

Puff, Puff, Vape: Vaping Trends

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Disclosures

- I have no relevant financial relationships to disclose

Case

- 13 year old male p/w syncope while at school. He was found unresponsive in the bathroom lying next to vomitus.
- Arouses only partially upon stimulation by school staff.

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Objectives

- Who, what, how, why vape?
- Toxicity of products
- Clinical conditions
- Treatment
- Next frontiers in vaping

Vaping

- “Vape,” or electronic cigarette, is a device that heats up a liquid to create a vapor to inhale.
- \$182.84B by 2030
- Compound annual growth rate of 30.0% from 2022 to 2030
- The rise of tobacco
- The rise of vaping



Adolescents

- National Youth Tobacco Survey, 2021; Monitoring the Future survey
- Disposable, flavored products more popular than any traditional cigarette
- 2 million US middle and high school students reported using e-cigarettes
- 8 of 10 used flavored e-cigarettes
- 40.5% of 12th graders reported vaping in the past year
- Disposable e-cigarette use since 2019.....
 - Increased 1000% among high school students
 - Increased 400% among middle school students

Johnston et al. 2019; Miech et al. 2019; NIDA 2019





Marketing

- Over 24 million adolescents exposed yearly to vaping ads
- Features adolescents
- Focus on teens not currently nicotine users
- Instagram ads
- Emphasize culture of e-cigarette use
- Vaping is an adult behavior
- “We’re all adults here. It’s time to take back your freedom”
- Sexual component; female models in suggestive clothing
- “Vaping tricks”
- JUUL

TAKE BACK
YO



- Smoke
- No To
- Flavor

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LOVE



18+ ID required. The only source to which product and price have been evaluated by the Food and Drug Administration. See us for complete information or visit our website.

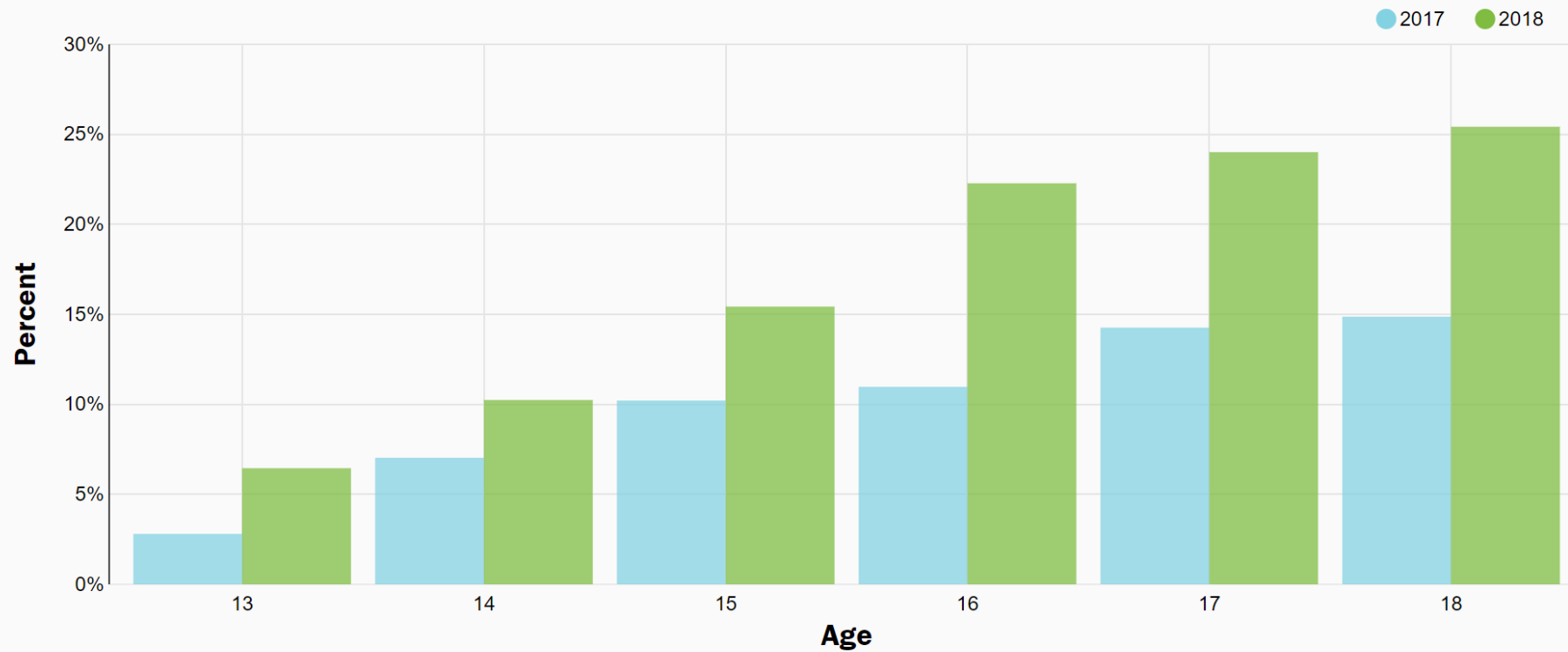


way, baby.

SMOKE WITHOUT SMELLING CIGARETTES
Smoke Without Carbon Monoxide.

Youth

Percentage of minors who have used e-cigarettes, by age

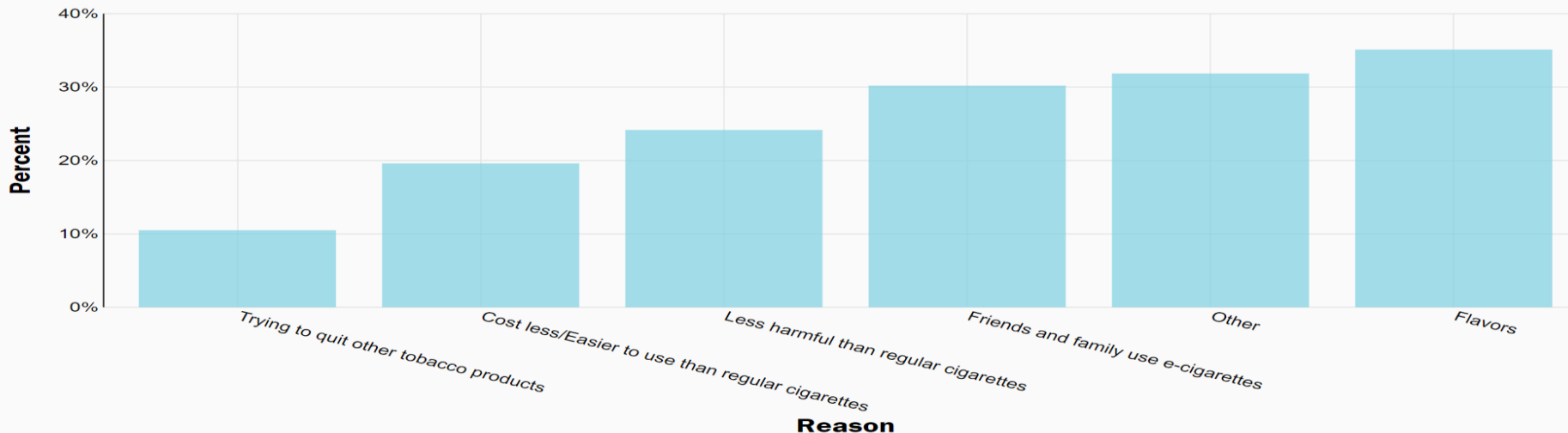


Note: Data shows regular e-cigarette users who have used an e-cigarette in the past 30 days.

E-Cigarettes Enticing to Youth

- “Vaping is less harmful than traditional smoking”
- Lower per use cost than traditional cigarettes
- Lack of pyrolytic smoke is appealing (no “smell stigma”)
- People of all ages taking up the habit

Reasons why youth use e-cigarettes, 2018



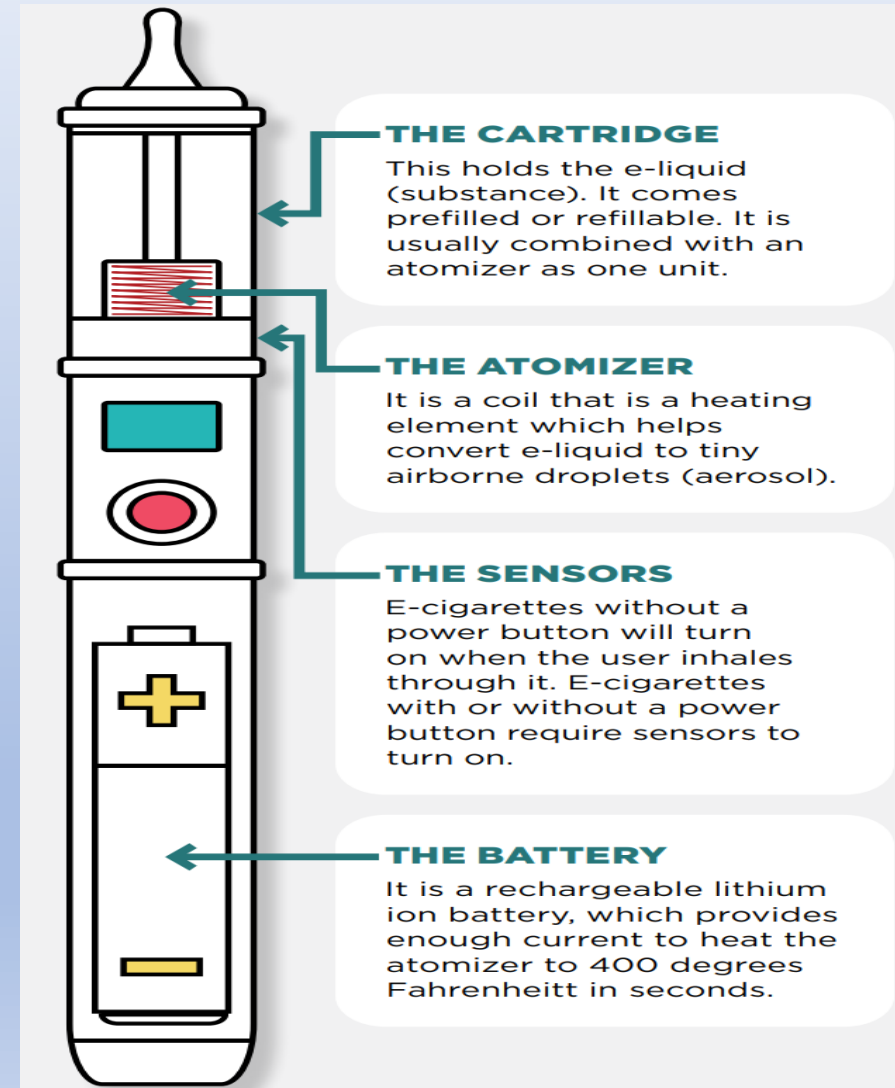
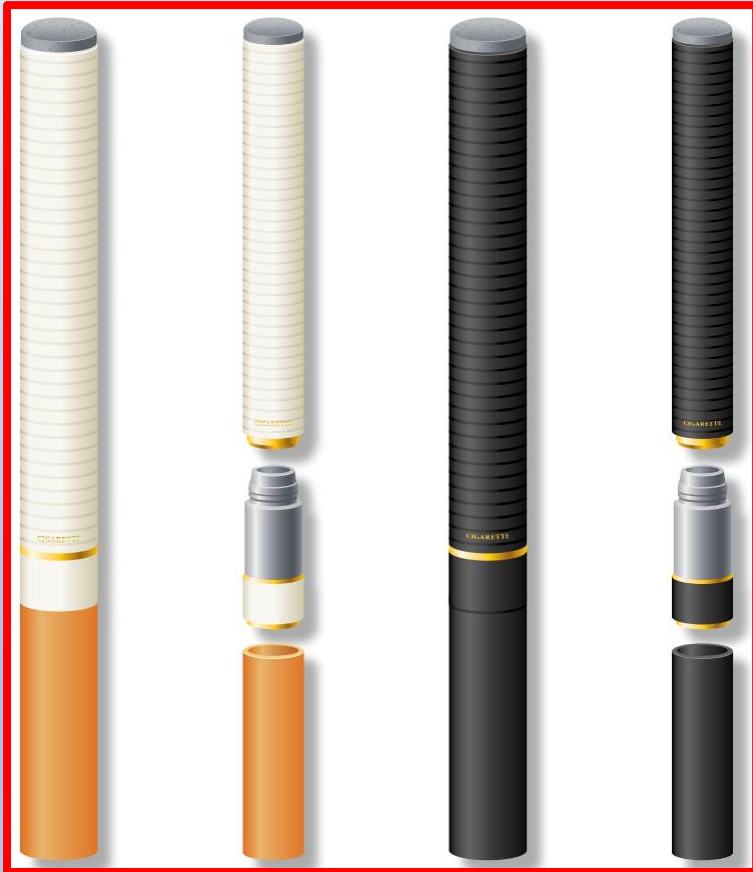
Dai and Hao 2016; Anand et al 2015

Note: Values add up to over 100 because respondents could select more than one answer.

How Vaping Pens Work



1st Generation, Disposable E-Cigarettes



2nd Generation, Refillable



3rd Generation, Tanks or Mods



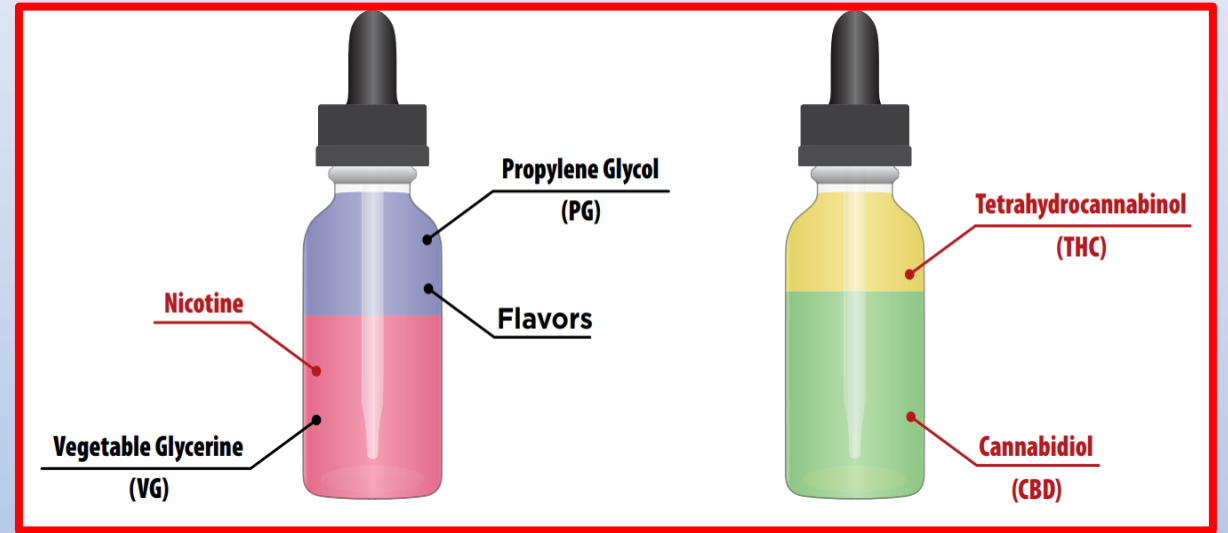
4th Generation, Pods



Case

- 13 year old male p/w syncope while at school. He was found unresponsive in the bathroom lying next to vomitus.
- Arouses only partially upon stimulation by school staff.
- Seizure witnessed by EMS during transport to ED
- Muscle fasciculations present in ED
- HR 152 BP 84/51 RR 12 Temp 36.9°C Pulse Ox 94% RA
- What is the toxicity?

E-Liquid



- Psychoactive agents
- Solvents
- Flavoring compounds (>7,000 commercially available)

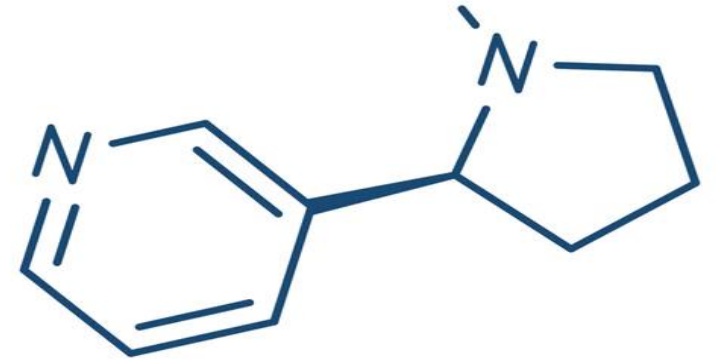
Nicotine

- Found in traditional cigarettes (10-30mg) and e-cigarettes (30mL bottles, 36mg/mL)
- Highly addictive
- E-liquid has high concentration
- Binds nicotinic cholinergic receptors
- Early: sympathetic nervous system stimulation
 - N/V, tachycardia, hypertension, fasciculations, seizures, salivation, bronchorrhea, hyperpnea, pallor, dizziness
- Late and higher doses: parasympathetic nervous system stimulation
 - Diarrhea, apnea, bradycardia, hypotension, paralysis, dysrhythmias
- Treatment is supportive

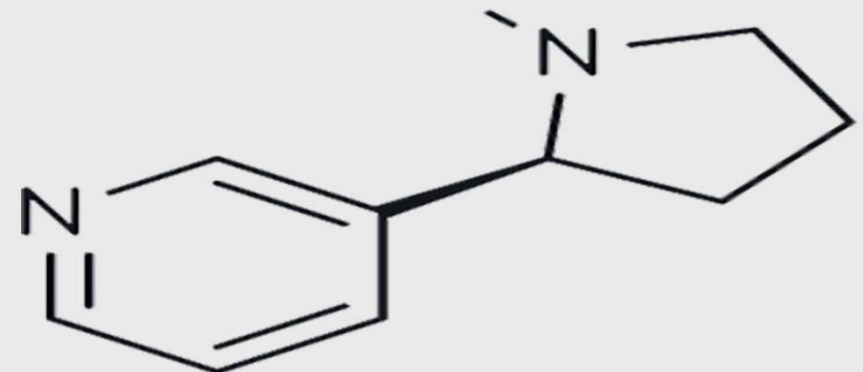
Nicotine

- Freebase
 - Unprotonated
 - “pure”
 - Vaporized easily
 - Absorbed across tissues easily
 - High concentrations unpleasant to consume
- Nicotine salt
 - Very high concentrations of nicotine (50mg/mL)
 - Increased addictive potential

NICOTINE FREEBASE



SALT NICOTINE



Δ -9 Tetrahydrocannabinol

- Psychoactive component of cannabis
- Vitamin E (tocopheryl) acetate used as thickening agent
- Disrupts phospholipid bilayers
- Hypothesized to decrease the effectiveness of pulmonary surfactant

Other Substances

- Cocaine
- Heroin
- Fentanyl



Toxicity



Other chemicals

- Propylene glycol and vegetable glycerin
 - Largest volume solvent in e-liquids
 - Dilutes psychoactive agent to desired concentration
 - Creates consistency allowing agent to be vaporized
 - “Cloud thickness”
- Diacetyl (butane-2,3-dione)
 - Food additive
 - Used to deepen e-cigarette flavors
 - Injures small airways in the lungs
- Formaldehyde
 - Causes lung disease and contributes to heart disease
- Acrolein
 - Most often used as a weed killer
 - Can cause pulmonary injury

E-Cigarette or Vaping Use-Associated Lung Injury

- EVALI
- February 2020: 2,807 cases and 68 deaths, median age 19
- Criteria
 - Recent vaping
 - Pulmonary infiltrates on chest imaging
 - Absence of pulmonary infectious
- Modification of vaping devices
- Use of black-market modified e-liquids
- Pathology reports findings consistent with fibrinous pneumonitis, diffuse alveolar injury
- Vitamin E acetate found in all lung fluid samples of fatal cases



Bronchiolitis Obliterans

- “Popcorn Lung”
- Injury to small airways of the lung
- Discovered when popcorn factory workers becoming ill
- Culprit butane-2,3-dione(diacetyl): additive used to simulate butter flavor for popcorn
- Inhaled diacetyl causes inflammation and may lead to permanent scarring in the smallest branches of the pulmonary tree
- “Diacetyl free” product still contained measurable diacetyl
- Bronchiolitis obliterans has no lasting treatment

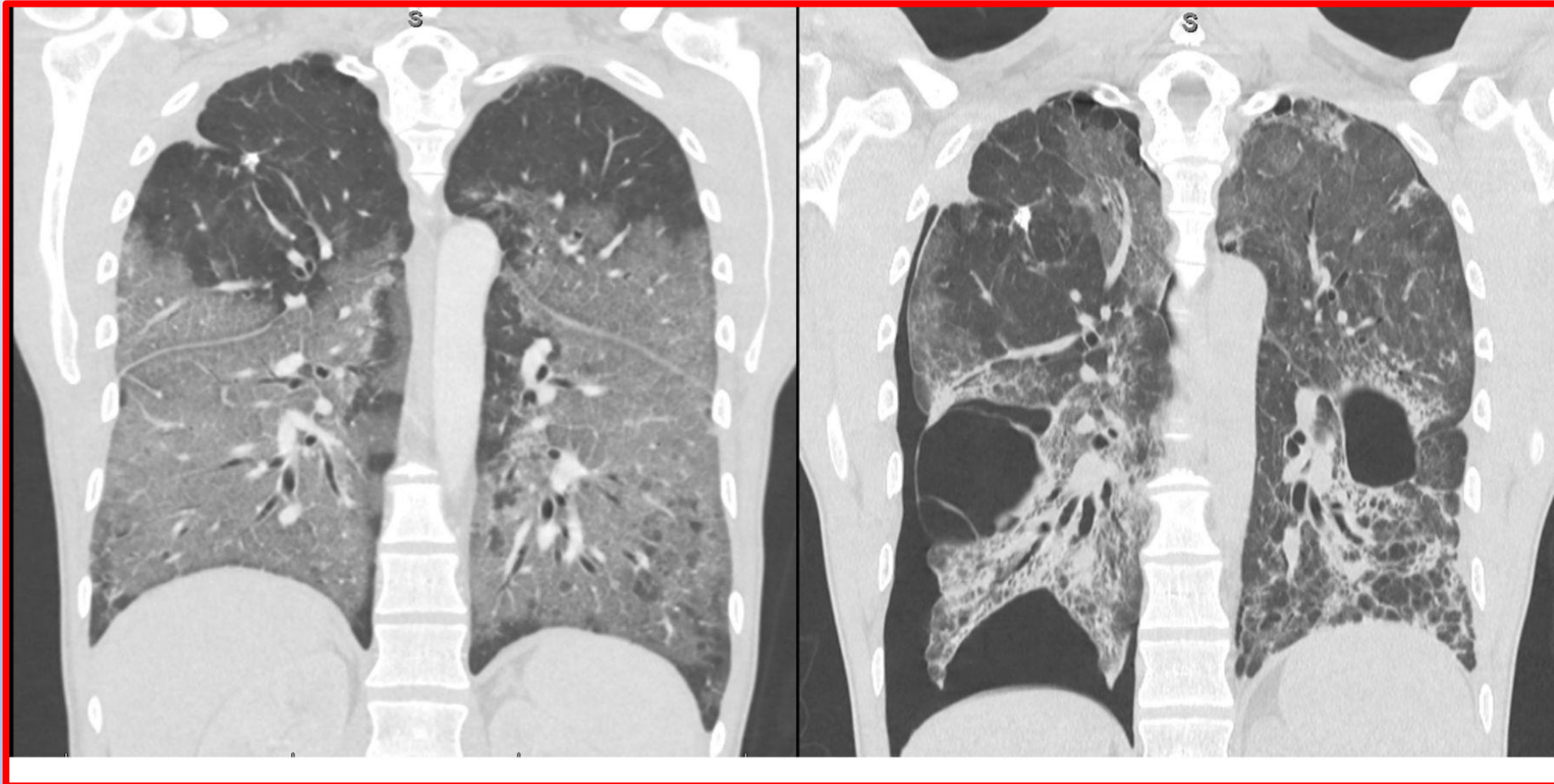


Vaping-Related Lipoid Pneumonia

- Develops when fatty acids enter the lungs
- Inhaling oily substances found in e-liquid
- Resulting pulmonary inflammatory response



Primary Spontaneous Pneumothorax



Cancer?

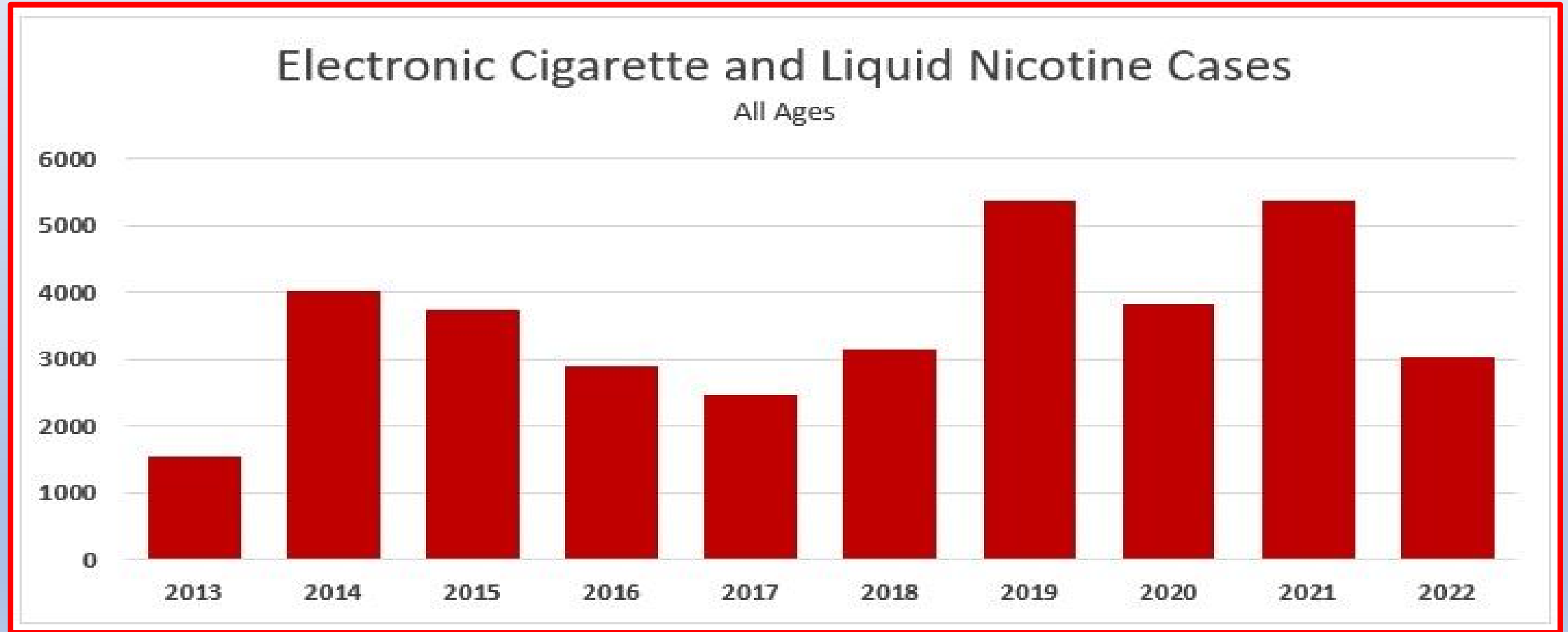
- Vaping products have not been around long enough to assess
- Secondhand smoke harmless?
 - Nicotine
 - Ultrafine particles
 - Diacetyl
 - Benzene (found in car exhaust)



Cardiovascular Effects

- Daily vaping associated with increased risk of myocardial infarction
- Relatively less than daily traditional cigarette use
- Increased platelet activating factor receptor activity

Calls to Poison Centers



National Poison Data System, American Association of Poison Control Centers, 2022

Burns



Summary

- Number of people vaping has increased significantly
- Adolescents particularly susceptible
- Can be significant acute toxicity from the e-liquid
- Long term clinical repercussions
- Cancer risk?
- Future toxicity risks



Questions?

