

# Teenage Smoking: Vaping (What You Need to Know)

COMMON PROBLEMS IN PEDIATRICS

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# Disclosure

- I have no relevant financial relationships to disclose.

# Objectives/Gaps & Desired Outcome

- At the conclusion of this activity, participants should be able to successfully:
  - Become familiar with electronic nicotine delivery systems (ENDS)
  - Learn the terminology associated with vaping
  - Understand the health and safety risks for teenagers associated with the use of (ENDS)
  - Screen for use of ENDS in the Primary Care Setting
  - Know the signs of E-cigarette or Vaping Associated Lung Injury (EVALI)
  - Discuss treatment of nicotine addiction from ENDS with patients

# What is vaping?

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The simple act of inhaling and exhaling vapor from an electronic cigarette or similar device

# History of Vaping

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- Vaping with stones (ancient Egypt) and shisha (thousands of years ago) in India
- **1927:** Joseph Robinson first came up with the idea of the contemporary “e-cigarette”
- **1963:** Herbert Gilbert made the “smokeless non-tobacco cigarette” popular
- **1970s-90s:** Scientists worked on deliverable e-cigarettes, but were faulty and never gained traction
- **2003:** Hon Lik made the first commercially successful modern e-cigarette (one motivator was that inventor’s father had died of lung cancer)

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- **Perceived benefit:** by bypassing combustion process, the risk of exposure to nicotine and other dangerous chemicals is minimized
  - E-cigarettes are currently falsely advertised as a way to help smokers quit, but this has not been proven and is not recommended by leading health organizations

# Electronic Nicotine Delivery Systems (ENDS)/e-Cigarettes

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## **Devices**

Small, battery powered

Have a “tank system”

Heat “e-liquid” into an inhalable steam/vapor

## **e-Liquids (“juice”)**

Variety of flavors

Varying nicotine levels (some nicotine-free)

# ENDS: Basic Parts

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**Battery:** disposable or rechargeable

**Coil/Atomizer:** the part that heats up/vaporizes the liquid

**Cartridge or container for liquid**



# How an electronic cigarette works

The electronic cigarette contains a battery that activates a heating device, atomizing liquid nicotine inside a cartridge and producing a vapor that is inhaled.



**Liquid  
nicotine  
cartridge**

**Inhaler**

**Atomizer/heating device**

**Lithium battery**

**Tip lights up**



Source: [allhookah.net](http://allhookah.net)

Tim Summers / The Detroit News

# “e” Ciga-likes

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Created to imitate the look and feel of a traditional cigarette

- Rechargeable, disposable battery
- Pre-filled disposable cartridges



# Other Vaporizer Devices

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Often have a rechargeable module combined with interchangeable e-liquid

- Vape Pens
- Box Mods
- Mechanical Mods (firing pin, no circuitry, not regulated)
- Newer: Juuls & Suorin Drops



# Juuls

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- Appealing to teens (16X more likely to use than older groups)
- Now over 70% of the e-cigarette market share
- 5-10% of 15-17 year olds have ever used a Juul
- Can “vape in class”
- One Juul pod has as much nicotine as 20 cigarettes! (per their website)



# Suorin Drops—the latest

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# “e” Liquids

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- The liquid that gets vaporized in the devices
- Also referred to as “e-juice” or “vape juice”
- Used to be in cartridge form only
- Now a separate industry
- Hundred of types

# “e” Liquids

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- Two ingredients that make up the vapor:
  - Vegetable Glycerin (VG)
  - Propylene Glycol (PG)—better at carrying flavor
- Other ingredients:
  - Varying degrees of nicotine (0-59+ mg/ml)
  - Flavoring
  - Other compounds



# “e” Liquids: Nicotine

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- Can be extracted in two ways:
  - Tobacco leaves
  - As a salt from the stems of tobacco plants
- Some companies use cheaper, imported tobacco that doesn't comply with United States pharmaceutical standards
- Up to 50% of the time labelled nicotine content is incorrect

# “e” Liquids: Flavoring

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- Fruit
- Dessert/sweet
- Mint
- Tobacco
- Nuts
- Spices
- Coffee/Tea
- Beverage
- Unflavored



# “e” Liquids: Flavoring

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- Flavoring has fueled popularity among teens
- Study found 81% of kids who have ever used tobacco products started with a flavored product
- A 2014 study identified more than 7,700 unique e-cigarette flavors
- Examples: gummy bear, cherry dynamite, wild berry, pink lemonade, “Surf Cake,” “I Love Cookies”
- As a side note, flavored cigars have resulted in increased use particularly among teenage boys

# “e” Liquids: The Other Stuff

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While vapor might be less hazardous than combustible cigarettes, can still find:

- Nitrosamines
- Formaldehyde
- Acetaldehyde
- Acrolein
- **Metals:** cadmium, nickel, lead, chromium, tin
- Toluene
- Propylene glycol
- Phenolic compounds
- Polycyclic aromatic hydrocarbons: Tobacco alkaloids: cotinine, myosmine, etc

# Dabbing

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- **Dabs:** Concentrated dose of cannabis
- Made by extracting THC and other cannabinoids using a solvent like butane or carbon dioxide
- Results in sticky oils commonly referred to
  - wax
  - shatter
  - budder
  - butane hash oil
- More than  $\frac{1}{4}$  of e-cigarette users say they also vape marijuana



# Dripping

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- Manual application of a few drops of vape liquid directly to the exposed heating coil
  - Thicker clouds of vapor
  - Stronger sensation in the throat
  - Makes flavors taste better
  - More conveniently change from one liquid flavor to another without wasting liquid



# Dripping

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- Greater temperatures make for higher emissions of chemical substances, including higher concentration of nicotine
- Greater incidence of skin contact
- Among 1080 teen e-cigarette users, 26.1% reported ever using e-cigarettes for dripping (Krishnan-Sarin et al, 2017)

# Use in Teenagers

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- E-cigarette has increased greatly among teenagers in the last several years
- Now the most common tobacco product used by teens
- From 2011 to 2018, current use of e-cigarettes among high school students increased more than thirteen-fold – from 1.5 percent to 20.1 percent – according to the National Youth Tobacco Survey



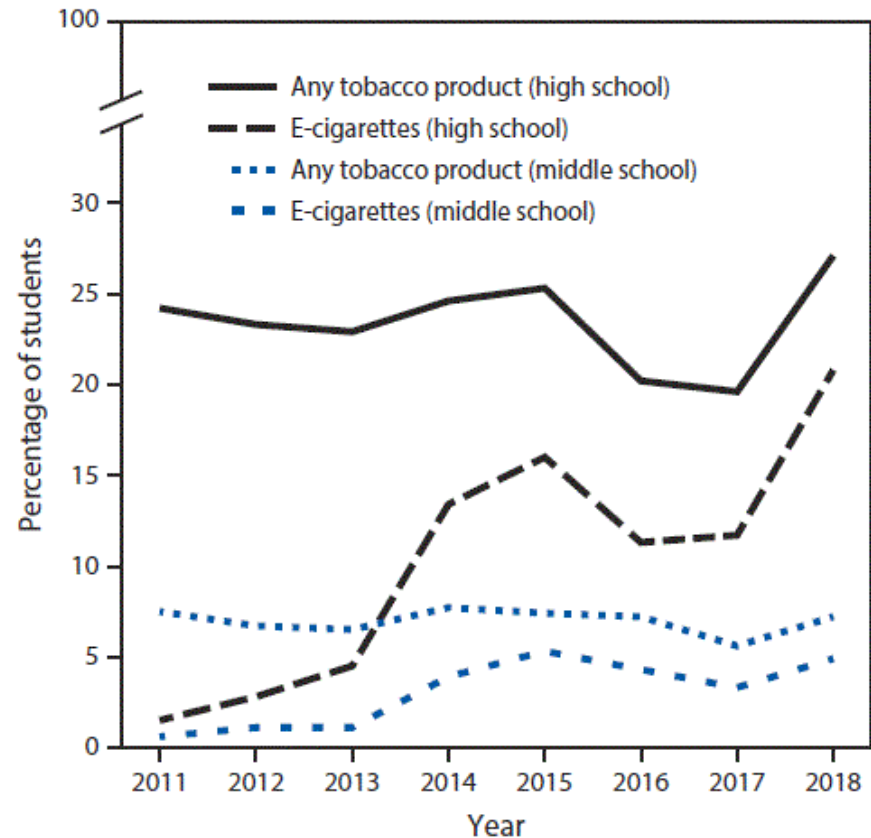
# Percentage of U.S. middle/high school students who report using tobacco products in past 30 days 2011–2018

E-cigs (HS)

38.3% increase from  
2017 to 2018

1.5% to 20.1% from  
2011 to 2018

7.2% of middle  
schoolers report  
tobacco use

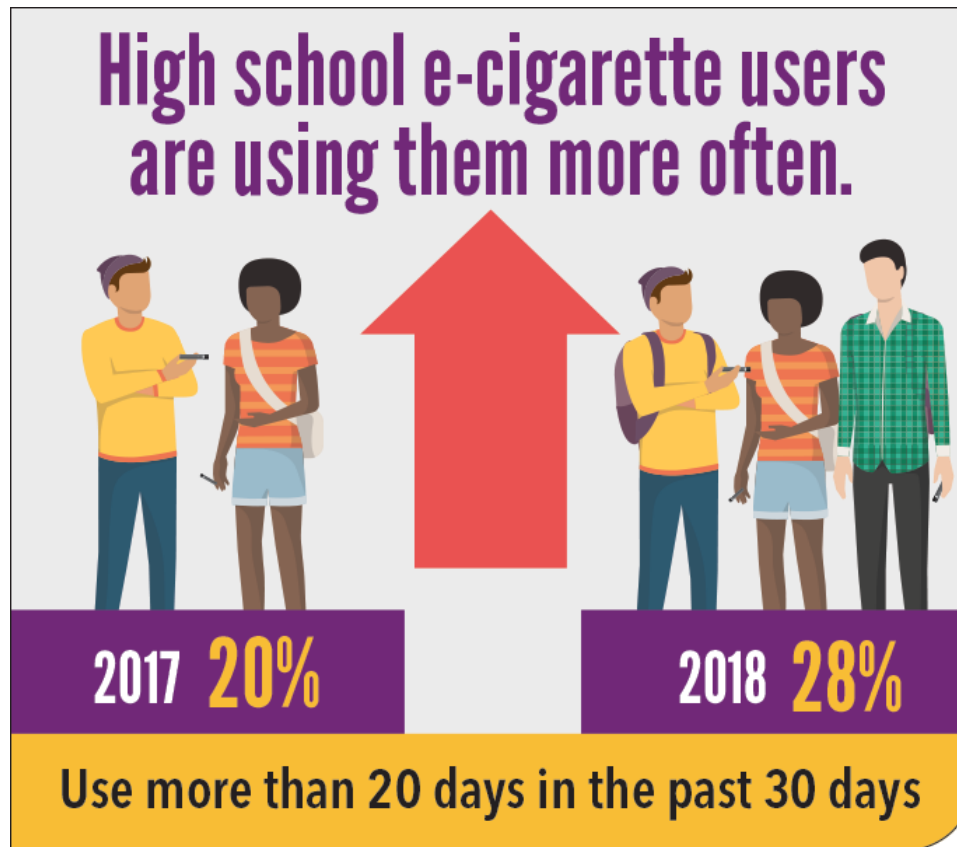


Source: Cullen KA, et al.  
MMWR Morb Mortal Wkly Rep  
2018;67:1276–1277.

# Frequent Use

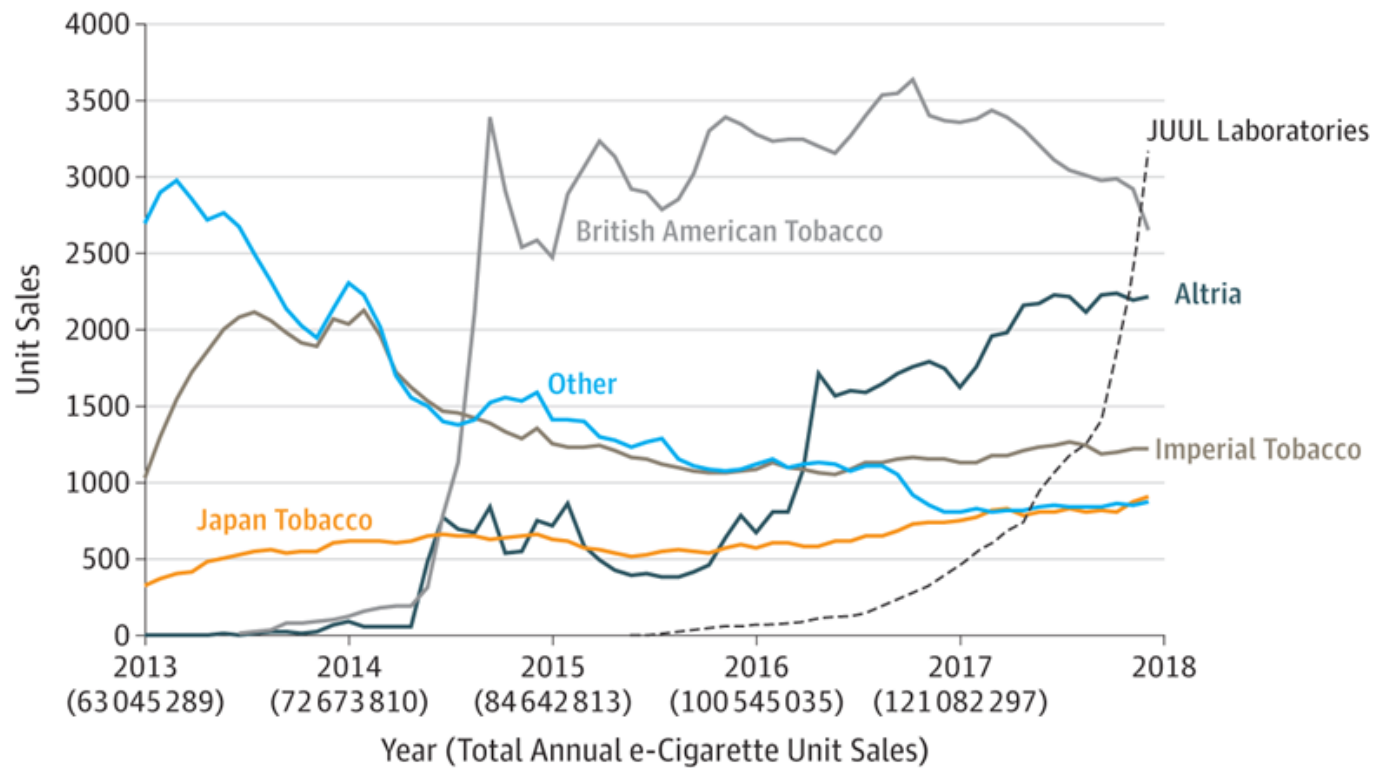
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Source:  
<https://stacks.cdc.gov/view/cdc/75892>



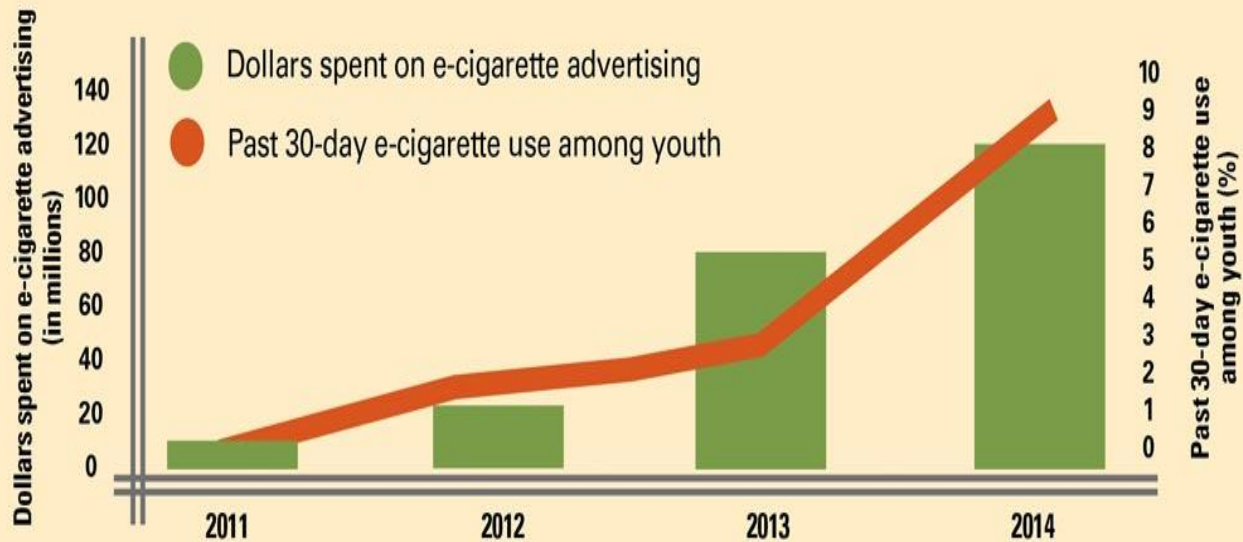
# Sales

**A** Unit sales



# Marketing

## E-cigarette use among youth is rising as e-cigarette advertising grows



SOURCE: National Youth Tobacco Survey, 2011-2014; Kim et al (2014), Truth Initiative (2015).

# Marketing

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In 2016, 7 in 10 teens were exposed to ENDS advertising



# Marketing

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# Risks: Use of other substances

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- Teens are more likely to use combustible cigarettes
  - 2013-15 survey >800 teens - teens who initiating vaping were 7x more likely to be smoking cigarettes 2 yrs later than those not vaping
  - E-cig use independently increases risk of subsequent cigarette smoking 3.5 times
  - E-cigarette use strongly associated with use of alcohol, marijuana, and other drugs (Curran, 2018; Dai, 2018; Klein, 2018)



# Risks—Nicotine Addiction

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- Nicotine takes 10-15 seconds to reach the brain – Effects last approximately 30 minutes
- Adrenal glands release epinephrine, increases BP and HR
- Activates receptors that increase dopamine, serotonin and glutamate, leading to pleasure center activation
- Highly addictive: More than alcohol and cannabis, similar to cocaine
- Nicotine salts: may deliver at higher concentrations without throat irritation

# Risks: Nicotine & the Teen Brain

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- Nicotine from any method is unsafe during adolescence
- Because of stage of brain development, there is an increased risk of dependence
- Developmentally primed to seek big rewards
- Nicotine activates the reward pathway
- ENDS can deliver higher levels of nicotine than traditional cigarettes (in one study, 63% of JUUL users did not know the product always contains nicotine)

# Risks—Nicotine Poisoning

## “Nic Sick”

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### **Early**

- Vomiting
- Tachycardia
- Jittery and unsteady appearance
- Difficulty breathing
- Increased saliva
- Sweating
- Seizures
- Tremor

### **Late** (30minutes-4hours)

- Hypotension
- Bradycardia
- Lethargy
- Respiratory failure

# Risks—Nicotine Withdrawal

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- Headaches
- Anxiety
- Irritability
- Difficulty concentrating
- Restlessness
- Hunger
- Tremors
- Sweating
- Dizziness

# Risks: Toxins

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- Health effects not completely understood
- Toxic and irritating compounds have been found in ENDS vapor, compared:
  - Tobacco-specific nitrosamines
  - Heavy metals (nickel, lead, tin)
  - Ultrafine particles
- Study (Rubinstein, 2018) tested urine of teenagers (dual users, e-cigs only, none)
  - acrylonitrile, acrolein, propylene oxide, acrylamide, and crotonaldehyde
  - Dual >>> e-cigs only >>> none

# Risks: Burns

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- **Burns** (battery explosions): 2,035 explosion and burn injuries from ENDS seen in U.S. Emergency Departments from 2015-2017
  - **Front pocket**
  - **Face**



# Risks: Exposure

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- Nicotine contained in cartridges can be poisonous within a matter of minutes if spilled on skin
- $\frac{1}{2}$  to 2 teaspoons of liquid nicotine can be fatal for a child
- From 2012-2017, there were 8,269 liquid nicotine exposures reported in children <6 years old
- Emerging evidence about dangers of second hand vape exposure

# Risks: EVALI

## Background and History

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- E-cigarette or Vaping-Associated Lung Injury (EVALI)
- First reported in June 2019, peaked in September, declining since
- As of October 2019: CDC reported 2,000 cases, 39 deaths in US
- Possibly from a Vitamin E acetate additive
- Ask about the use of e-cigarette, or vaping, products in teenagers with:
  - Respiratory symptoms (95%)
  - Gastrointestinal symptoms (77%)
  - Fever, chills, weight loss (85%)
- If confirmed, ask about types of substances used, where they were obtained (more commonly THC and off-label), and delivery system



# EVALI:

## Physical Exam/Workup

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- Vitals including pulse ox
- Lung exam (may be clear)
- A chest radiograph (CXR) should be considered on patients with a history of ENDS use:
  - who have respiratory or gastrointestinal symptoms, particularly with:
  - chest pain, dyspnea, or decreased oxygen saturation (<95% on room air)
- Strongly consider VRP/flu testing, particularly in flu season
- Consider CBC, CMP, ESR, and CRP (about 90% of patients have leukocytosis with neutrophil predominance and elevated serum inflammatory markers and 50% have mildly elevated serum transaminases)

# EVALI: Diagnosis

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- A diagnosis of exclusion: lung injury associated with vaping/e-cigarette/Juul use
- CDC case definition:
  - Using an e-cigarette/vaping/etc. within 90 days prior to symptom onset
  - AND pulmonary infiltrate, such as opacities on CXR or ground-glass opacities on chest-CT
  - AND absence of pulmonary infection on initial work-up (neg VRP, influenza PCR/rapid, other ID testing)
  - AND no evidence of other medically plausible alternative diagnoses

# Risks: Misc

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- Bacterial and Fungal Contamination
- Oral candidiasis
- “Vaper’s cough”
- Oral sores

# Regulation

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- The U.S. Preventive Services Task Force concluded that the current evidence is insufficient to recommend ENDS for smoking cessation
- 2016, U.S. Surgeon General reported:
  - Youth use of ENDS products is a public health concern
  - Youth use of e-cigarettes is associated with the use of other tobacco products
  - Youth use of nicotine in any form, including ENDS, is unsafe
  - Secondhand exposure to ENDS aerosol contains nicotine and other harmful constituents

# Regulation

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- 2016 Child Nicotine Poisoning Prevention Act
  - Requires child-proof packaging
- In 2016, the (FDA) expanded its regulatory authority to include the manufacture, import, packaging, labeling, advertising, promotion, sale, and distribution of ***all*** tobacco products, including ENDS.
  - Requires health warnings on ENDS and other tobacco products
  - Prohibits the sales of ENDS to youth under the age of 18
  - Bans free samples and prohibits the sale of ENDS in vending machines
  - Requires that ENDS manufacturers receive marketing authorization from the FDA
  - Requires vape shops that mix e-liquids to comply with legal requirements for tobacco manufacturers

# What can we do?

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## **Nice framework:**

**A**sk about use (nonjudgmental)

**\*A**ssess readiness to quit

**A**dvice to quit

**A**ssist in quit attempt

**A**rrange follow-up

# Screening

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- Substance Use Validated Screening tool
- Include e-cigarette terminology:
  - E-cigs
  - Juuls
  - Mods
  - Dabbing

Can't just ask: "Do you smoke?" ("Do you vape?" "Do you use e-cigarettes?" "Do you Juul?")

- LGBTQ youth at higher risk
- Don't forget the middle schoolers!

# Motivational Interviewing

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- Counseling method informed by level of readiness
- Assisting patients to resolve ambivalence
- Aims to elicit the patient's own reasons for change and advantages favoring change
- Use:
  - Open-ended questions
  - Affirmations
  - Reflective listening
  - Summarizing



# For users: Ask Non-Judgmental Questions

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- Do they realize there is nicotine in over 99% of vaping products?
- Do they know about the other harmful chemicals?
- What do *they* see as potential negative consequences?
- Why did they start vaping?
- What would be hard about stopping?

# Give Information

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- Let them know it's not just flavored “water vapor”
- Remind them that brains continue developing until mid-20s
- Discuss the addictive potential
- Let them know that scientists are still in the process of learning about all of the potential health risks
- Counsel about known risks (keep focused on more immediate, rather than long term): burns, poisonings, mouth sores
- Explain that they are the targets of advertising, **highlight \$\$\$\$**

# From the Teens

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- Show respect (don't judge if they use)
- Warn them about “nic sick” and possible long term damage
- Tell them about burns
- Discuss how it is a waste of money

# If They're Ready to Quit

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- Recommend FDA approved cessation products (nicotine replacement therapy, Wellbutrin, Chantix)
- Give them quit line #: 1800 QUIT NOW or text QUIT to 47848
- My Life My Quit: an online resource designed for adolescents by National Jewish Health
- Truth Initiative: text-messaging quit program designed for adolescents
- Remind them insurance often covers medications and quit programs

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