E-Cigarettes 101
LEARNING OBJECTIVES

At the end of this session, participants will be able to:

• Understand the epidemiology of youth e-cigarette use
• Utilize the terminology related to e-cigarettes
• Discuss the types of e-cigarettes
• Describe the components of e-cigarettes and e-cigarette liquid
E-Cigarette Use Among Youth: A Public Health Crisis
“E-cigarette use among youth has skyrocketed ... at a rate of epidemic proportions”\(^1\)
E-Cigarette use is Common

CDC National Youth Tobacco Survey:²,³,⁴

• E-cigarettes are the MOST POPULAR tobacco product used by adolescents.

• Rates of use increased by 78% from 2017-2018.

• In 2019, rates jumped to their highest levels to date, with 27.5% of high school students reporting that they had used e-cigarettes in the past month.

• In 2020 rates declined to 19.6% among high school students reporting that they had used e-cigarettes in the past month.
CURRENT TOBACCO USE AMONG U.S. MIDDLE SCHOOL STUDENTS²,4,5,6

Note: Dashed lines represent change in survey administration

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CURRENT TOBACCO USE AMONG U.S. HIGH SCHOOL STUDENTS

Any tobacco: 23.6%  19.6%  E-cigarette

Cigar: 5.0%
Cigarette: 4.6%
Smokeless: 3.1%
Hookah: 2.7%
Pipe: 0.7%

Note: Dashed lines represent change in survey administration

Slide adapted with permission from Centers for Disease Control and Prevention
## 2020 E-Cigarette Use Trends

CDC 2020 National Youth Tobacco Survey:⁴

<table>
<thead>
<tr>
<th></th>
<th>High School Students n=10,097</th>
<th>Middle School Students n=8,837</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current e-cigarette users</td>
<td>19.6%</td>
<td>4.7%</td>
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<tr>
<td>Among the current e-cigarette users:</td>
<td></td>
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<tr>
<td>Frequent e-cigarette users</td>
<td>38.9%</td>
<td>20%</td>
</tr>
<tr>
<td>Used pod-based e-cigarettes</td>
<td>48.5%</td>
<td>41.9%</td>
</tr>
<tr>
<td>Used disposables</td>
<td>26.5%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Used flavored e-cigarettes*</td>
<td>84.7%</td>
<td>73.9%</td>
</tr>
</tbody>
</table>

*most common flavors were fruit, mint/menthol, and candy/dessert/sweet
“Tobacco use among youth and young adults in any form, including e-cigarettes, is not safe”
ALTERNATIVE FORMS OF E-CIGARETTE USE

Dripping
- Placing e-liquid directly onto the heated coil of an e-cigarette and inhaling the vapor
- Recent study: 26% of teens have tried dripping
- May increase amount of nicotine and toxic chemicals

Dabbing
- Vaping e-liquid or e-wax, which may contain THC

Vaping Marijuana (THC)
- 2019 Monitoring the Future: 14% of seniors reported vaping marijuana in the past month
  - This is the second largest one-year jump for any substance in the 45-year survey history, behind past month nicotine vaping between 2017-2018
E-cigarettes are increasingly common in high school and college campuses. Educators report youth e-cigarette use in classrooms, hallways and restrooms, and are sharing devices with peers. Sharing behavior encourages new users to try e-cigarettes and enables students who are too young to purchase these products or who could not otherwise afford them, to access them through peers. This increase in use occurred prior to e-cigarette research and regulation, resulting in a critical “catch-up” period for health care professionals, educators, and regulators.
What is an E-Cigarette?
Types of E-Cigarettes

Cig-a-Likes * Vape Pens * Mods * Advanced Personal Vaporizers * E-cigars/Pipes * Pod Systems

Image source: J. Gorzkowski (Personal photo). Used with permission.
Types of E-Cigarettes

Image source: Centers for Disease Control and Prevention, What are E-cigarettes?, March 2019
First Generation “Cigalikes”

Earliest form of e-cigarettes

Designed to look like a traditional cigarette

Disposable or rechargeable forms

Manual or automatic heating elements

Examples: Blu, Logic, Vuse, Mark 10

Image source: J. Gorzkowski (Personal photo). Used with permission.
SECOND GENERATION

- Generally larger in size with a reservoir to hold the solution (ie, e-liquid)
- Manual heating button
- Vape devices and vape pens
- Tank systems

Image source: J. Gorzkowski (Personal photo). Used with permission.
Third Generation

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

Image source: J. Gorzkowski (Personal photo). Used with permission.
FOURTH GENERATION

- Greatest departure from traditional cigarette
- Diverse products often difficult to recognize as an e-cigarette
  - Example: JUUL, Suorin, Phix, Stig, Smok
- Newer products are disposable (eg Puff Bars) and exempted from new flavor bans

Image adapted with permission from Tobaccoprevention toolkit.Stanford.edu
A Closer Look: JUUL and Other Pod-Based Systems

Pod-based Systems:
- Salt-based nicotine
- 41 mg of nicotine
- Pods not made to be refilled
- Can be disposable

Mods:
- Freebased nicotine
- 25 mg of nicotine
- Refillable tank
- Modifiable

Images source: J. Gorzkowski (Personal photo). Used with permission.

Slide adapted with permission from Tobaccopreventiontoolkit.Stanford.edu
NICOTINE SALTS

• Designed to deliver more nicotine and with less throat irritation, compared to closed system devices\textsuperscript{10}
• Contribute to more frequent use, increasing potential for addiction
• All salt-based e-juice and liquid contains nicotine (ie, JUUL, Puff Bars)

Image source: "Nicotine 3D Model" by Unknown Author is licensed under CC BY 2.0.
Nicotine salts allow high levels of nicotine to be inhaled more easily.
YOUTH USE OF POD-BASED SYSTEMS

Click on the image for full video

Image source: Truth Initiative, Is JUUL getting a new generation addicted to nicotine? November 2018
E-Cigarettes are Sold Everywhere

- Vape shops
- Convenience stores
- Gas stations
- Retail outlets
- Mall kiosks
- Grocery stores
- Internet vendors

Image source: S. Walley (personal photo). Used with permission.
AAP Policy Priorities related to e-cigarettes:

- Reduce youth access:
  - Regulate e-cigarettes like traditional cigarettes
  - Ban the sale of e-cigarettes to youth under age 21
  - Ban internet sales of e-cigarettes/e-liquid

- Reduce youth demand:
  - Ban all characterizing flavors, including menthol
  - Ban all e-cigarette product advertising/promotion in places where youth can see it
  - Tax e-cigarettes at comparable rates to conventional cigarettes

- Incorporate e-cigarettes into current tobacco-free laws and ordinances where children and adolescents spend time
What’s in an E-Cigarette?
HOW DOES AN E-CIGARETTE WORK?

• Battery-operated heating element
• When the user inhales, the heating element heats the “e-liquid” to produce an aerosol
• The user inhales the aerosol into their lungs
• Bystanders can also inhale the aerosol as the user exhales

Images source: J. Gorzkowski (Personal graphic). Used with permission
What’s in E-Cigarette Aerosol?

- Nicotine
- Carcinogens
- Ultrafine particles
- Heavy metals
- Flavoring elements

Image source: Centers for Disease Control and Prevention, *What is in E-cigarette Aerosol?*, March 2019
What’s in e-liquid?¹¹

- **Nicotine** (0-59+ mg/ml)
- **Propylene Glycol**
- **Vegetable Glycerin**
- **Flavoring**
- **Other compounds**

Image source: S. Tanski (personal photo). Used with permission.
**FLAVORING**

**Flavor categories**
- Fruit, dessert/sweet
- Tobacco
- Menthol/mint
- Alcohol
- Nuts/spices
- Coffee/tea
- Beverage
- Unflavored

Image source: S. Tanski (personal photo). Used with permission.
KEY POINTS

• E-Cigarettes use a battery-powered heating element to aerosolize an e-liquid containing nicotine and other constituents
• E-cigarette use by adolescents has risen to epidemic levels and continues to rise
• There are four “generations” of e-cigarettes with distinct characteristics
  – The 4th generation pod-products are the most popular and have the highest levels of nicotine
• In addition to nicotine, e-cigarette aerosol contains known toxins
• Flavors are especially attractive to adolescents
• Current proposed regulations will not adequately limit adolescent access to flavored e-cigarettes
REFERENCES

1. US Department of Health and Human Services. Surgeon General Releases Advisory on E-cigarette Epidemic Among Youth. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2018


