



Hawai'i Youth Vaping Epidemic

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Terminology

- Electronic cigarette (e-cigarette; e-cig)
- **Electronic nicotine delivery system (ENDS)**
- Electronic smoking device (ESD)
- Vaping
- Vape

US High School Cigarette and E-Cig Use

30% % who used in last 30 days

20%

10%

0%

2012

2013

2014

2015

2016

2017

2018

2019

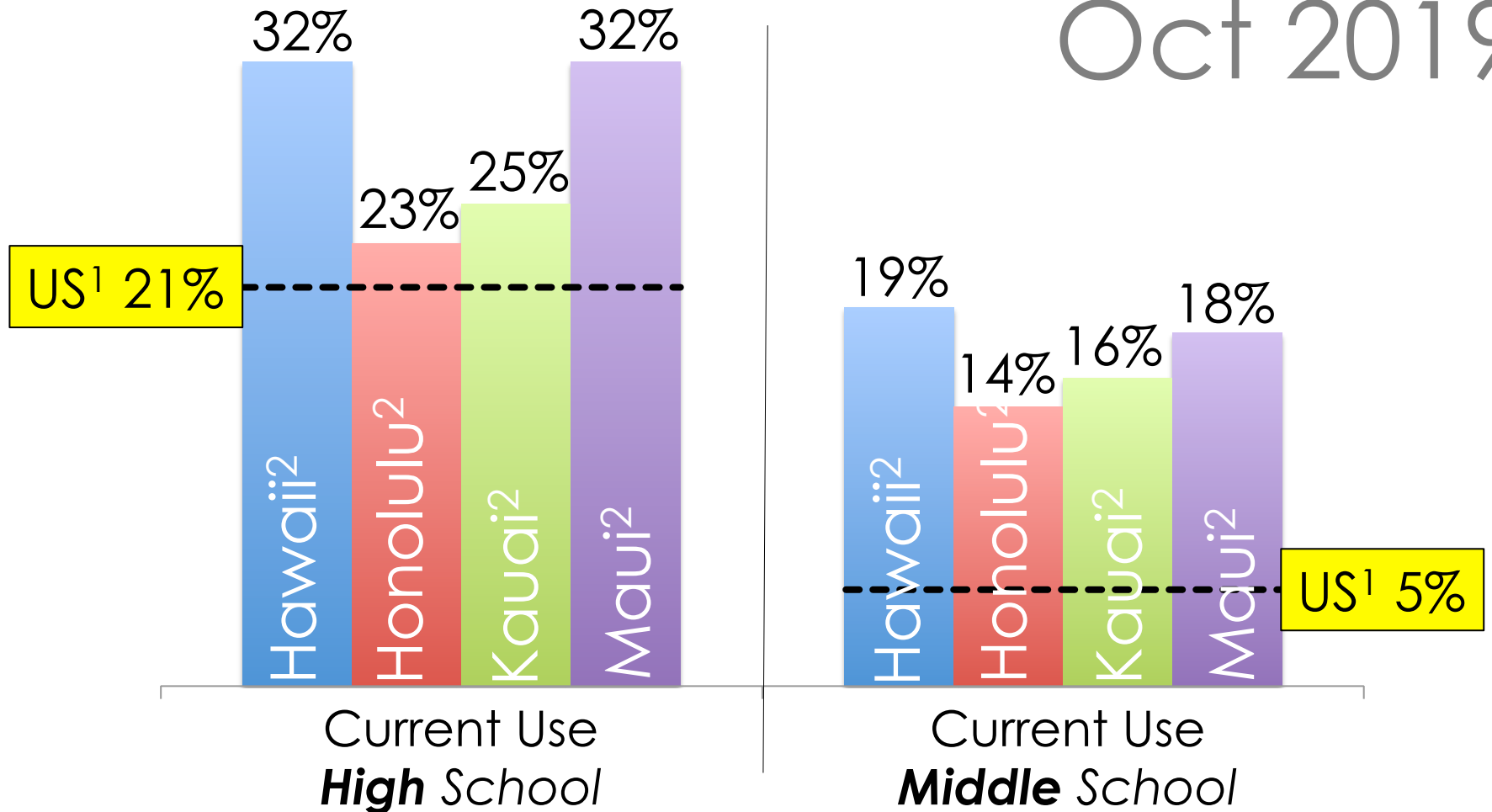
E-cigarettes

Combustible Cigarettes

Meich R, et al. Trends in Adolescent Vaping 2017-2019. N Engl J Med. published online Sep 18, 2019.

Hawai'i Youth ESD Use by County

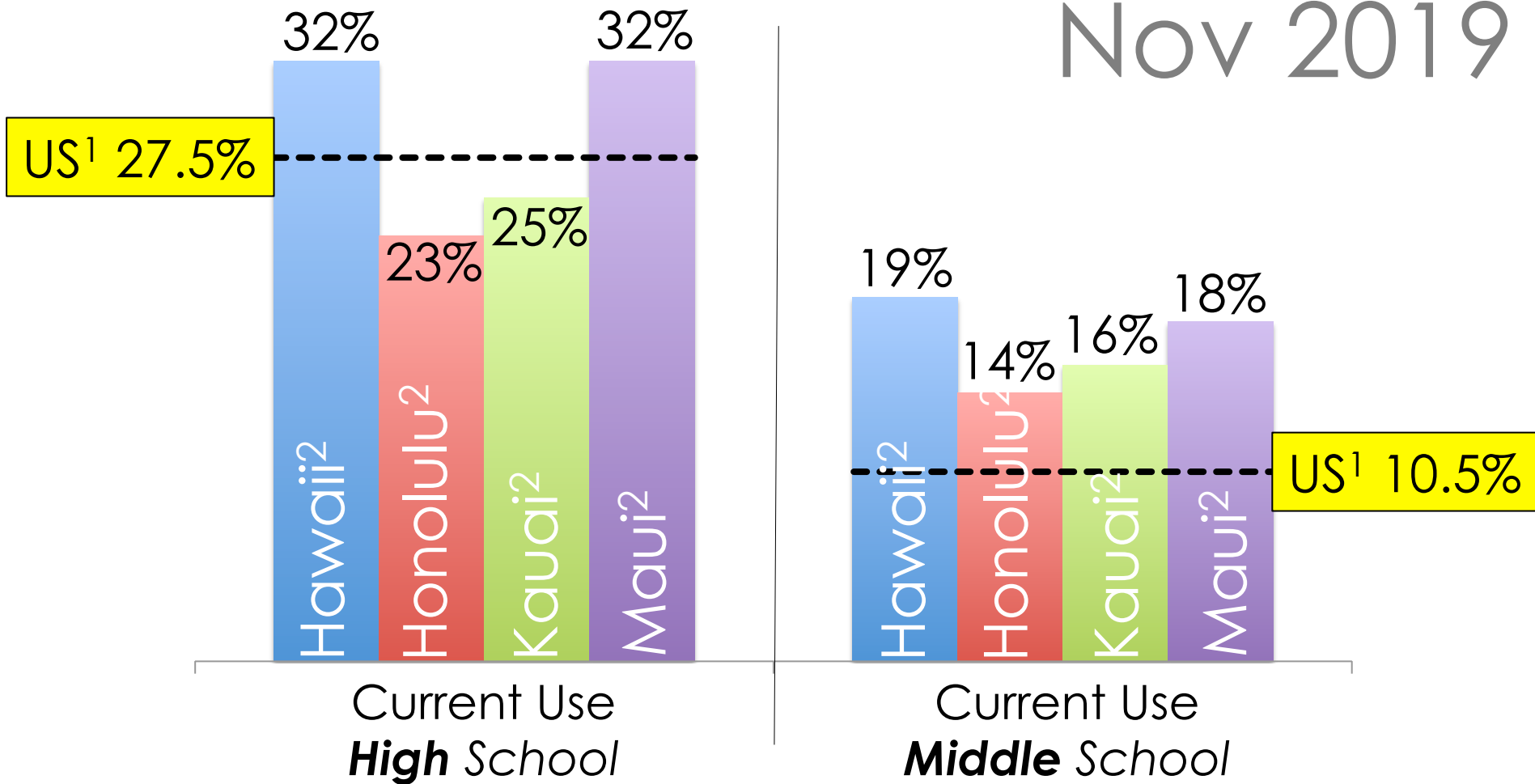
Oct 2019



1. Cullen, KA, et al. Use of Electronic Cigarettes and Any Tobacco Product Among Middle and High School Students — United States, 2011-2018. MMWR. 2018;67(45):1276-1277.
2. Hawai'i Youth Risk Behavior Survey 2017.

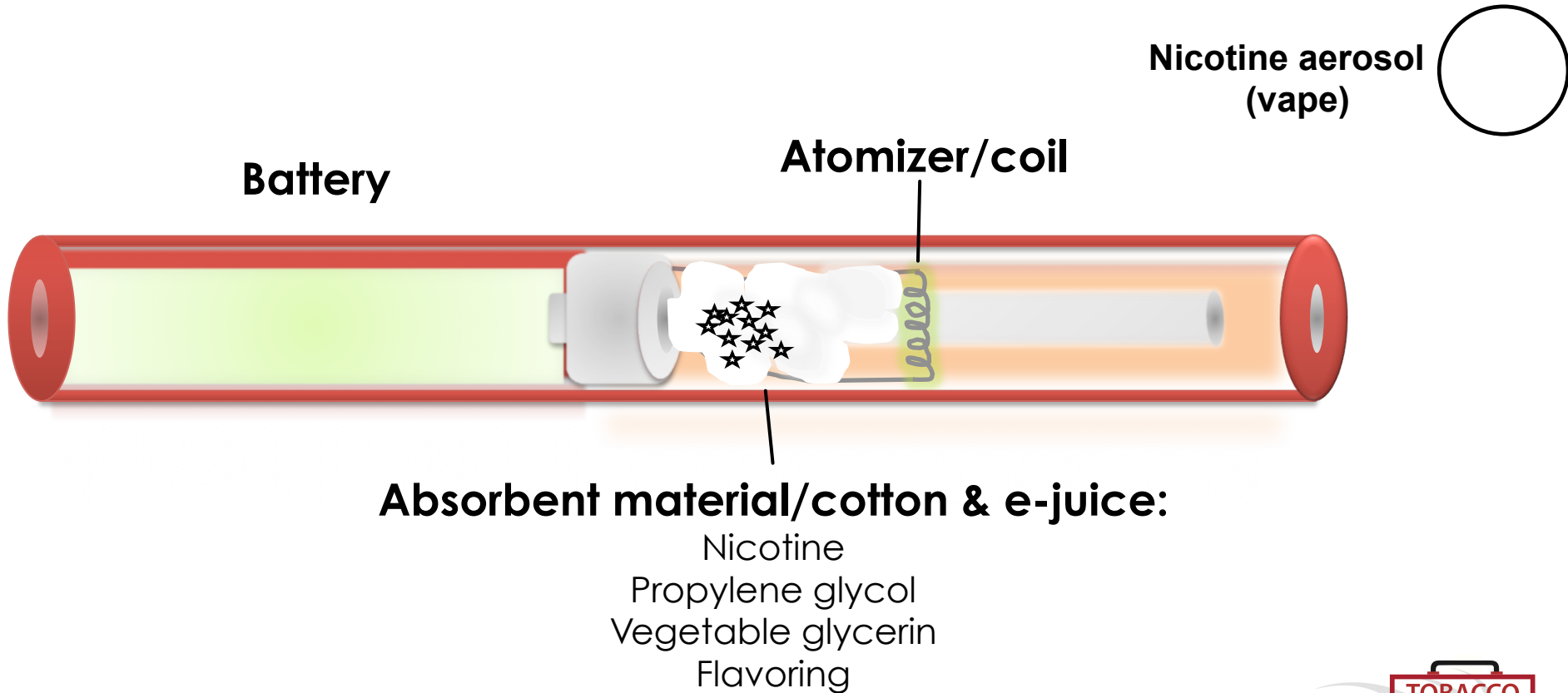
Hawai'i Youth ESD Use by County

Nov 2019



1. Cullen KA, et al. e-Cigarette Use Among Youth in the United States, 2019. JAMA 2019;322(21):2095-2103.
2. Hawai'i Youth Risk Behavior Survey 2017.

What Are E-Cigarettes?



Electronic Nicotine Delivery Systems (ENDS)



Disposable
as little as **\$1 each**

Cigarette
E-cigs
came
market
2
Most
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Pod-Based ENDS



Nicotine Concentration

nicotine base

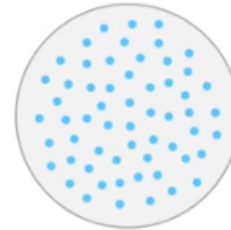


6mg/mL → 36mg/mL



refillable
tank

nicotine salts

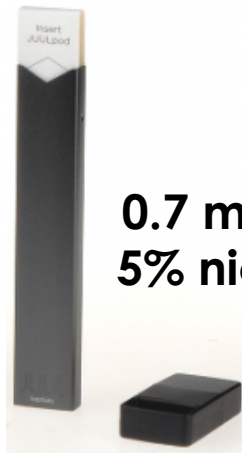


59mg/mL



Pods
Puff Bars

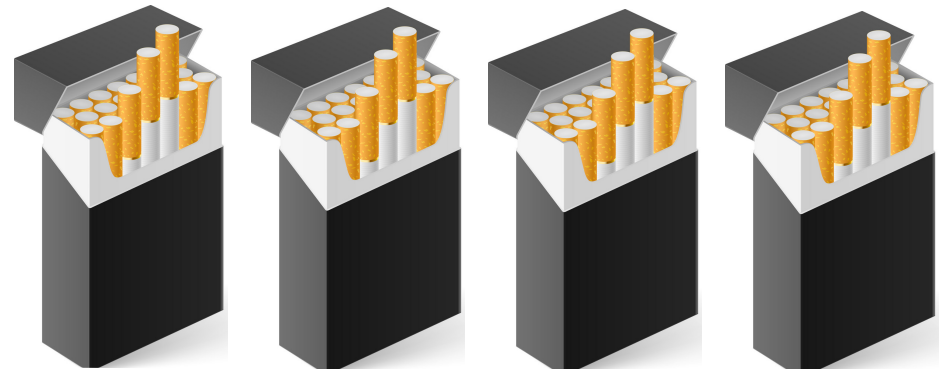
Pod-Based ESD Nicotine Delivery



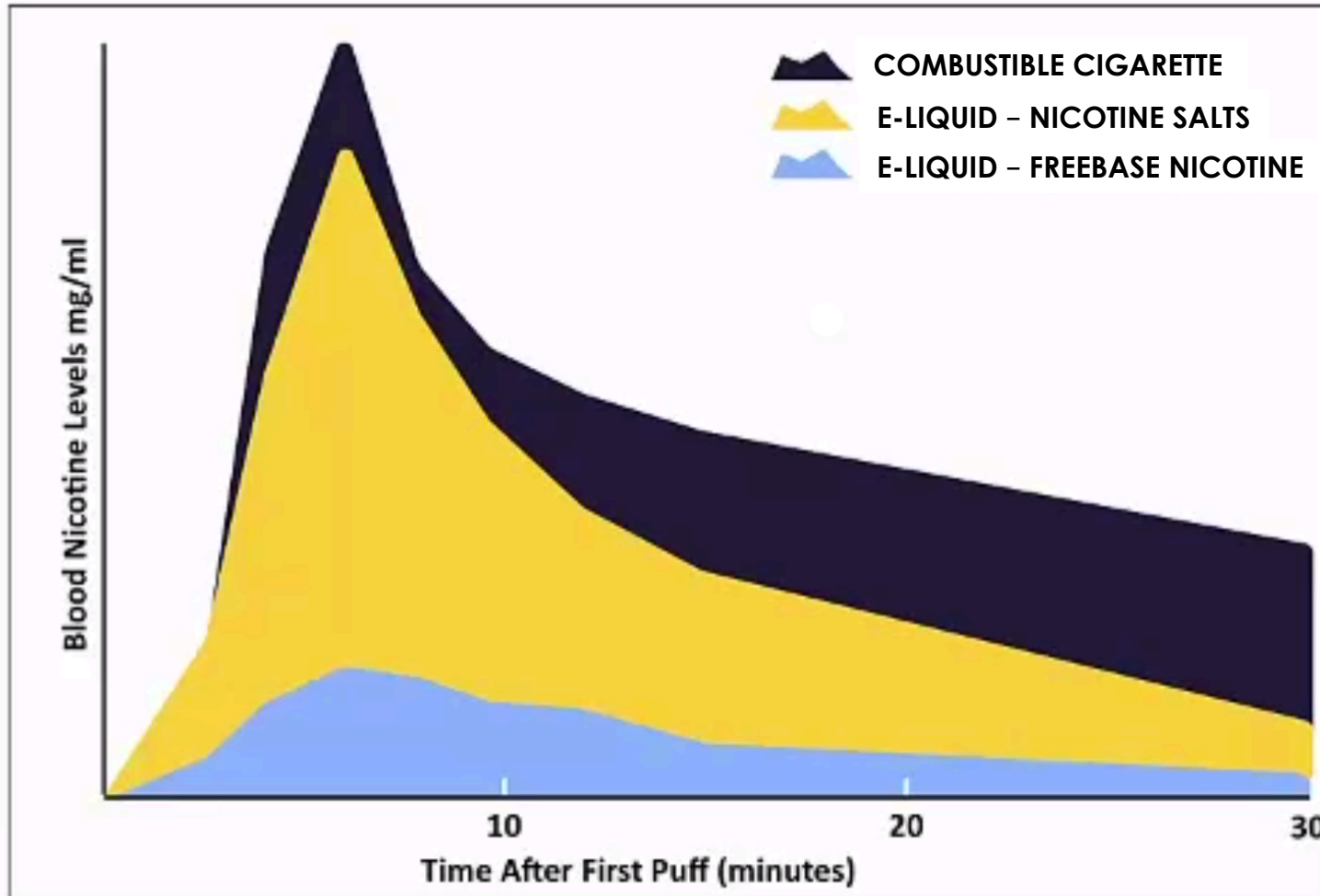
**0.7 mL pod
5% nicotine**



**1.5 mL pod
5% nicotine**



Nicotine Absorption



US Patent Application for Nicotine Salt Formulations For Aerosol Devices And Methods Thereof
Application #20150020824, Oct 10, 2014. <https://patents.justia.com/patent/20150020824>
(accessed 19.Apr.2019)

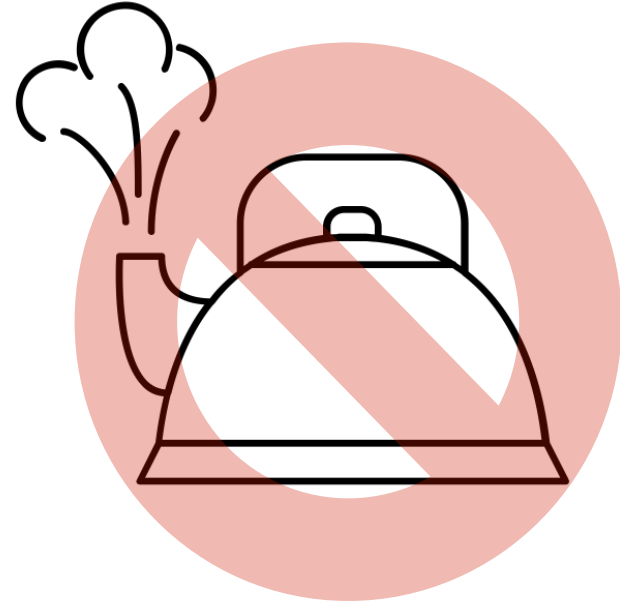
Vape: Just Water Vapor, Right?



It's **Aerosol** not Harmless Water Vapor

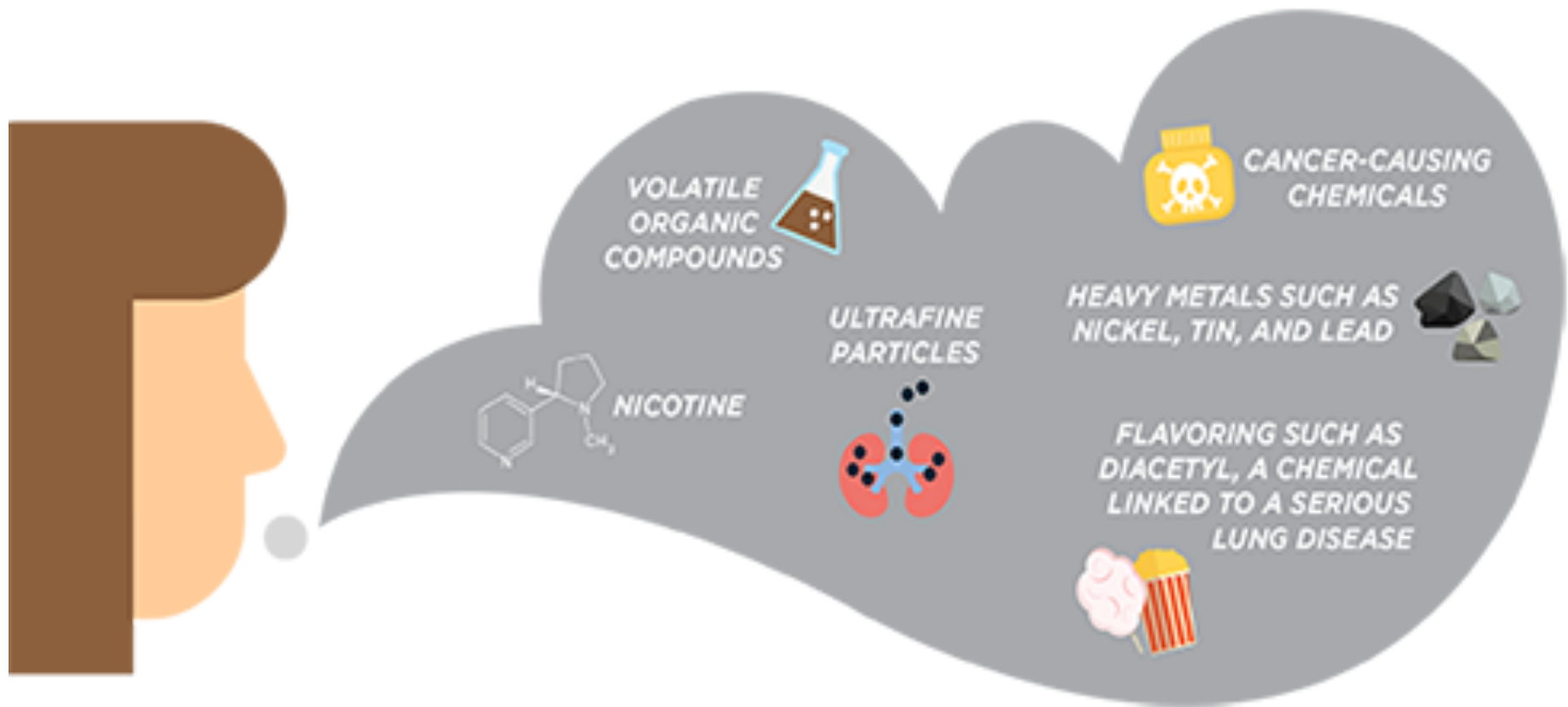


Mixture of many different droplets and particles suspended in air, some present in e-juice, others produced during e-cig heating process

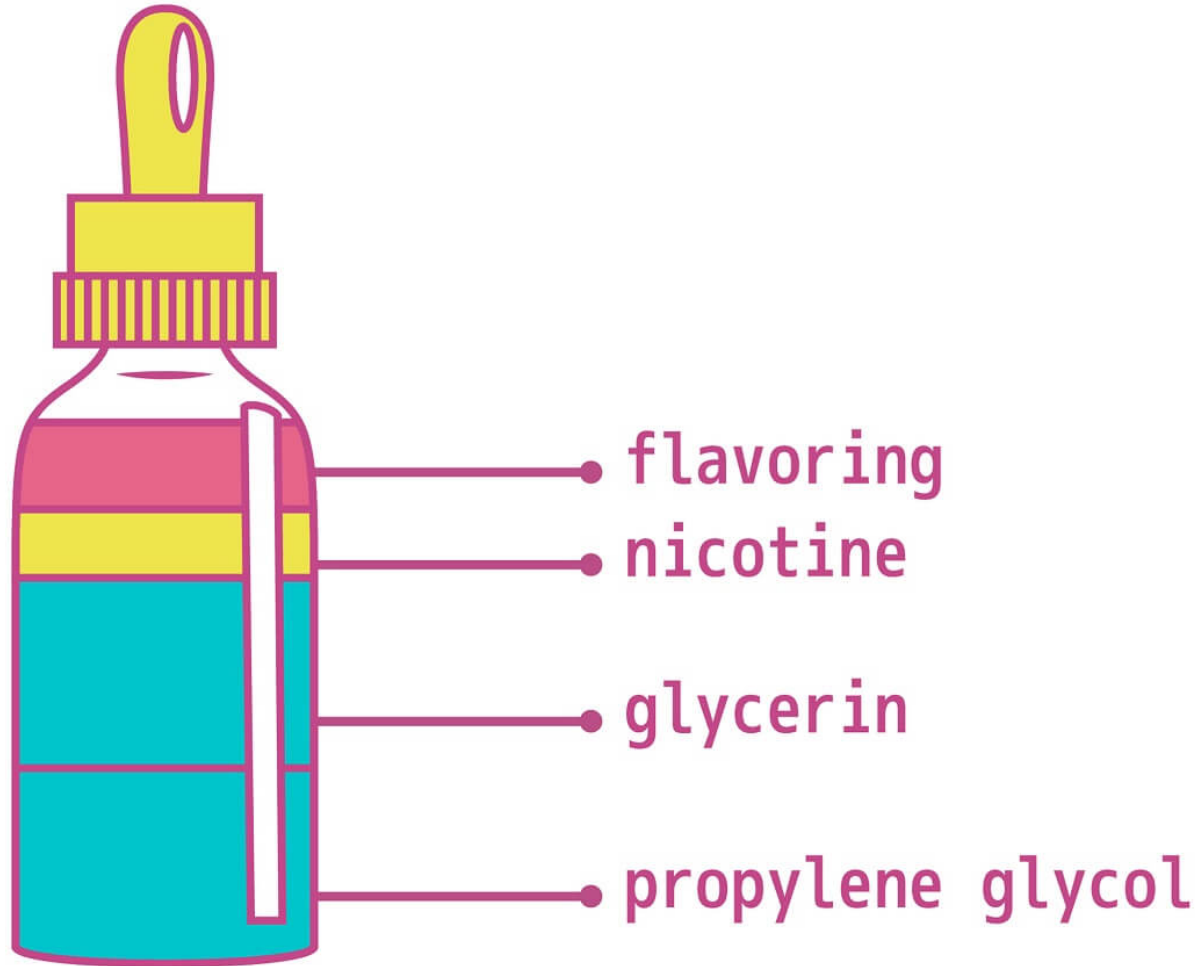


Water vapor
(steam)

What's in E-Cig Aerosol?



What's in E-Juice?



Ingestion vs. Inhalation

Propylene glycol and other e-juice ingredients may be approved as safe for use in *foods*...
NOT approved as safe for **inhaling**

Consuming



Digestive Tract

Breathing In



Respiratory Tract

NOT APPROVED

Flavorings & Other Ingredients



Thousands of e-juice flavors

- ❖ Some ingredients are **toxic**
- ❖ Some ingredients create **new toxic compounds** when mixed
- ❖ Some ingredients are **converted to toxic compounds** when e-juice is heated by e-cig

- aluminum
- chromium
- lead
- manganese
- nickel
- zinc

- ❖ **Metals** from e-cig mechanisms found in vape aerosol are **toxic** or **toxic when inhaled**

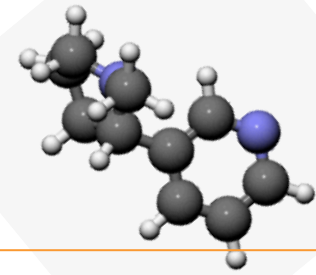
Youth Perceptions of ESD Risks

| Grade | <i>Do not</i> perceive great risk of harm |
|------------------|--|
| 8 th | 80% |
| 10 th | 81% |
| 12 th | 84% |

Survey response options: no risk, slight risk, moderate risk, great risk, can't say

Trends in Harmfulness as Perceived by 8th, 10th and 12th Graders. The Monitoring the Future study, University of Michigan, 2017. <http://monitoringthefuture.org/2017/risk/ecig>

Nicotine



- **Highly addictive** substance
- Causes changes in brain chemistry – stimulates pleasure centers, alters normal brain function
- As nicotine levels in brain drop, brain craves nicotine to feel pleasure and relieve feelings of anxiety and stress (withdrawal)
- Nicotine addiction in youth increases risk of other addictions¹

1. Califano J, et al. Tobacco: The Smoking Gun. The National Center on Addiction and Substance Abuse at Columbia University, 2007.

Nicotine is Brain Poison for Youth

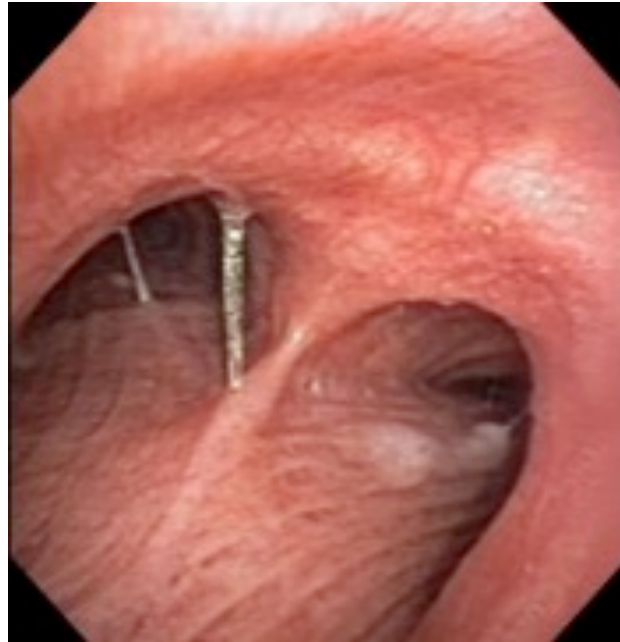
- ❖ Slows development of attention, learning and memory
- ❖ Impairs decision-making skills
- ❖ Reduces impulse control
- ❖ Worsens mood, anxiety and depression
- ✧ Brain changes can be permanent

Effects of Vape on Lungs

Non-Smoker



Smoker

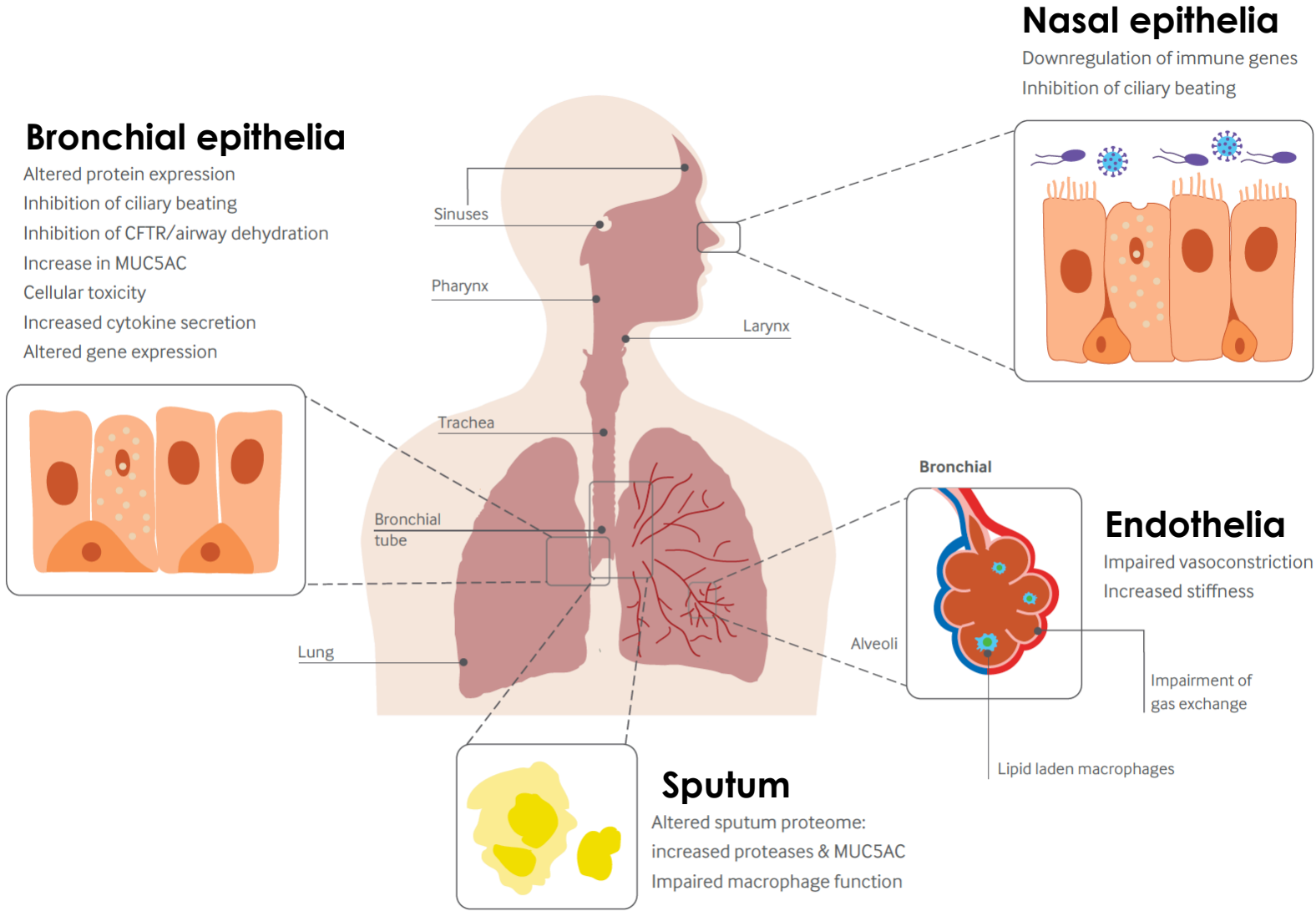


Vaper



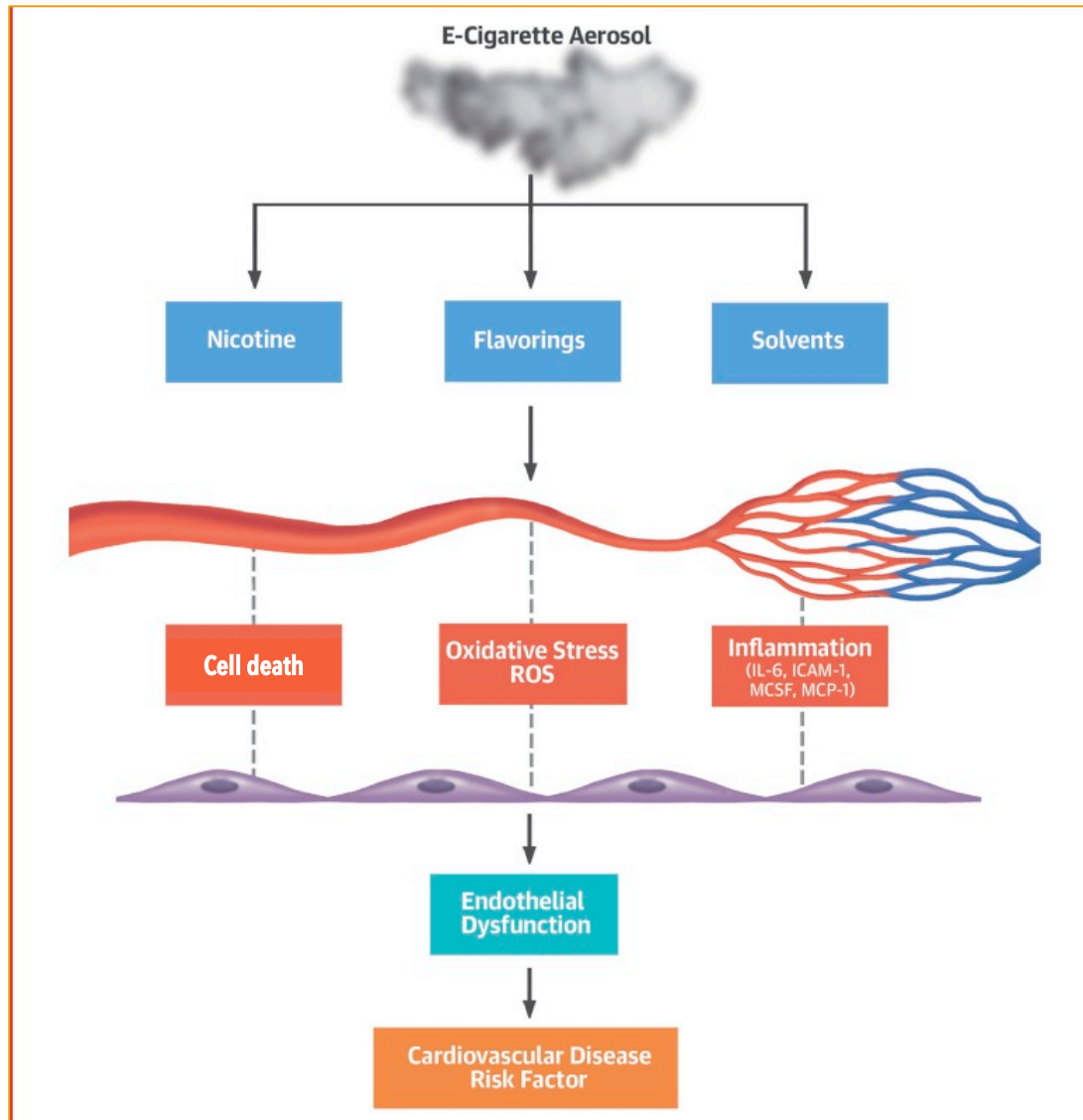
Ghosh A, et al. Chronic E-Cigarette Exposure Alters the Human Bronchial Epithelial Proteome. *Am J Respir Crit Care Med.* 2018;198(1):67-76.

Effects of Vape on Respiratory System



Gotts JE, et al. What are the respiratory effects of e-cigarettes? BMJ. 2019;366:l5275.

Effects of Vape on CV System



Lee WH, et al. Modeling Cardiovascular Risks of E-Cigarettes With Human-Induced Pluripotent Stem Cell-Derived Endothelial Cells. *J Am Coll Cardiol.* 2019;73(21):2722-2737.

Effects of Vape on Oral Health

E-liquid ingredients ***soften tooth material and allow more cavity-causing bacteria to stick***

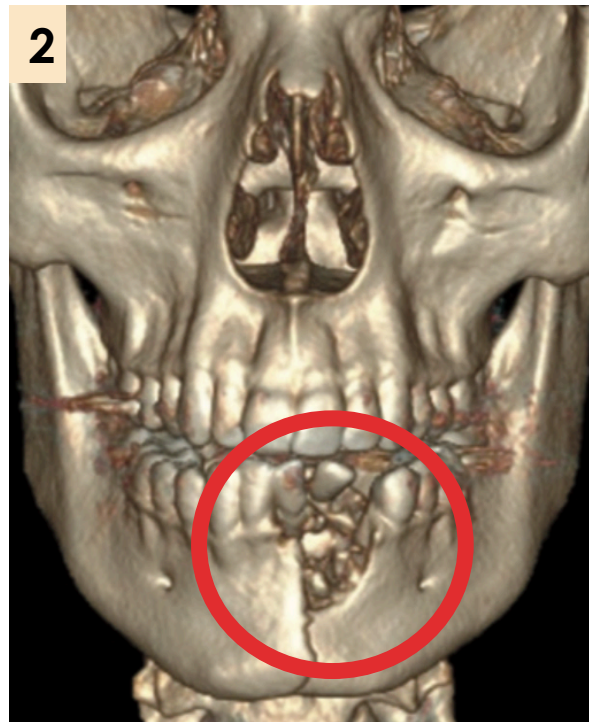
- **Propylene glycol** breakdown products harmful to tooth enamel and oral soft tissue
- **Vegetable glycerine + flavorings** increase microbial adhesion and biofilm formation
- **Flavorings** reduce enamel hardness
- **Nicotine** increases risk of gum disease and tooth loss

Froum S, et al. Vaping and oral health: It's worse than you think.

<https://www.perioimplantadvisory.com/clinical-tips/article/16412201/vaping-and-oral-health-its-worse-than-you-think> (accessed 10.Jul.2019)

ESD Explosion Injuries

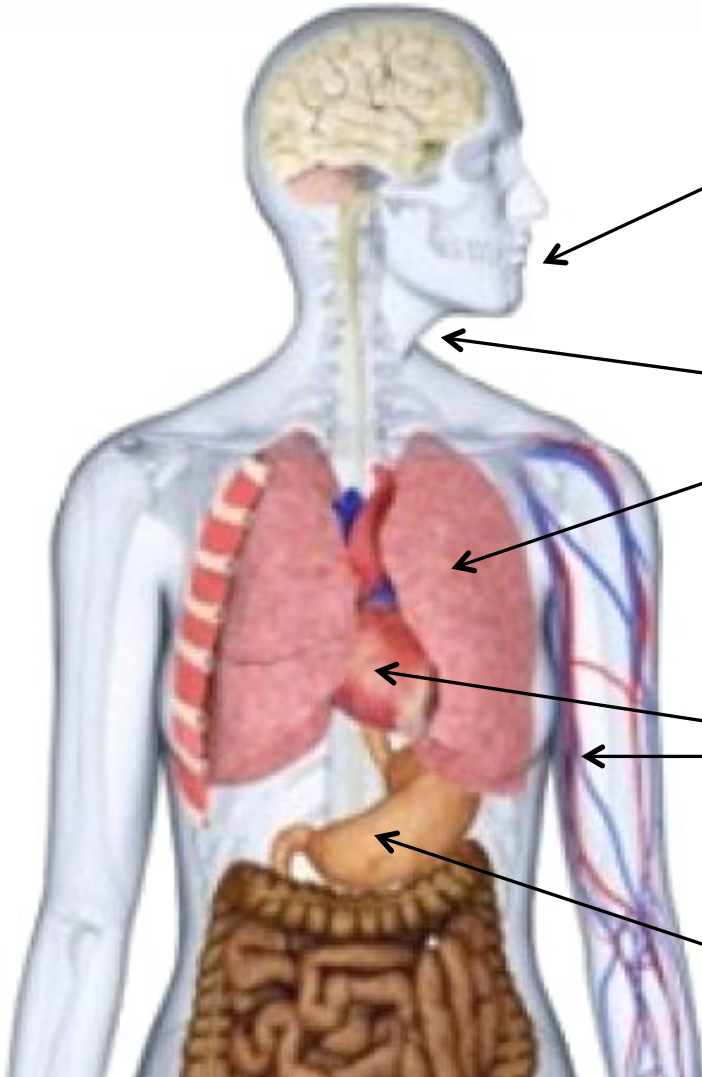
Estimated **2035 e-cigarette explosion and burn injuries** presented to US hospital emergency departments from 2015 to 2017¹



1. Rosshem ME, et al. Electronic cigarette explosion and burn injuries, US Emergency Departments 2015-2017. *Tob Control*. 2019;28(4):472-474.

2. Katz MG, et al. Injury from E-cigarette Explosion. *N Engl J Med*. 2019;380(25):2460.

Other Effects of Vape



Mouth

- Cracked teeth
- Tongue & inner cheek pain

Airway & Lungs

- Increases airway resistance
- Impairs lung immune activity
- Toxic to lung cells and cilia
- Promotes lung inflammation
- **Increases risk of chronic bronchitis in youth**

Heart & Circulation

- Chest pain
- Increases artery stiffness
- **Doubles risk of heart attack**

Stomach

- Nausea, vomiting
- Heartburn
- **Acid reflux**

Vaping-Associated Seizures

127 reports, most involve <21yo

Reported by first-time and regular e-cig users

After a few puffs or up to a day after use

Reports lack specific e-cig brand information

Causation *NOT* established



1. FDA Special Announcement: Some E-cigarette Users Are Having Seizures, Most Reports Involving Youth and Young Adults. <http://tinyurl.com/y3sts3vn> (accessed Apr 3, 2019)
2. FDA Continues to Receive Reports of E-cigarette Users Having Seizures, More Information Needed to Determine Possible Causes <https://tinyurl.com/y5y77q38> (accessed Aug 7, 2019)

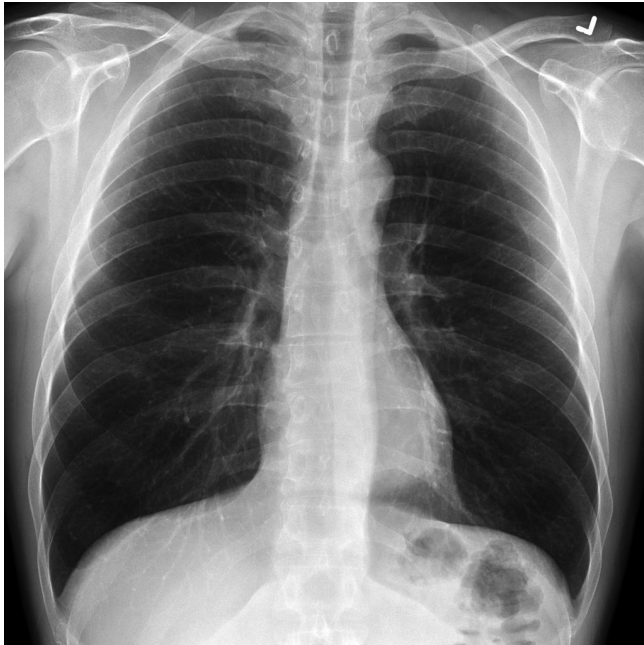
Vaping *Epidemic* vs *Outbreak*

Hawai'i Youth Vaping ***Epidemic***

Vaping-Associated Lung Illness ***Outbreak***

E-cigarette, or Vaping, product use Associated Lung Injury (EVALI)

Healthy lungs



Vape-injured lungs



17yo victim



Tryston Zohfeld

- ◆ 18 days in hospital
- ◆ 10 days medically-induced coma

EVALI

2,561 hospitalized cases of severe lung damage
linked to vaping

55 deaths confirmed (as of Dec 31, 2019)

15% under 18 years old

38% 18-24 years old

All **vaped** nicotine, THC or both

Vitamin E acetate linked to many but not all cases

Symptoms: coughing, shortness of breath, chest pain, nausea, vomiting, abdominal pain, diarrhea, fever, chills, weight loss

CDC. Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products.
https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html (accessed Dec 19, 2019)

CDC. CDC, States Update Number of Hospitalized EVALI Cases and EVALI Deaths (Dec 31, 2019).
<https://www.cdc.gov/media/releases/2019/s1231-evali-cases-update.html> (accessed Jan 2, 2020)

2nd Hand Vape

From 2017-2018, high school student **second hand vape exposure increased by 50%**¹

2nd hand vape **increases risk of asthma attacks** in youth with asthma *who don't vape*²

1. Tan AS, et al. Trends in the Prevalence of Exposure to e-Cigarette Aerosol in Public Places Among US Middle and High School Students, 2015 to 2018. JAMA Netw Open. 2019;2(8):e1910184..
2. Bayly JE, et al. Secondhand exposure to aerosols from electronic nicotine delivery systems and asthma exacerbations among youth with asthma. Chest. published online Oct 22, 2018.



Hook Kids

- ✓ 88% of youth who vape use flavored e-juice¹
- ✓ Puff more often²
- ✓ Longer inhalations³
- ✓ More likely to be vaping 6 months later⁴
- ✓ **More likely to later use unflavored tobacco⁵**

1. McMillen R, et al. Adolescent Use of Different E-cigarette Products 2018;142(4):e20180260.
2. Audrain-McGovern J, et al. The impact of flavoring on the rewarding and reinforcing value of e-cigarettes with nicotine among young adult smokers. Drug Alcohol Depend. 2016;166():263-267.
3. St. Helen G, et al. Impact of e-liquid flavors on e-cigarette vaping behavior. Drug Alcohol Depend. 2018;189:42-48.
4. Leventhal AM, et al. Flavored E-cigarette Use and Progression of Vaping in Adolescents. Pediatrics. 2019; 144(5):e20190789.
5. Villanti AC, et al. Association of Flavored Tobacco Use With Tobacco Initiation and Subsequent Use Among US Youth and Adults, 2013-2015. JAMA Netw Open. 2019;2(10):e1913804.



Hook Kids

Among ESD users, *if flavors did not exist*:

- ✓ 78% of youth would NOT use
- ✓ 74% of 18-24 year olds would NOT use

75% of flavored tobacco product users (youth and young adults) would quit if flavors were unavailable

Harrell MB, et al. Flavored tobacco product use among youth and young adults: What if flavors didn't exist. *Tob Reg Sci.* 2017;3(2):168-173

Youth Cannabis Use with ESDs

33% of high school students who ever used ESDs report using cannabis in ESDs¹

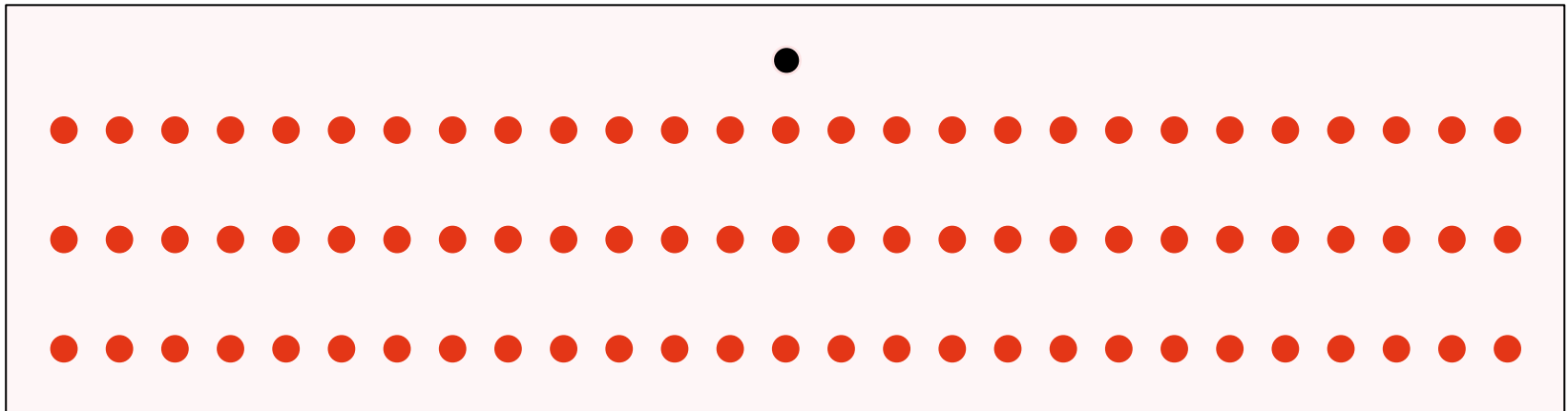
23% of middle school students who ever used ESDs report using cannabis in ESDs¹

Youth who vape are **3.5 times more likely to use cannabis** than vape-free youth²

1. Trivers KF, et al. Prevalence of Cannabis Use in Electronic Cigarettes Among US Youth. JAMA Pediatr. Published online Sep 17, 2018.
2. Chadi N, et al. Association Between Electronic Cigarette Use and Marijuana Use Among Adolescents and Young Adults A Systematic Review and Meta-analysis. JAMA Pediatr. published online August 12, 2019.

Adult vs Youth E-cig Use

For each adult tobacco cigarette smoker who switches to e-cigs...



81 youth start using e-cigs

Soneji SS, et al. Quantifying population-level health benefits and harms of e-cigarette use in the United States. PLoS One. 2018;13(3): e0193328.

Regulatory Updates

May 15, 2019

Federal judge orders FDA to regulate ESDs

- FDA abdicated its statutory responsibility in postponing application deadline to 2021

Jul 12, 2019

Federal judge orders FDA to implement ESD applications

- Submission deadline May 12, 2020
- Products with applications can stay on market up to 1 year while FDA considers application
- Products without applications by May 12, 2020 subject to FDA removal from market

Regulatory Updates

Dec 19, 2019

Congress raises age of tobacco purchase to 21

- Unclear how long to takes effect
- FDA has 6 months to amend policies

Maloney J. U.S. Raises Tobacco-Buying Age to 21. Wall Street Journal, Dec 19, 2019.
<https://www.wsj.com/articles/u-s-raises-tobacco-buying-age-to-21-11576796159> (accessed Dec 20, 2019)

Regulatory Updates

Jan 2, 2020

FDA finalizes e-cigarette enforcement priorities

- ✓ All flavored cartridge-based products, **includes mint**
 - **Exempts menthol** and tobacco flavors
- ✓ All ENDS that lack adequate measures to prevent access by minors
- ✓ All ENDS that lack approval after May 12, 2020

◆ **Exempts all flavors in tank/refillable systems**

FDA. Enforcement Priorities for Electronic Nicotine Delivery Systems (ENDS) and Other Deemed Products on the Market Without Premarket Authorization, Jan 2, 2020.

<https://www.fda.gov/media/133880/download> (accessed Jan 3, 2020)

What Can You Do?



Flavorshookkidshi.org

Questions?