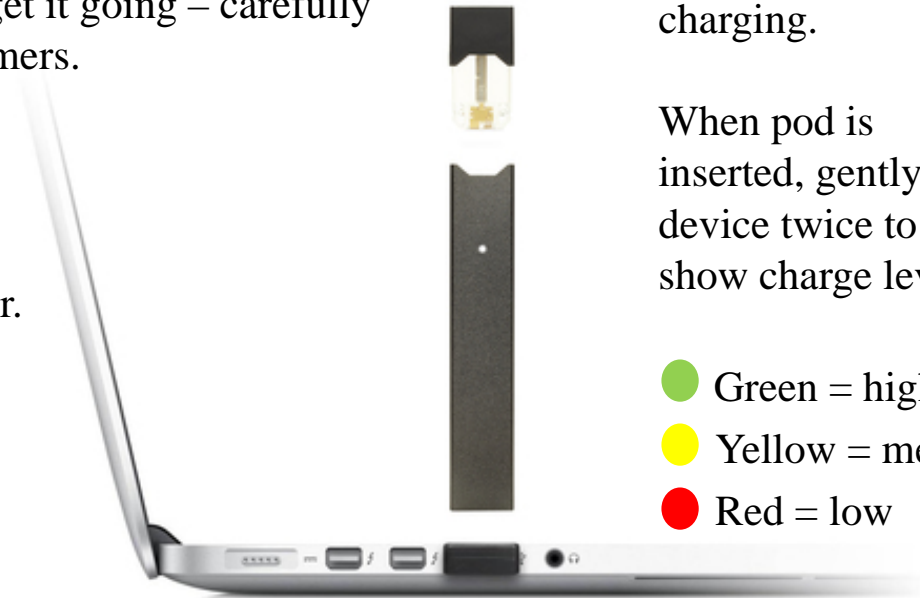
Stand the device in magnetic USB charger. Reaches full charge in 1 hour.

Consult the indicator

The indicator glows during use to reflect pull strength and charging.

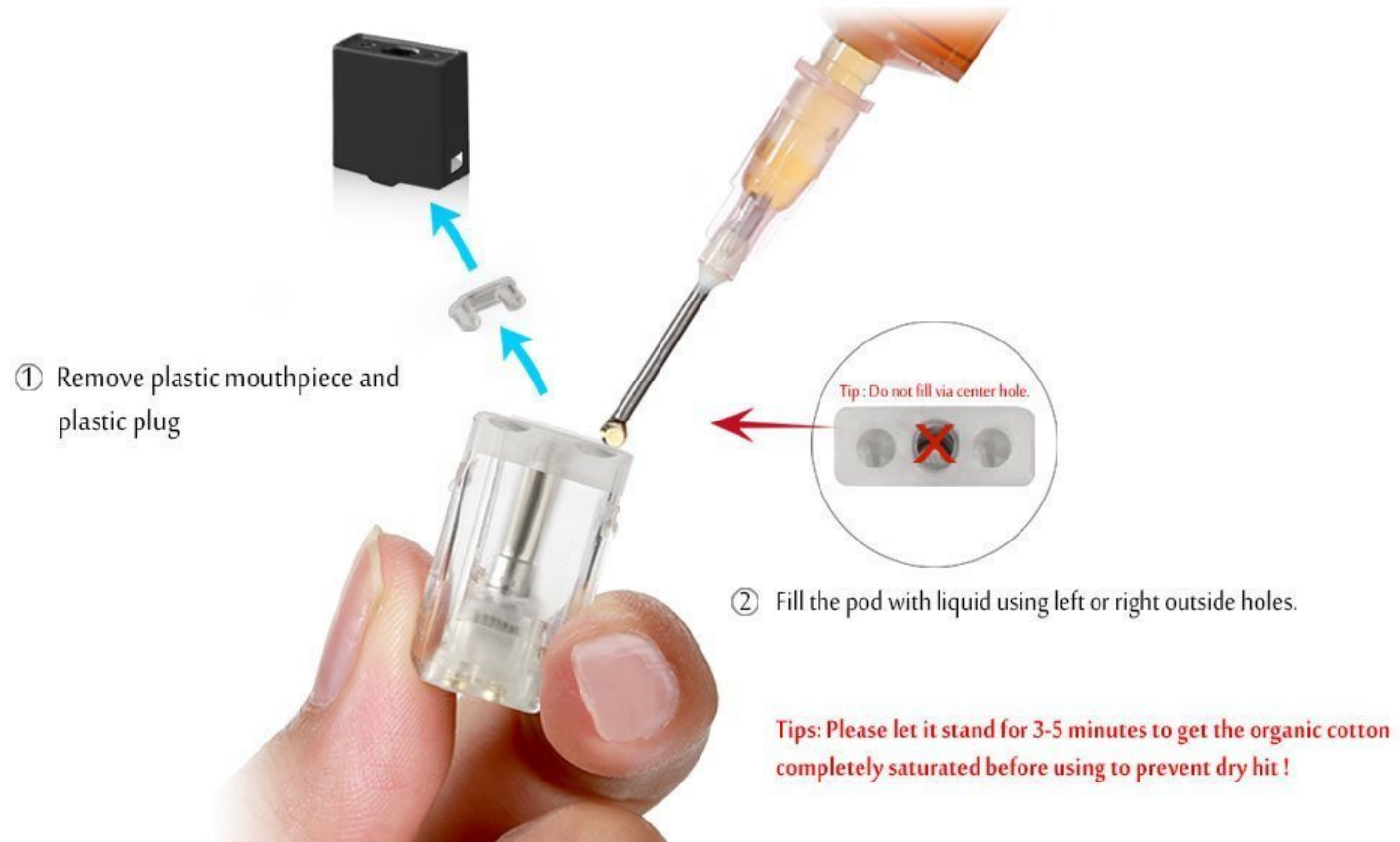
When pod is inserted, gently tap device twice to show charge level.

- Green = high
- Yellow = medium
- Red = low



Filling the j-Pod

How to fill J-Pod



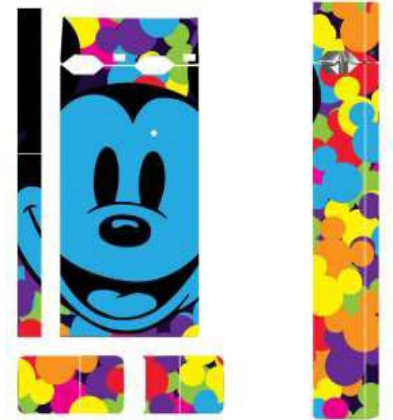
Vaping Vocabulary

- **Vaping** – the act of using an ENDS, e-cig or similar device; and with JUULs is called “JUULing”
- **E-juice** – also called e-liquid is available in a variety of flavors, packaging and nicotine levels
- **Cloud chasing** – the activity of blowing large clouds of vapor
- **Dripping** – using a modified device or open heating coils to create thicker vapor clouds with a stronger hit of flavoring and nicotine
- **Dabbing** – Vaping using marijuana concentrates



“JUULing”

- 75% of the e-cigarette market (as of October 2018)
- **THEY ALL CONTAIN NICOTINE**
 - Uses nicotine salt with benzoic acid = higher [nicotine]/puff
- Attempts to deliver peak nicotine in 5 minutes
- Single JUUL pod = ~200 puffs = 1 -2 packs of cigarettes
- Small “plume” is easier to hide
- Lots of accessories to customize
- Capability to refill with other liquid
- Starter kit = \$20-35



Vaping and Risks for Other Substance Use

- If you vape, you are 4 times more likely to smoke cigarettes
- Adolescents who use e-cigarettes are more likely to:
 - Binge drink alcohol
 - Use marijuana
 - Use other illicit drugs
- Some studies show 24% high school students have used concentrates
 - 9% had used marijuana in the e-cigarette
 - “Dab” vaporizing cannabis concentrate
 - Highly concentrated = 50-95% THC (vs 1980s = 3-4%)

Berry KM, PATH Study, *JAMA Open Network*, Feb. 2019; McCabe, *J Adolesc Health*, 2017 and Sillvelra, *Drug Alcohol Depend*, 2018
Morean et al, *Pediatrics*, 2014; Meler, M., *Pediatrics*, 2019



Health Impact

- Nicotine
- Vapor vs. aerosol
- Flavors
- Other components



- **Blood** – Increased clotting
- **Lungs** – Bronchospasm
- **Muscular** – Tremor, pain
- **Gastrointestinal** – Nausea, dyspepsia, dry mouth, diarrhea, heartburn
- **Joints** – Pain
- **Central** – Lightheadedness, headache, sleep disturbances, abnormal dreams, irritability, dizziness
- **Heart** – Increased or decreased heart rate, increased blood pressure, tachycardia, more (or less) arrhythmias, coronary artery constriction
- **Endocrine** – Hyperinsulinemia, insulin resistance





Prefrontal Cortex = Executive Functions and Attention Performance

- Adolescent brain is still maturing so vulnerable to imbalance
 - Earlier maturation of limbic region/rewards system with slower development of cognitive control
- Clinical relevance
 - Increased cognitive impairment, particularly later in life
 - Increased risk for developing psychiatric/mood disorders
 - Increase in attention deficit issues, that increase with years of use





How Much Nicotine?

- Different bioavailability per puff
- Depends on many factors:
 - Temperature of atomizer
 - How much liquid used
 - Size of droplets
 - Depth of the puff
 - Concentration of the e-liquid
- Absorption:
 - Large droplets = oropharynx and upper airway
 - Small droplets = lung alveoli with more rapid transit to brain



How Much Is That?



5% strength
of what?

How much is
5%?





Cigs in a Pod



tobaccopreventiontoolkit.stanford.edu

1 Pack of Cigarettes
≈ 20 mg of nicotine

1 JUUL pod
≈ 41.3 mg of nicotine

1 PHIX pod
≈ 75 mg of nicotine

1 Suorin pod
≈ 90 mg of nicotine



ALL PODS CONTAIN HIGH
LEVELS OF NICOTINE

=20
CIGARETTES

≈41
CIGARETTES

≈75
CIGARETTES

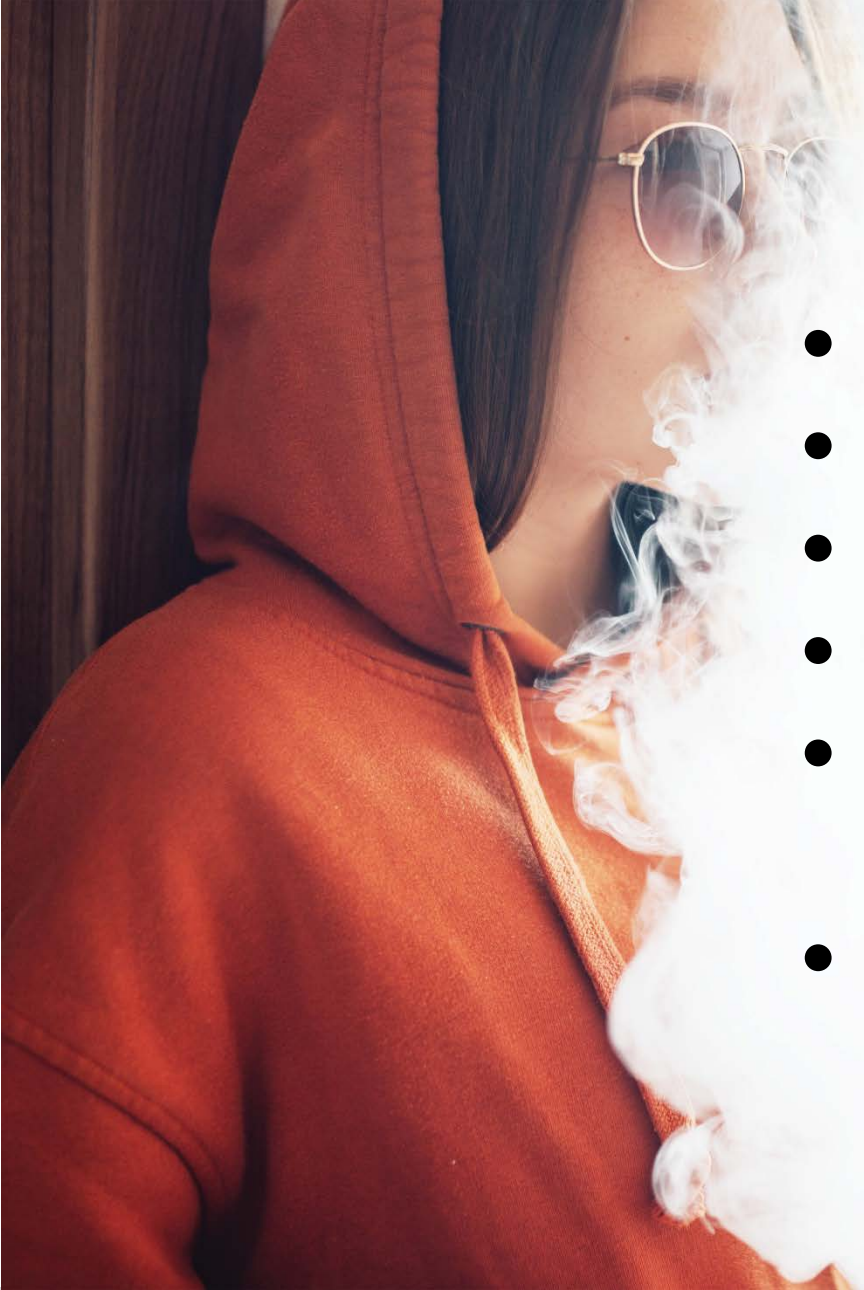
≈90
CIGARETTES



Despite what the industry says, e-cigs produce aerosol, not vapor.

- What is the difference between aerosol and vapor?
 - The difference is that vapor is *100% liquid*, while aerosol carries *tiny bits of solid* with it.
- Another example of an aerosol? - Smoke





- Volatile organic compounds
- Nicotine
- Ultrafine particles
- Cancer-causing chemicals
- Heavy metals, such as nickel, tin and lead
- Flavorings, such as diacetyl (a chemical linked to a serious lung disease)





Components

- **Humectants** (substance to reduce loss of moisture)
 - Propylene glycol (+ flavorants = acetals)
 - Glycerol
- **Flavoring toxicants**
 - Different toxicant profiles – many unknown
 - Aldehydes and Acetals – lung inflammation
 - Diacetyl – “popcorn lung”
- **Particulate Matter** (from heating element)
 - Metallic nano-particles = tin, nickel & chromium
- **Carcinogens**
 - propylene glycol + heat = formaldehyde
 - From particulate matter
- **Psychoactive ingredients** (added by users or pre-packaged)



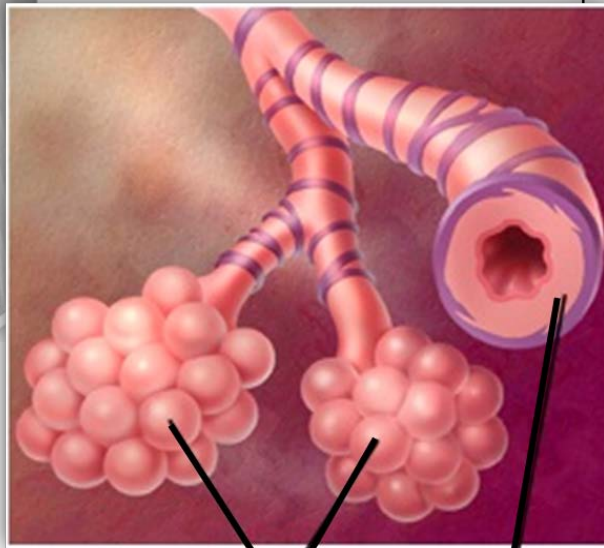
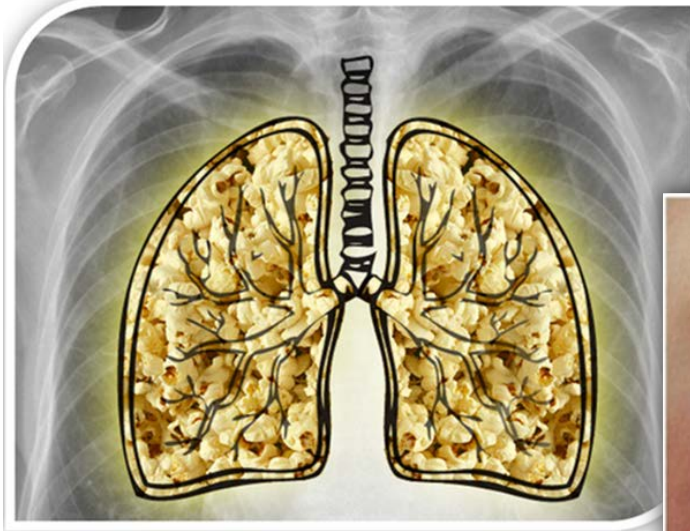


The Danger in Flavors

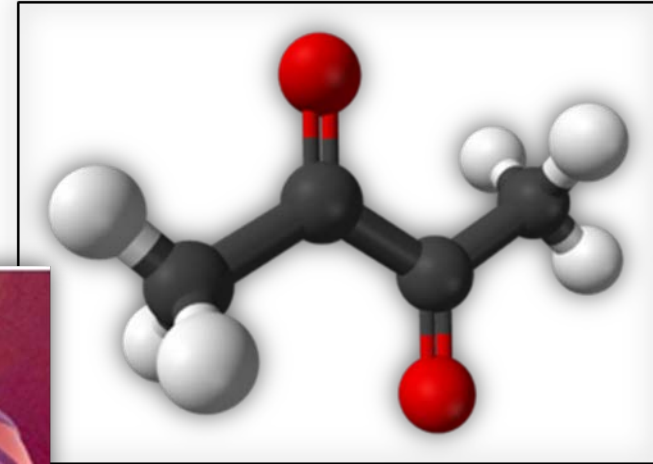
- Lung toxicity of condensed aerosol from E-CIG liquids: influence of the flavor and the in vitro model used, R Bengalli, E Ferri, M Labra, P Mantecca, *International Journal of ...* 2017. www.mdpi.com.
- E-cigarettes and flavorings induce inflammatory and pro-senescence responses in oral epithelial cells and periodontal fibroblasts, IK Sundar, F Javed, GE Romanos, I Rahman, *Oncotarget*, 2016. www.ncbi.nlm.nih.gov.
- Vapors produced by electronic cigarettes and e-**juices** with **flavorings** induce toxicity, oxidative stress, and inflammatory response in lung epithelial cells and in ...CA Lerner, IK Sundar, H Yao, J Gerloff, DJ Ossip...PloS one, 2015 - journals.plos.org.
- E-cigarettes induce toxicological effects that can raise the cancer **risk** D Canistro, F Vivarelli, S Cirillo, CB Marquillas...Scientific reports, 2017, nature.com.



Popcorn Lung



Alveoli & Bronchioles
Experience scarring



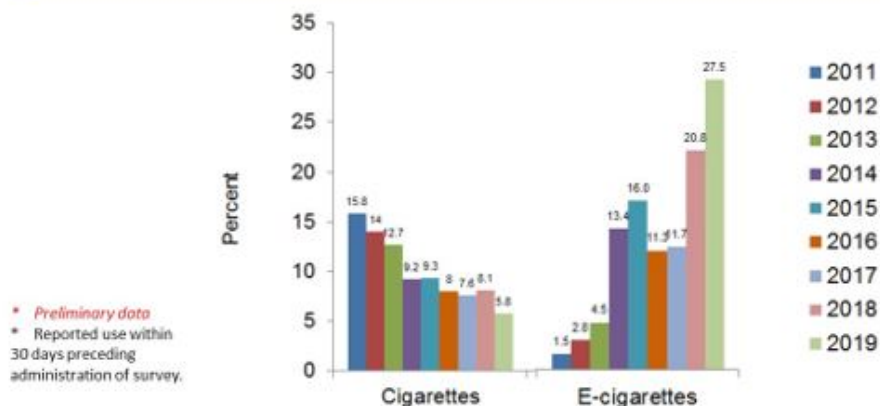
Diacetyl

Image Credit: fileapopcornlunglawsuit.9k.com

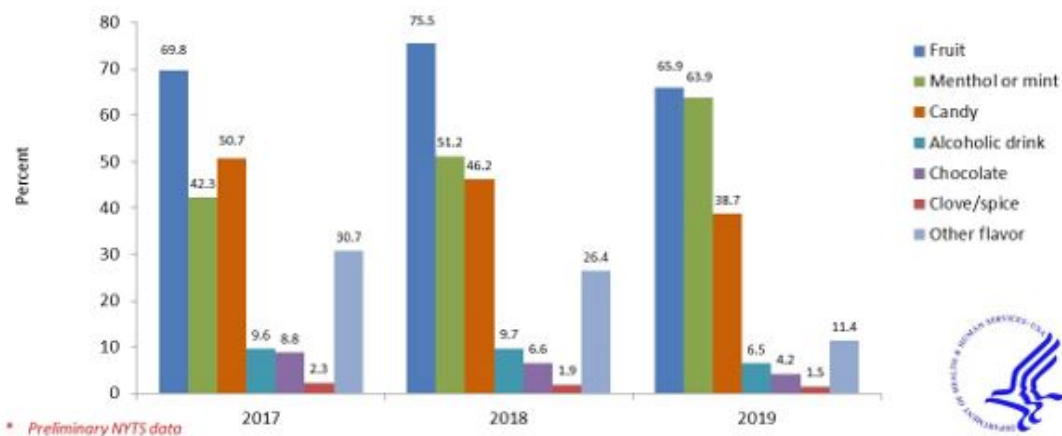


Target Audience

NATIONAL YOUTH TOBACCO SURVEY*: YOUTH USE OF E-CIGARETTES CONTINUES TO CLIMB



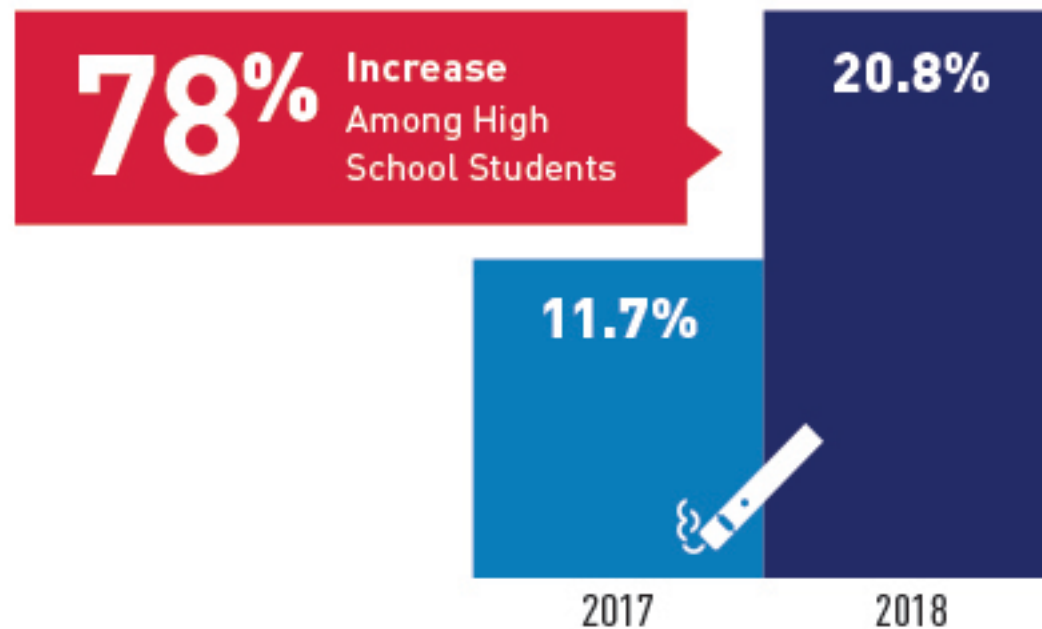
FLAVORS POPULAR AMONG HIGH SCHOOL USERS OF E-CIGARETTES*



National Youth Tobacco Survey,
United States, 2016. MMWR
Morb Mortal Wkly Rep 2018;
67:196–200.



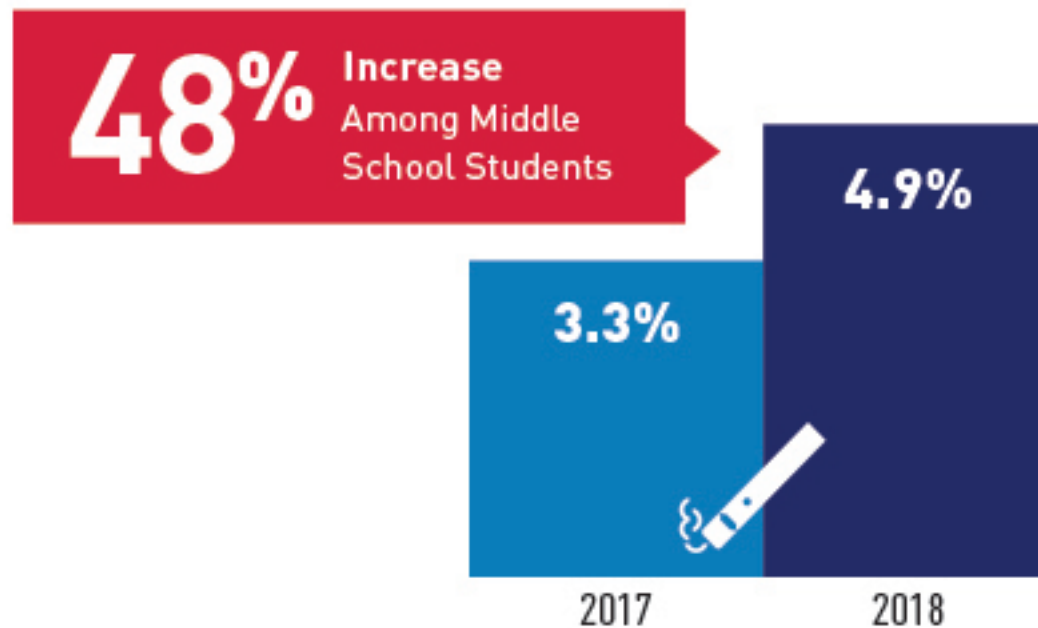
SURGE IN YOUTH CURRENT E-CIGARETTE USE



<https://www.fda.gov/tobacco-products/youth-and-tobacco/2018-nyts-data-startling-rise-youth-e-cigarette-use>



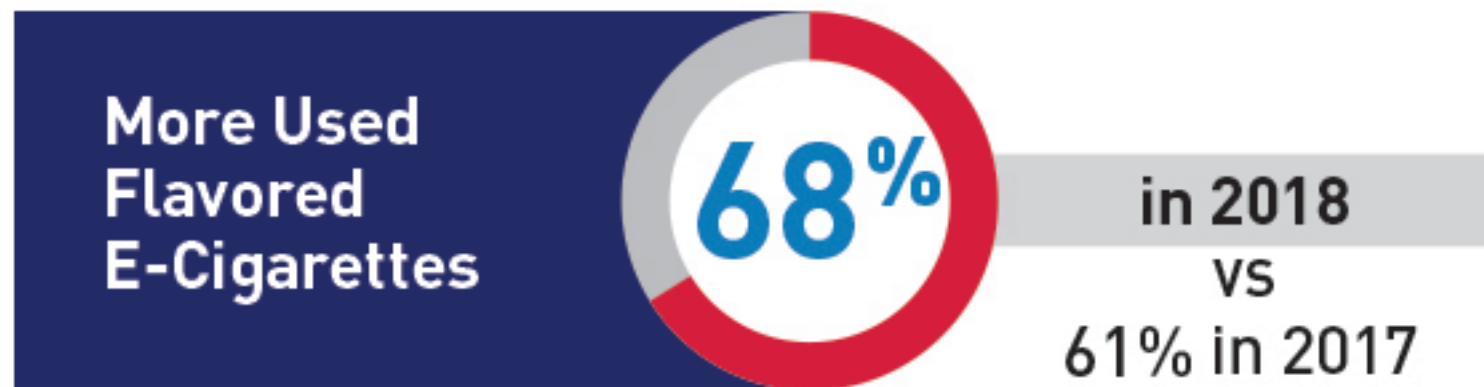
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AMONG HIGH SCHOOL CURRENT E-CIGARETTE USERS — Rise in Use of Flavors



<https://www.fda.gov/tobacco-products/youth-and-tobacco/2018-nyts-data-startling-rise-youth-e-cigarette-use>



Target Audience

National Youth Tobacco Survey, United States, 2019 at <https://www.fda.gov/tobacco-products/youth-and-tobacco/youth-tobacco-use-results-national-youth-tobacco-survey#1>.

2019 NATIONAL YOUTH TOBACCO SURVEY SHOWS YOUTH e-cigarette use at ALARMING LEVELS

OVER 5 Million
youth are currently using e-cigarettes

MORE THAN 3.6 M 2018
MORE THAN 5 M 2019

NEARLY 1 Million
used the product daily



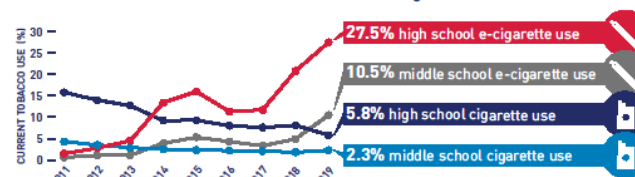
ABOUT 1.6 MILLION
youth used the product frequently (on 20 or more days per month)

MAJORITY of the current e-cigarette users reported

JUUL

as their usual brand

Current e-cigarette use has **INCREASED DRAMATICALLY**, while current cigarette use has dropped, **UNDERMINING PROGRESS** toward reducing overall tobacco use



Why is this concerning?

The use of e-cigarettes, particularly those with high levels of nicotine, places youth at risk for developing nicotine addiction. Nicotine exposure during adolescence could harm brain development. Additionally, youth who use e-cigarettes are more likely to start smoking cigarettes. Further, e-cigarette aerosol may expose users to other harmful substances such as heavy metals, volatile organic compounds, and ultrafine particles that could harm the lungs.

CENTER FOR TOBACCO PRODUCTS

Source: T. Cohen ML, Gentone AS, Sweling MD, et al. E-cigarette Use Among Youth in the United States, 2011–2019. JAMA. 2019; 321:1000–1008. DOI: 10.1001/jama.2019.10000. Copyright 2019 American Medical Association. All rights reserved.

CTP-136

www.fda.gov/tobacco

@FDATobacco

facebook.com/fda



FDA





TOBACCO PRODUCT USE AMONG HIGH SCHOOL STUDENTS

31.2%



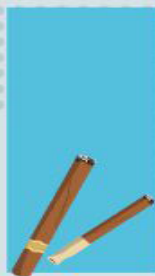
any tobacco product

27.5%



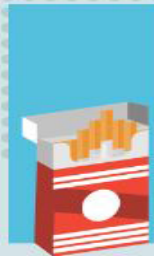
e-cigarettes

7.6%



cigars

5.8%



cigarettes

4.8%



smokeless tobacco

3.4%



hookah

1.1%



pipe tobacco

Learn more at bit.ly/NYTS-2019

Source: National Youth Tobacco Survey, 2019



Why Students Use E-cigarettes

- “I was curious about them” (55.3%)
- Used by "friend or family member" (30.8%)
- Availability of “flavors such as mint, candy, fruit or chocolate” (22.4.0%)
- The belief that "they are less harmful than other forms of tobacco such as cigarettes" (17.1%)



63%

**OF JUUL USERS
DON'T KNOW THAT
THE PRODUCT
ALWAYS CONTAINS
NICOTINE.**



truth initiative
INSPIRING TOBACCO-FREE LIVES

truthinitiative.org



Future Market



What next?

- Medical management
- Start the Conversation
(rack card handouts)
- Peer to Peer Prevention
- Resources





Vaping for Smoking Cessation

If used **VAPING** to quit;
18% successfully quit at one year



1 year after quitting:
80% still used e-cigarettes

If used **OTHER NICOTINE
REPLACEMENT** options:
9.9% successfully quit at one year



1 year after quitting:
**9% still using nicotine
replacement treatment**

Hajek P et al. A randomized trial of e-cigarettes versus nicotine replacement therapy. N Engl J Med 2019 Jan 30;



Nicotine Replacement Therapy

- Precautions should be taken for people under 18 years of age, women who are pregnant or breastfeeding and people who have had a recent heart attack, abnormal heart rhythms or worsening chest pain
- Studies have shown that NRT is well-tolerated by adolescents
- Evidence of efficacy is lacking
- Not currently recommended for adolescent smoking cessation treatment; however, benefits of NRT may outweigh risks in certain situations



Keep in Mind.....

- Data to support pharmacologic treatment of nicotine dependence in adolescents is not supported.
- Cognitive Behavioral Therapy (CBT) and motivational interviewing are considered the “gold standard” of treatment.





Start the Conversation

- We need to ask
- We need to listen
- We need to be able to answer questions
- We need to support youth in learning the skills to be healthy, resilient, successful adults
- We need to know when to ask for help



The Power to Choose

- Teens don't want to be told they can't do something.
- Instead of telling teens not to vape, we should be telling them what the consequences of vaping are, then allowing them to make an informed decision for themselves.



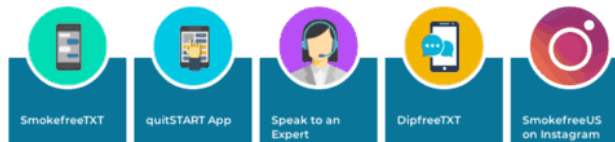


smokefree**teen**



Tools & Tips

Learn about different tools to help





QUIT for your health

Tobacco Cessation Program

(220) 564-QUIT (7848)



Questions?

