E Cigarettes, Vape pens, and hookah, oh my!

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Disclosures

I have no financial disclosures or conflicts of interest.

While there is mention of some name brands of some products, this is strictly for educational purposes and how they are used or named commonly and does not constitute any endorsement for any product.

Objectives

- Become familiar with devices used for vaping, how they work, and some history of their development.
- Review current statistics for vaping in the United States
- Understand some of the implications of vaping versus cigarette smoking.
- Gain understanding on the various ingredients in vaping fluids and their potential harmful effects as well as other risks associated with vaping devices.
- Review vaping associated lung injury incidence, presenting symptoms, and diagnosis.
- Understand risks of nicotine effects in teens, and addiction/substance misuse
- Understand marketing strategies in pediatrics.

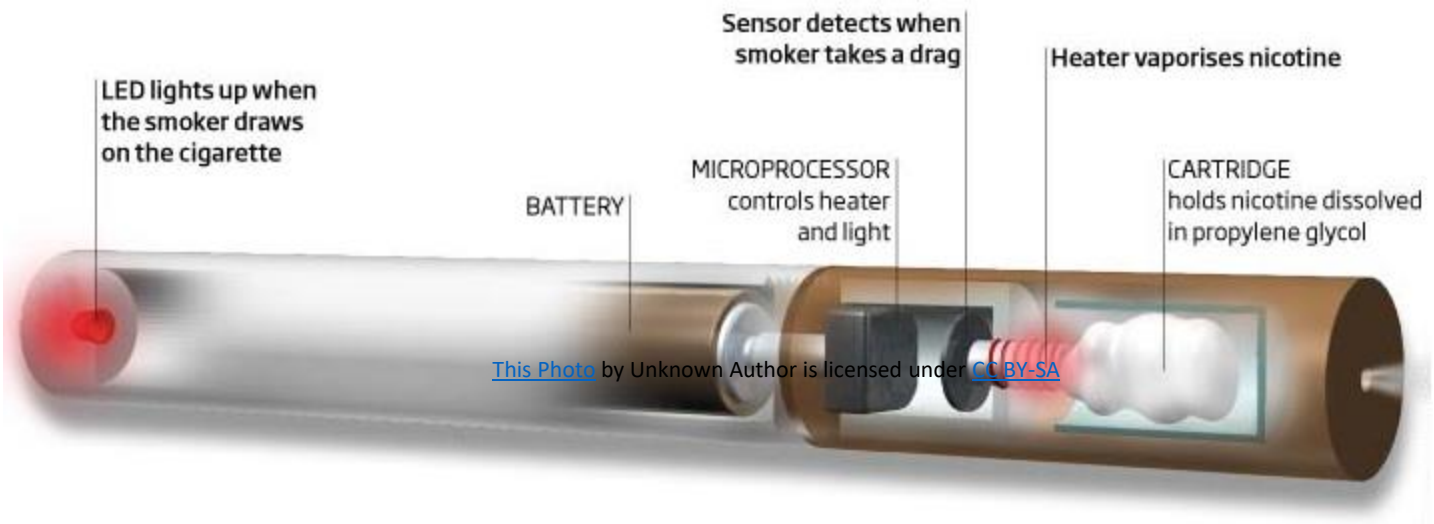
A Little History

- Invented in 2003 by a Chinese inventor
- Appeared in US in the mid 2000's
- There is a wide variety of devices

Many Device Options

- Electronic Nicotine Delivery Systems (ENDS)
- Vape devices, vape pens, vapes, dab pens, dab rigs
- JUUL
- Personal Vaporizers
- Alternative Nicotine Delivery Systems (ANDS)
- Electronic cigars or e-cigars
- E-hookah or hookah sticks/pens
- Mechanical mods and tanks
- Cigalikes
- Pod systems

How they work:



- Smoker inhales on device.
- Sensor detects when smoker puffs.
- microprocessor controls heater and light and vaporizes product from cartridge as needed.

Cigalikes: 1st Generation

- “Cigalike”.
- Similar in size to traditional cigarettes.
- Different colors and size

2nd Generation E-Cigarettes: Open systems

- Generally larger in size with a reservoir to hold the solution (i.e. e- liquid).
- Tank systems.
- Vape devices and vape pens.
- Not been tested in clinical trials.

3rd generation E cigarettes: Mods

- Highly customizable and modifiable
  - Manual heating button
  - Variable voltage
  - Digital readouts
- Advanced Personal Vaporizer (APV) or Mods
- Example: Volcano and Apollo

4th generation e cigarettes:

- Greatest departure from traditional cigarettes
- Adjustable voltage/wattage
- Adjustable airflow
- Temperature sensing
- Not been tested in clinical trials.

THE EVOLUTION OF E-CIGS

FIRST GENERATION

The Cigalike - an early vaping device made to resemble a traditional cigarette. Poor battery life and an overall unsatisfying experience. Many people using them as an aid to quit smoking cigarettes found them less useful than later devices.

SECOND GENERATION

Vape Pens - so called because they resemble pens. Much larger than the first generation devices and with an improved battery life. Many second generation devices are still available, often used as a 'starter kit' for those new to vaping.

THIRD GENERATION

Much bulkier devices, with a clear tank and a larger battery, or a chunkier pen style, looking somewhat like Dr Who's 'Sonic Screwdriver.' Devices of this generation introduced a higher degree of control over the individual's vaping experience.

FOURTH GENERATION

Light years ahead of the earliest devices, the latest generation offer considerable advances in technology, and the ability to modify and adjust devices to the user's specifications - coils, wicks etc - giving the best experience possible.

Vaporizers

Images Source: Centers for Disease Control and Prevention, E-cigarette, Or Vaping, Products Visual Dictionary March 2019

Finally….JUUL aka Pod Systems, the cig of 1000 faces

- Greatest departure from traditional cigarette
- Diverse products often difficult to recognize as an e-cigarette
- Using a JUUL is referred to as “JUULing” rather than “vaping”
- ‘JUUL uses “pods” that contain 59mg/mL nicotine
- Example: JUUL, Suorin, SMPO

Disposables:

- Flavors still being sold in disposable devices
- Stig, Puff Bars, Posh among popular disposable brand names
- Come pre-charged and pre- filled
- Contain high amounts of nicotine

IQOS: I quit ordinary smoking

- Electronic device classified as a cigarette, NOT an e-cigarette.
- FDA has permitted it to be sold as of April 2020 as a heat-not-burn tobacco product.
- It has not been proven as safer than traditional cigarettes .

E juice solutions:

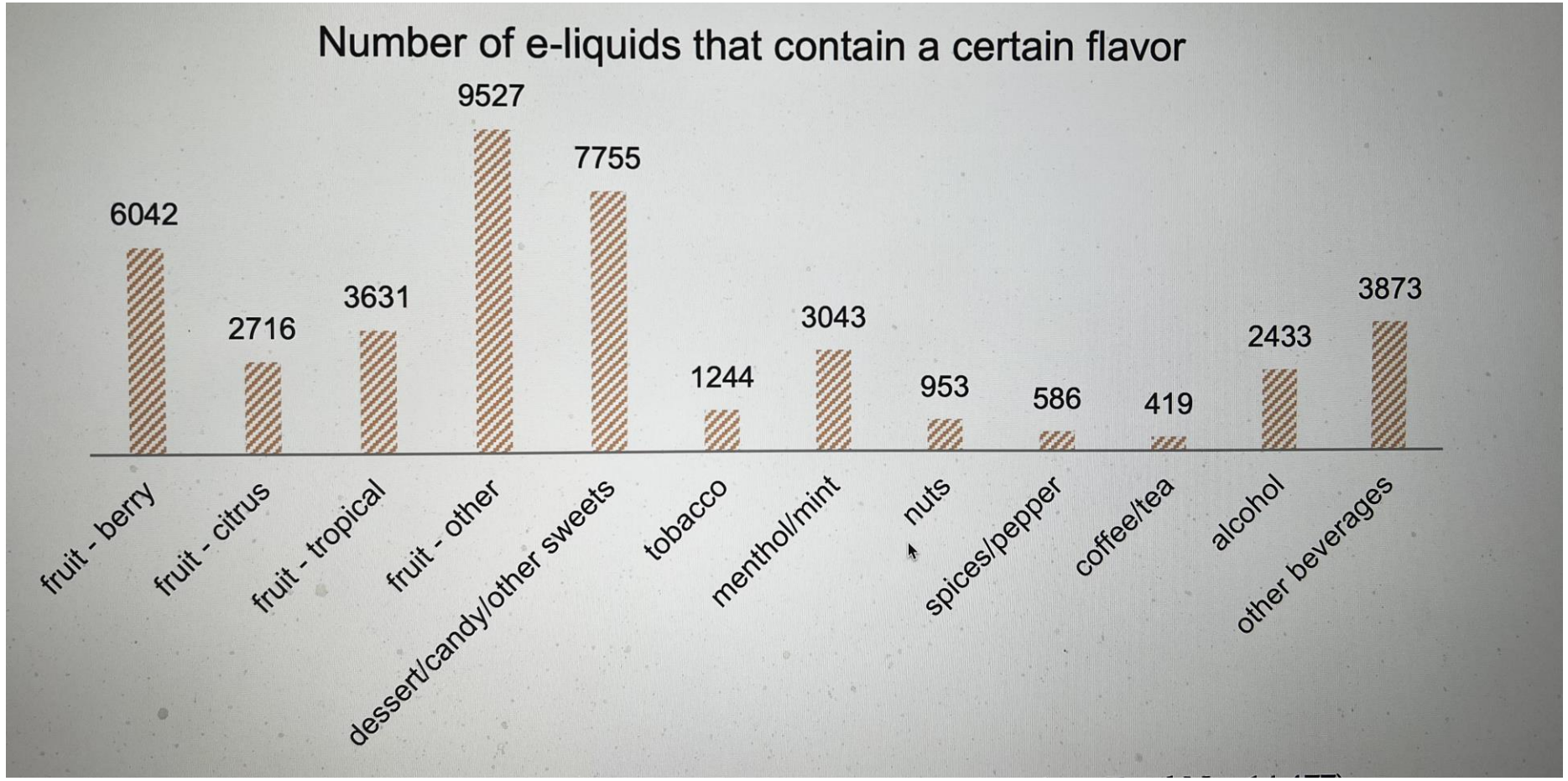
Different concentrations of nicotine

Different flavors, often dessert and candy flavored

Image Source: Centers for Disease Control and Prevention, E-cigarette, Or Vaping, Products Visual Dictionary March 2019

Over 14,000 flavors of E cigarettes

E-fluids by flavor category



Marketing and Sales

- Vape shops
- Convenience stores
- Gas stations
- Retail outlets
- Mall kiosks
- Grocery stores
- Internet vendors
- E-cigarette advertising unrestricted, with TV and radio ads for the first time since 1971
- May be allowed in places where smoking is not allowed

What's in it?

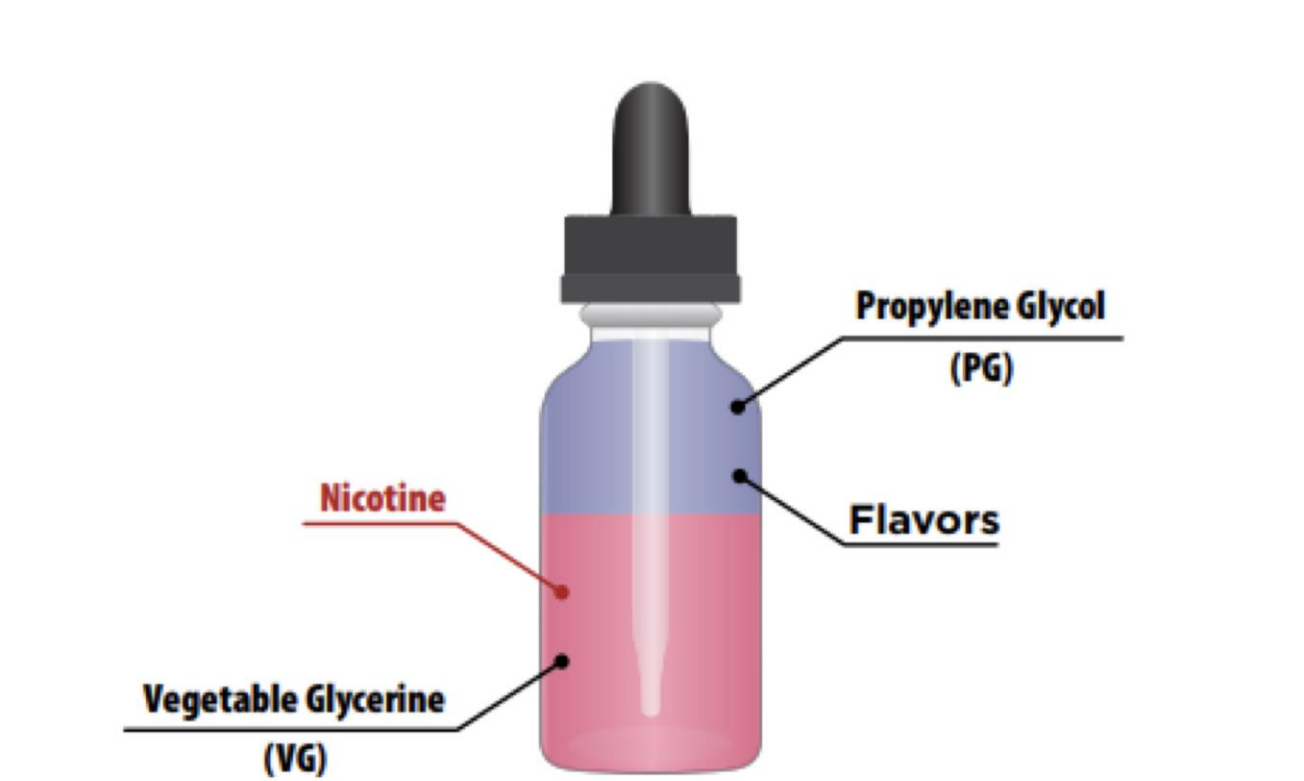


Image Source: Centers for Disease Control and Prevention, E-cigarette, Or Vaping, Products Visual Dictionary March 2019

- Humectant
- Vegetable glycerin
- Propylene glycol
- Flavoring
- Nicotine

Ahhh, but what's REALLY in it.....

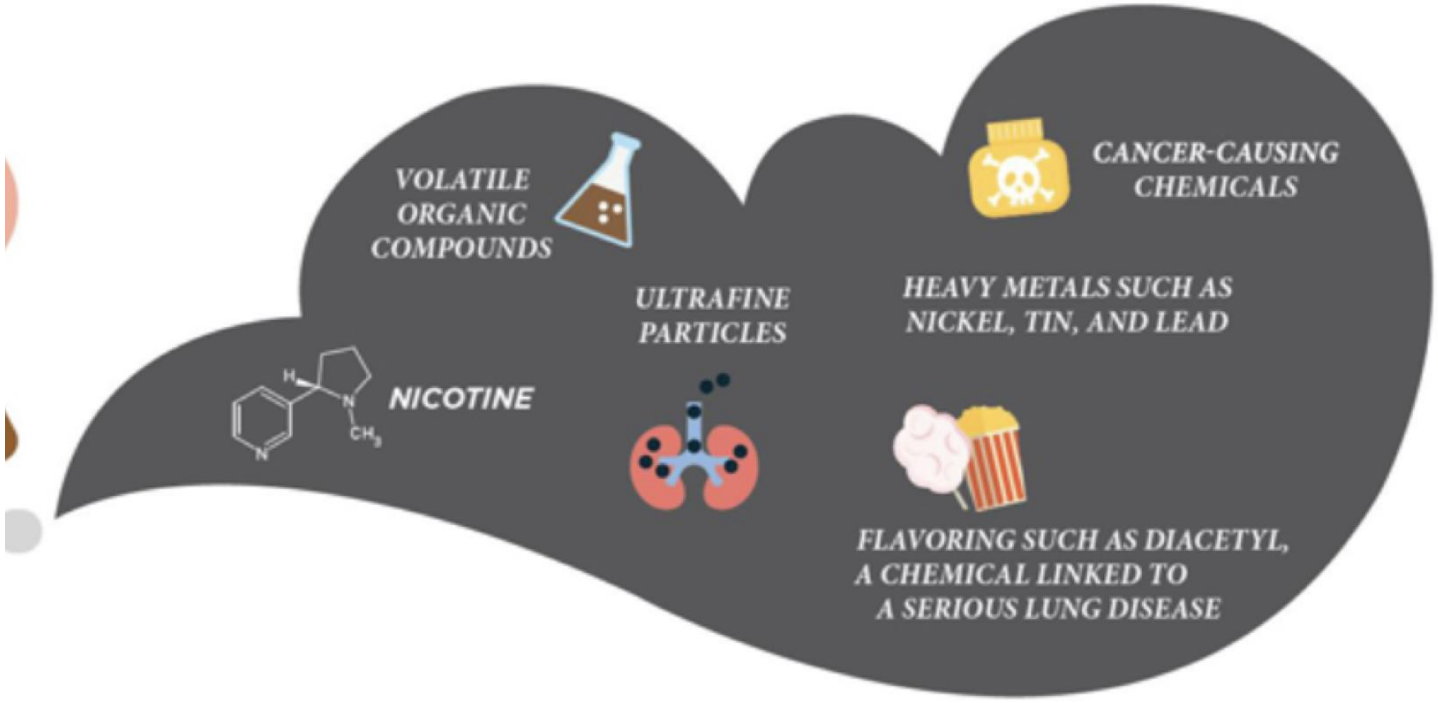


Image Source: Centers for Disease Control and Prevention, What is in E-cigarette Aerosol?, March 2019

- Humectant
- Flavoring
- Nicotine
- Toxicants
- Ultrafine particles
- Carcinogens
- Metallic nano-particles (from the coil/heating element)
- Other psychoactive ingredients (added by users)

Ahhh, and is it safer?.....

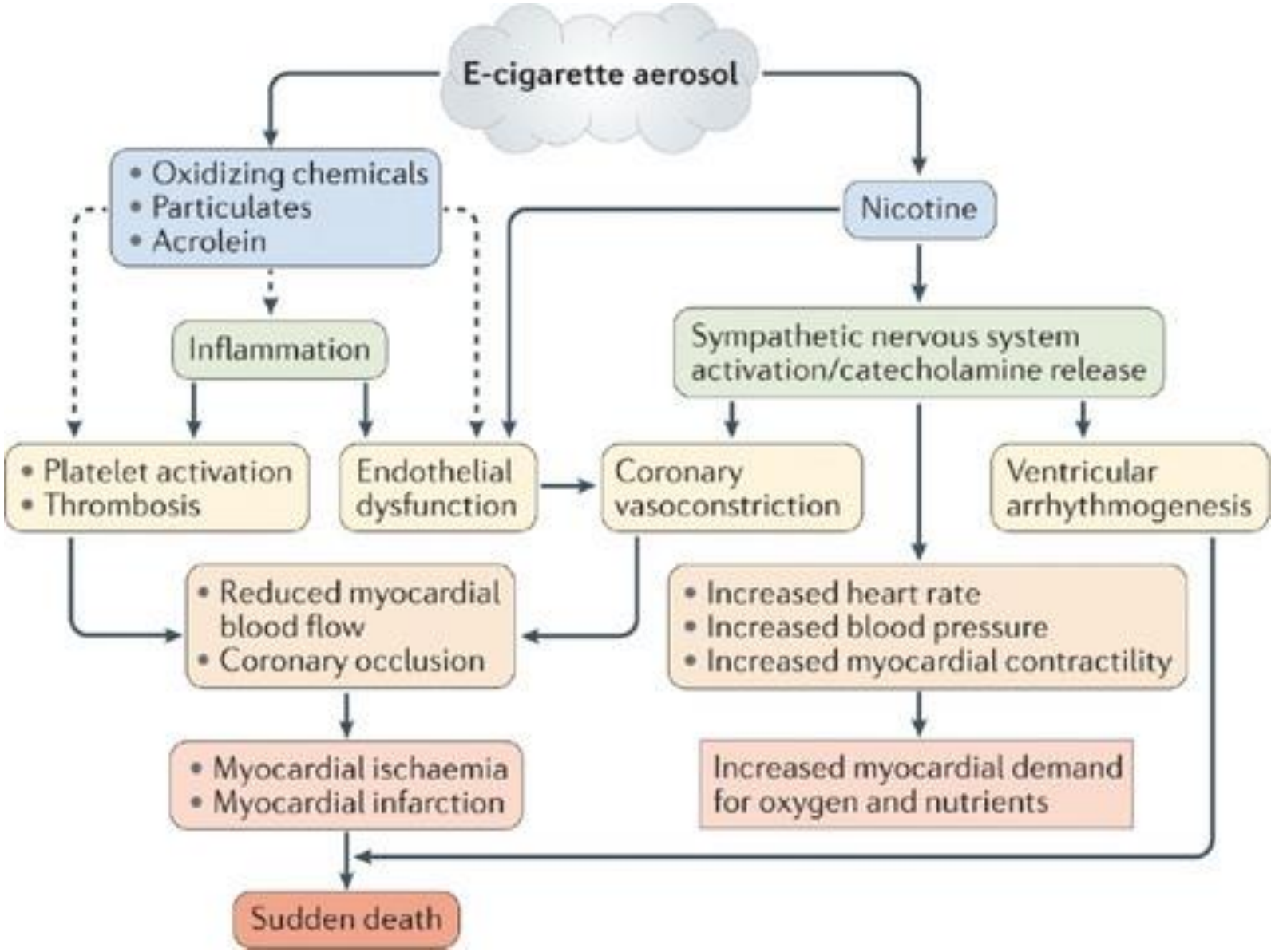
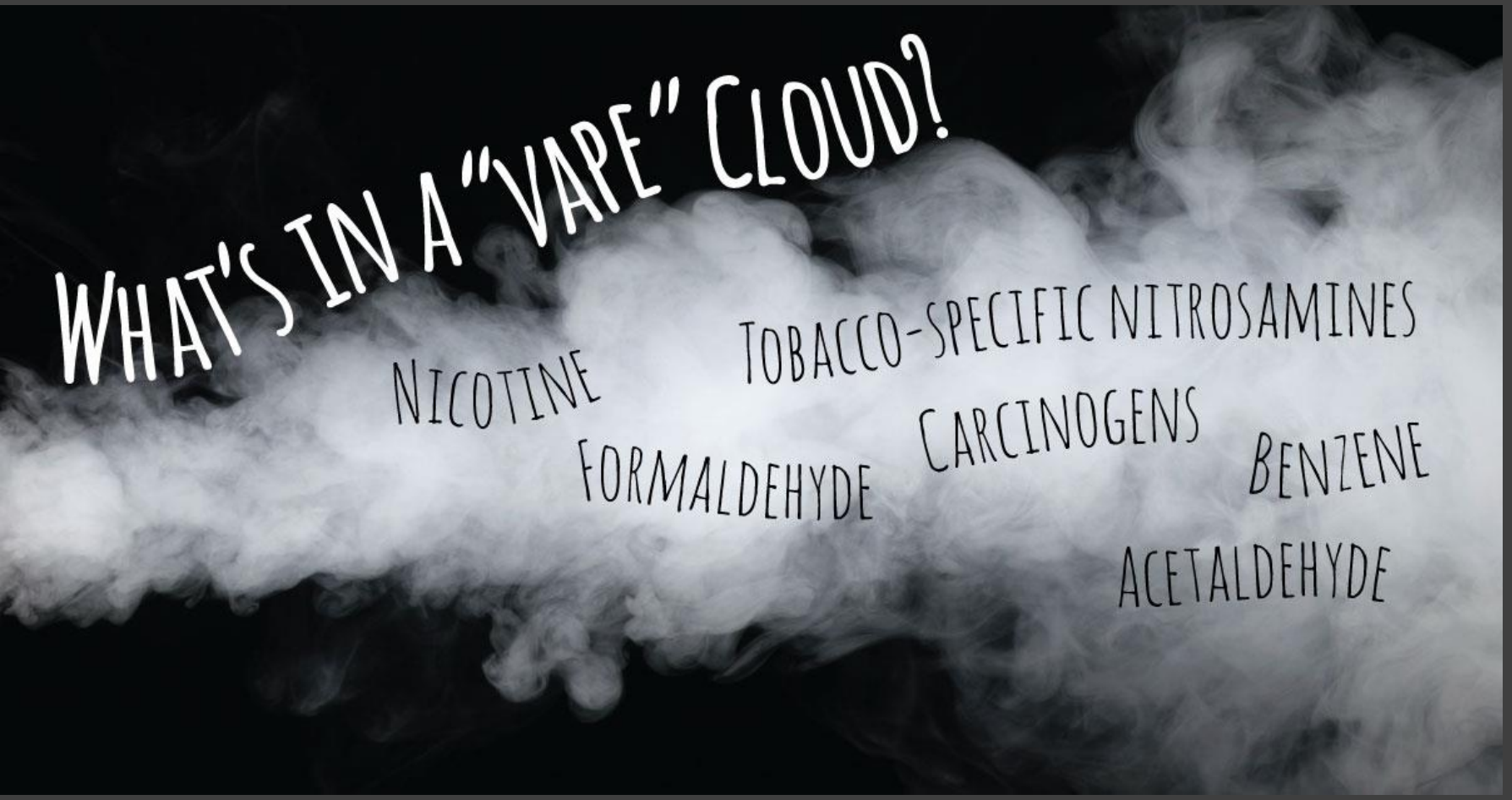


Image source: https://www.ahajournals.org/doi/10.1161/CIR.0000000000001160



Public concerns for nonusers

- Second and thirdhand aerosol exposure
- Poisoning risk of e-cigarette solution with nicotine
- Battery explosions with e -cigarette devices

Battery Explosions

E cigarette Vaping Associated Lung Injury

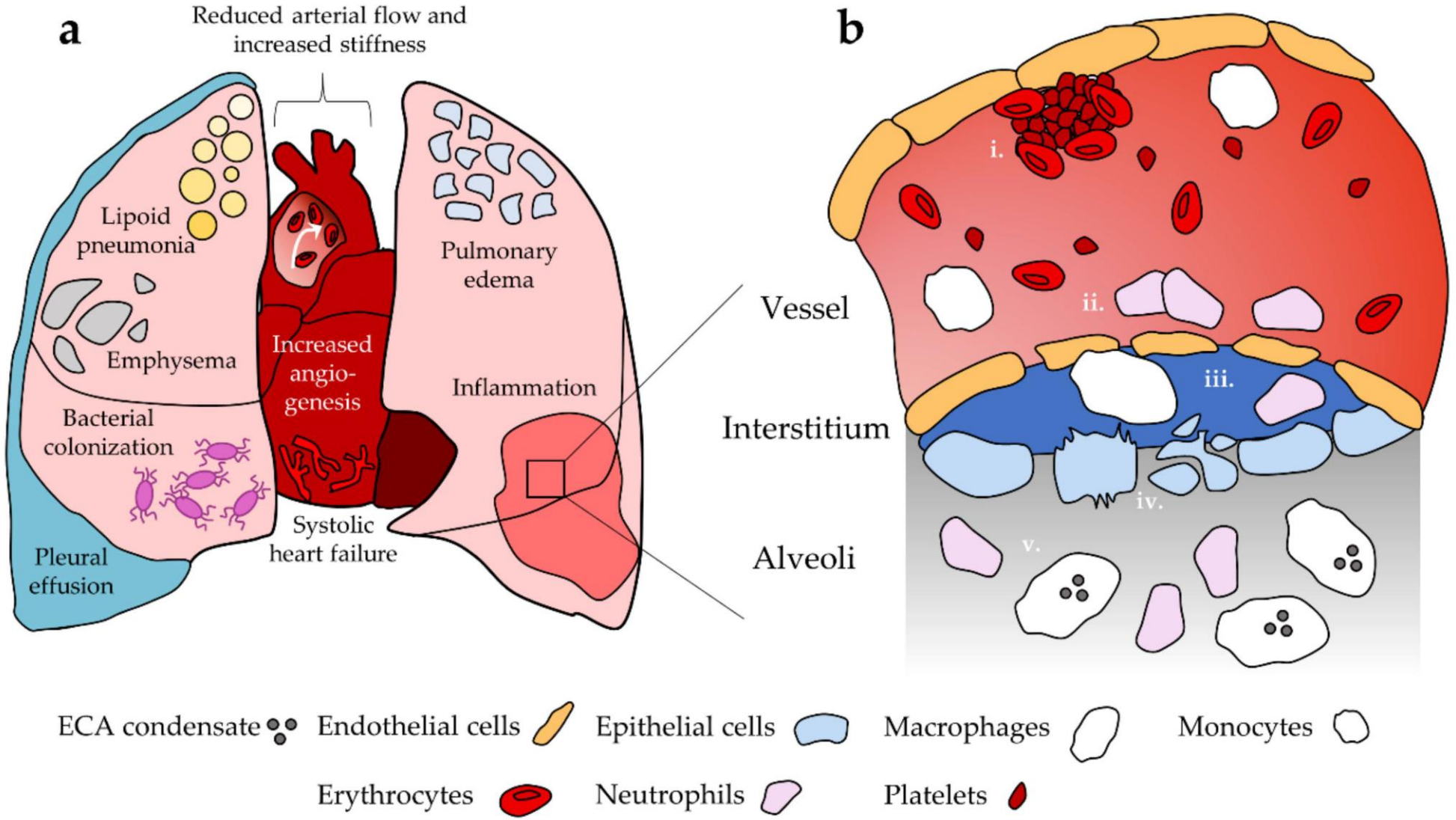
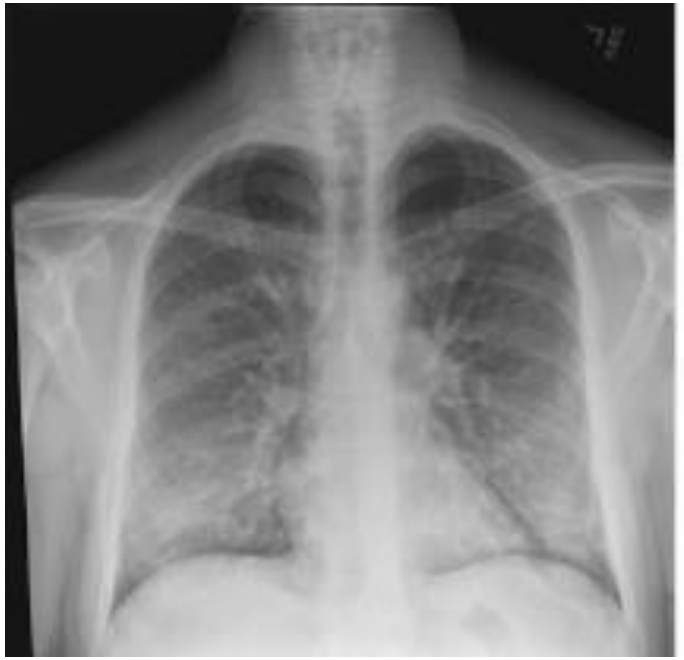


Image from International Journal of Molecular Sciences. 2021

E cigarette Vaping Associated Lung Injury

Epidemiology:

- Among the 2,668 hospitalized EVALI cases or deaths reported to CDC (**as of January 2020**):
- 66% were male.
- Median age was 24 years range: 13–85 years.
- By age group category:
- 15% of patients were under 18 years old;
- 37% of patients were 18 to 24 years old;
- 24% of patients were 25 to 34 years old; and
- 24% of patients were 35 years or older.
- 2 deaths in Kansas, 2 deaths in Missouri



History:

- Patterns of pneumonitis chronic or recurring
- Lipoid pneumonia
- Organizing pneumonia
- ARDS

Almost 80% reported using THC containing products from informal sources, family friends, dealers, online.

Image from: ACP hospitalist.org
American College of Physicians Hospitalist

E cigarette Vaping Associated Lung Injury

Symptoms and Clinical Features:

- Cough, shortness of breath, chest pain, fever, vomiting, abdominal pain, diarrhea, and fatigue.
- Bilateral Infiltrates on CXR.
- Absence of infection on evaluation.
- **Vaping use within last 90 days.**
- No other plausible cardiopulmonary explanation (dx by exclusion)

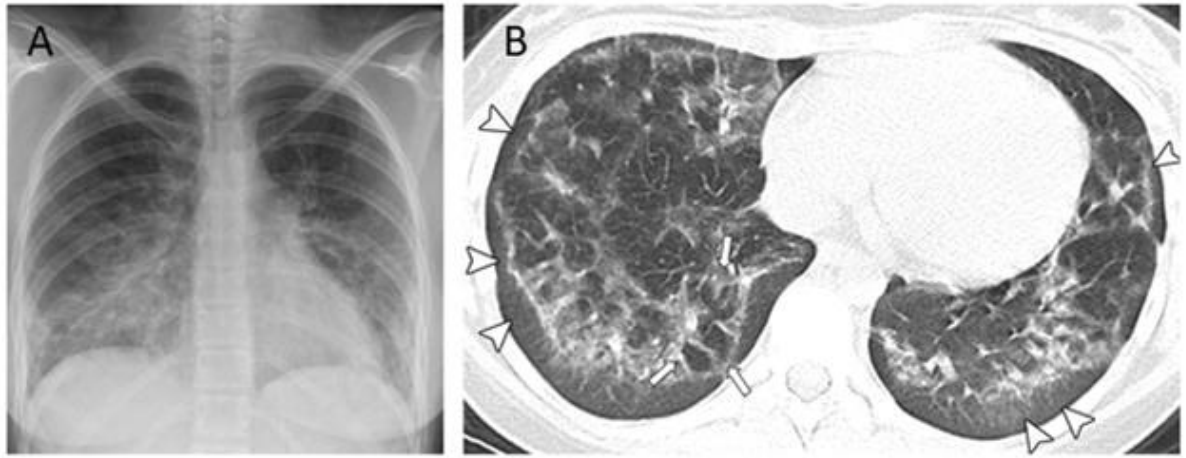
If you suspect EVALI?

- Obtain CXR.
- Consider Chest CT if worsening or suspicious findings on CXR.
- Consider Admission if oxygen saturations are less than 95% on room air or noted. respiratory distress.
- Consider antibiotics/steroids based clinical picture.
- Consider pulmonology consultation or transfer to a higher level of care.

CESSATION OF VAPING IS ESSENTIAL!!!

Image from: ACP hospitalist.org
American College of Physicians Hospitalist

Pediatric Chest Radiographic and CT Findings of Electronic Cigarette or Vaping Product Use–associated Lung Injury (EVALI)



Images in a 16-year-old with history of e-cigarette use for 1 year who presented with cough and weight loss for 3 weeks. *A,* Chest x-ray showed bilateral lower lobe opacities. *B,* Chest CT demonstrated bilateral ground-glass opacities with subpleural sparing (arrowheads) and reversed halo sign (atoll sign) (arrows) in right lower lobe.

- The imaging findings of EVALI in pediatric patients included bilateral (14 of 14, 100%) and symmetric (13 of 14, 93%) ground-glass opacities, often with consolidation (nine of 14, 64%) and lower lobe predominance (seven of 14, 50%).
- Subpleural sparing of pulmonary abnormalities at CT was frequently present (11 of 14, 79%).
- The reversed halo sign (atoll sign) was found at CT (five of 14, 36%) in pediatric patients with EVALI.

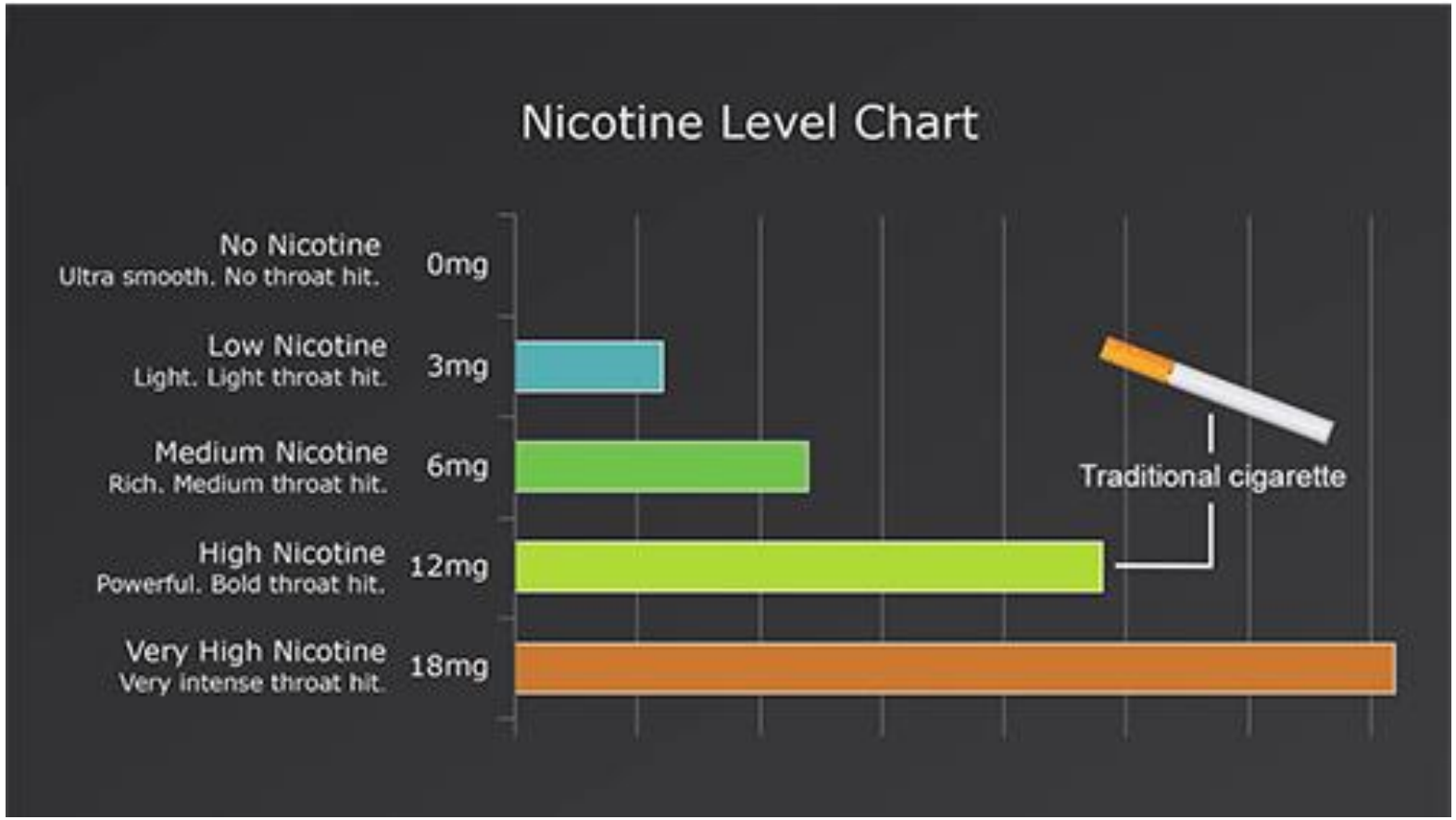
Artunduaga M et al. Published Online: March 3, 2020
https://doi.org/10.1148/radiol.2020192778

Radiology

Nicotine and addiction

- The adolescent brain is uniquely susceptible to nicotine addiction.
- Animal studies show that nicotine exposure has effects including:
- Brain cell damage including long term changes in synaptic function.
- Immediate and persistent behavior changes that leave the brain susceptible to subsequent re-addiction.

Nicotine Content: E-cigarette vs. Conventional

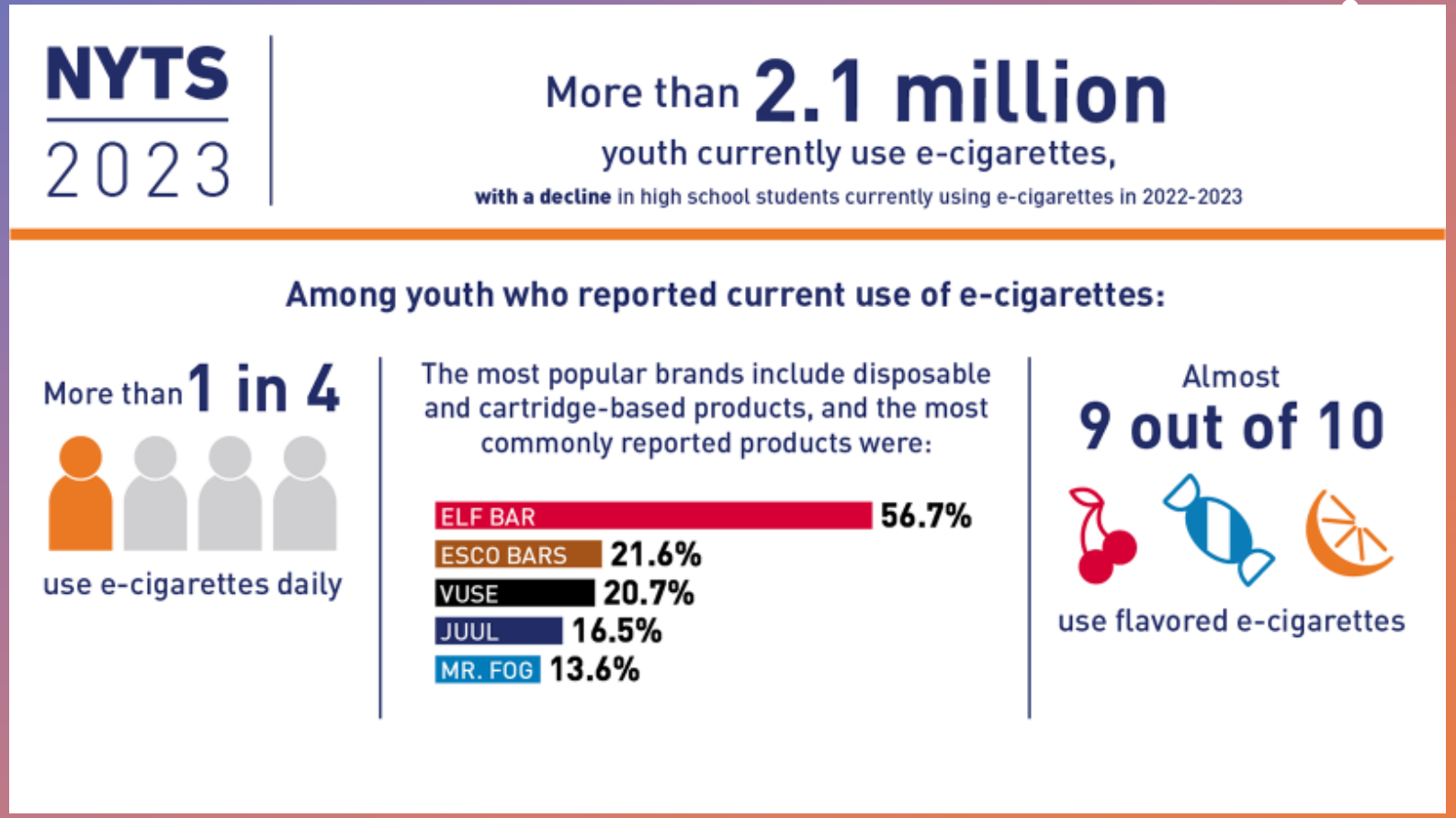


A single JUUL pod contains 59mg/ml of Nicotine, a pod contains 0.7ml

E cigarettes are recruiting teens to conventional cigarettes.

- Image Source: Centers for Disease Control and Prevention, Youth Tobacco Use Infographics
- Khouja JN, Peters SE et al. *Tobacco Control* March 2020

Vaping now a predominate form of Nicotine use in Teens



The most commonly used are actually not legal…

June of 2023: the U.S. Food and Drug Administration is announcing it has issued warning letters to 189 retailers for selling unauthorized tobacco products, specifically Elf Bar and Esco Bars products. Both brands are disposable e-cigarettes that come in flavors known to appeal to youth, including bubblegum and cotton candy.

Use associated with risk to use other substances

Image Source: Centers for Disease Control and Prevention, E-cigarette, Or Vaping, Products Visual Dictionary

Adolescents who used e- cigarettes were more likely to:

- Consume alcohol
- Use THC via various routes
- Use more than one substance while vaping
- Use other illicit drugs

Of youth e-cigarette user 2021 data who reported vaping cannabis in the last 30 days :

- 2.9% of 8th graders
- 8.4% of 10th graders,
- 12.4% of 12 graders

AAP policy statement E cigarette and similar devices public policy recommendations

The FDA should act immediately to regulate e-cigarettes and ban the sale of the products to people under 21.

Internet sales of e-cigarettes and e-cigarette solution should be banned.

Efforts should be made to reduce youth demand, by banning characterizing flavors, including menthol in e-cigarettes.

Advertising and promotion of e-cigarettes that are accessible to youth should be banned.

E-cigarettes should be incorporated into current tobacco-free laws and ordinances where children and adolescents live, learn, play, work and visit.

Pediatricians should screen for e-cigarette use, counsel about health effects and should not recommend e-cigarettes as a treatment option for tobacco cessation.

American Academy of Pediatrics

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"It took decades to raise awareness of the deadly effects of smoking and traditional tobacco use," Dr. Jenssen said. "Today, we know that e-cigarettes are dangerous for children and teens. We have a chance to protect this generation, but we need to act now."

https://www.healthychildren.org/English/news/Pages/E-Cigarettes-Need-Stronger-Regulations.aspx#:~:text=The%20AAP%20recommends%20that%3A&text=Internet%20sales%20of%20e%2Dcigarettes,to%20youth%20should%20be%20banned.

Resources:

FDA Vaping prevention and education resource center

American Academy of pediatrics

Truth Initiative nonprofit public health organization committed to making tobacco use and nicotine addiction a thing of the past. PDF education materials

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Published Date : 12/13/19, URL : https://stacks.cdc.gov/view/cdc/103783

Pediatric Chest Radiographic and CT Findings of Electronic Cigarette or Vaping Product Use–associated Lung Injury (EVALI)
Maddy Artunduaga, Devika Rao, Jonathan Friedman, Jeannie K. Kwon, Cory M. Pfeifer, Amy Dettori, Abbey J. Winant, and Edward Y. Lee
Radiology 2020 295:2, 430-438 .

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Image Source: Centers for Disease Control and Prevention, What is in E-cigarette Aerosol?, March 2019

Image Source: Centers for Disease Control and Prevention, E-cigarette, Or Vaping, Products Visual Dictionary March 2019


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