

# E-CIGARETTES 101: What, Who, Why, and What It Means for Your Patients' Health

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Kansas Department of Health Webinar • December 3, 2020



Centers for Disease Control and Prevention

National Center for Chronic Disease Prevention and Health Promotion

Office on Smoking and Health

The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



# TODAY'S ROADMAP

1

What are e-cigarettes?



2

Who is using them?



3

Implications:  
Health & Public Health



4

Actions to Take



# WHAT ARE E-CIGARETTES?

1

What are e-cigarettes?



2

Who is using them?



3

Implications:  
Health & Public Health

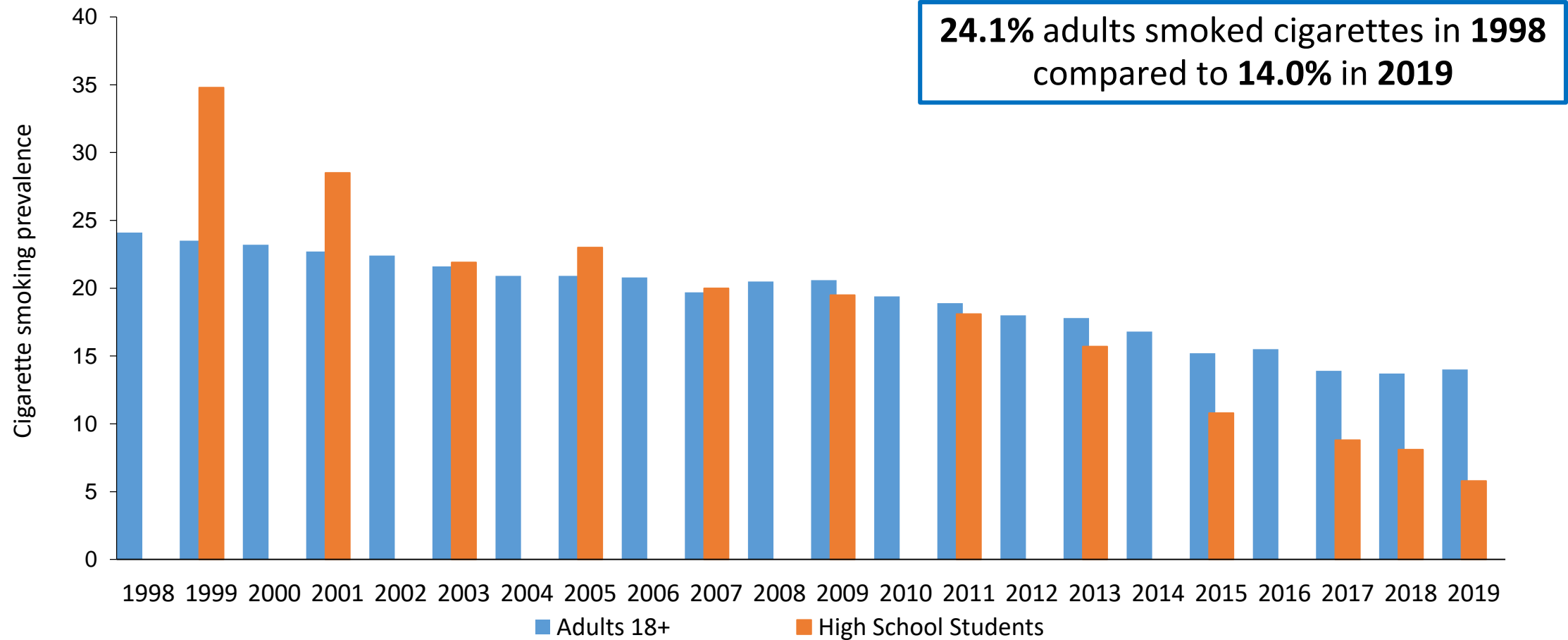


4

Actions to Take



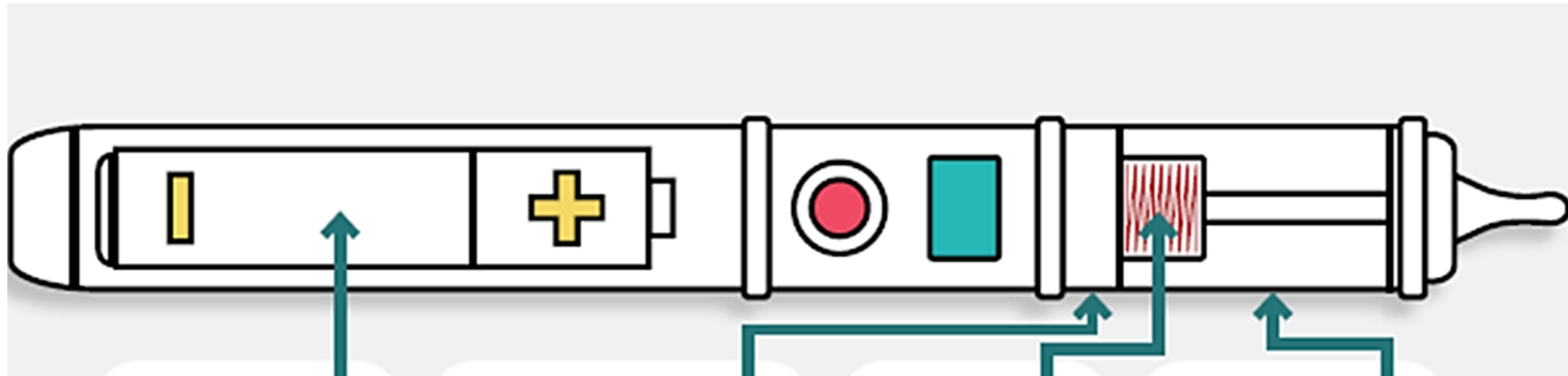
# GOOD NEWS: CIGARETTE SMOKING IS DOWN



# BAD NEWS: THE TOBACCO PRODUCT LANDSCAPE IS EVOLVING



# THE ANATOMY OF AN E-CIGARETTE



## THE BATTERY

It is a rechargeable lithium ion battery, which provides enough current to heat the atomizer to 400 degrees Fahrenheit in seconds.

## THE SENSORS

E-cigarettes without a power button will turn on when the user inhales through it. E-cigarettes with or without a power button require sensors to turn on.

## THE ATOMIZER

It is a coil that is a heating element which helps convert e-liquid to tiny airborne droplets (aerosol).

## THE CARTRIDGE

This holds the e-liquid (substance). It comes prefilled or refillable. It is usually combined with an atomizer as one unit.

# THE EVOLUTION OF E-CIGARETTES



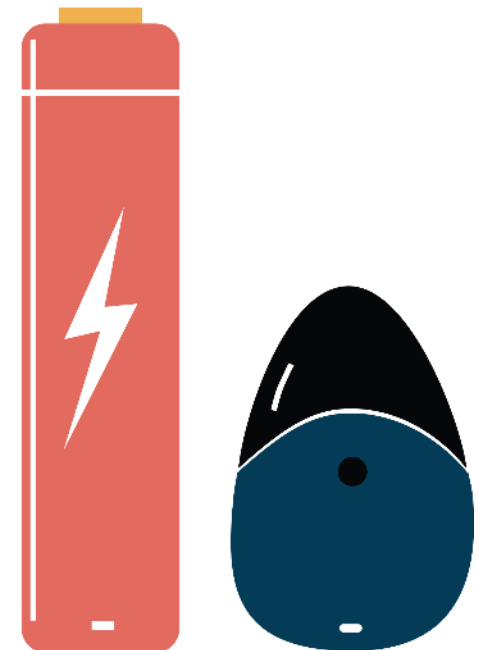
1st Gen



2nd Gen

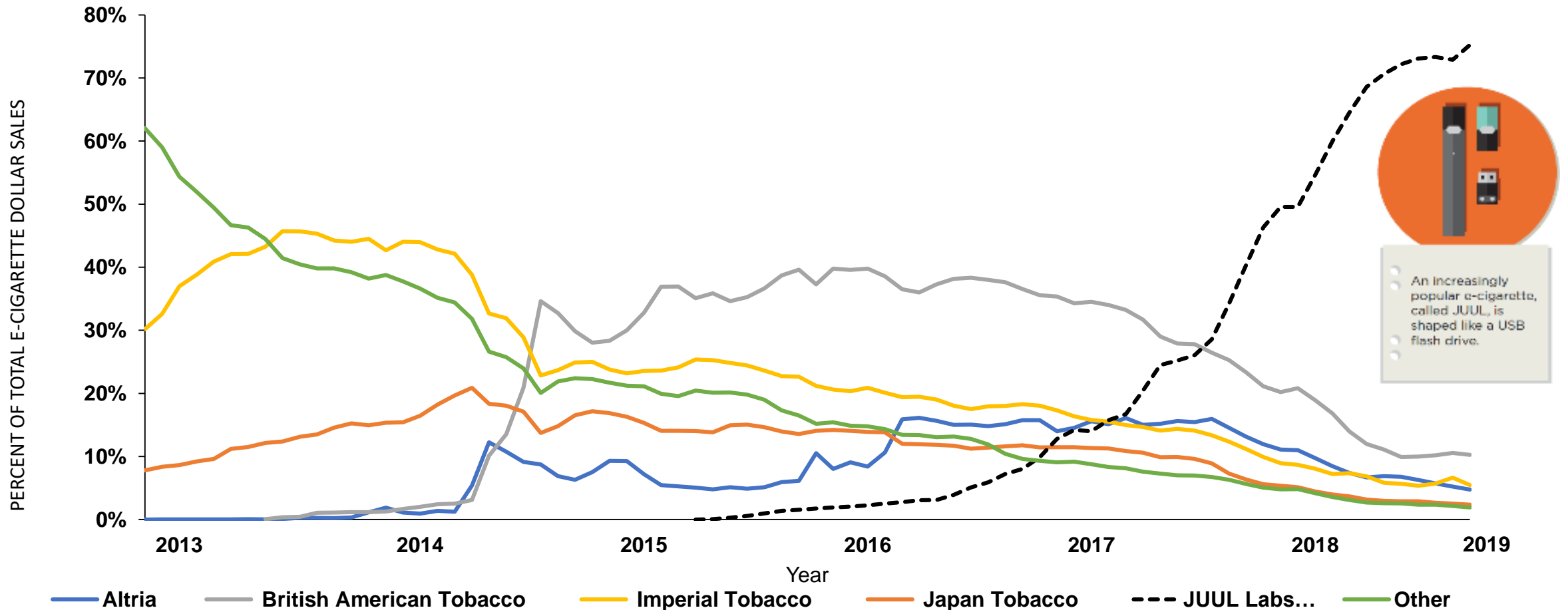


3rd Gen



4th Gen

# E-CIGARETTE MARKET SHARE, BY DOLLAR SALES, U.S., 2013–2018





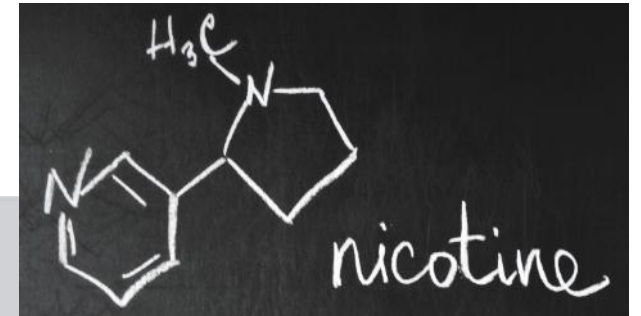
# MOST E-CIGARETTES SOLD CONTAIN NICOTINE

Percentage of products that contained nicotine

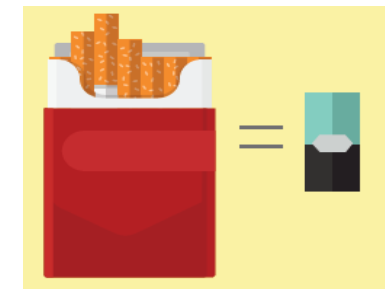
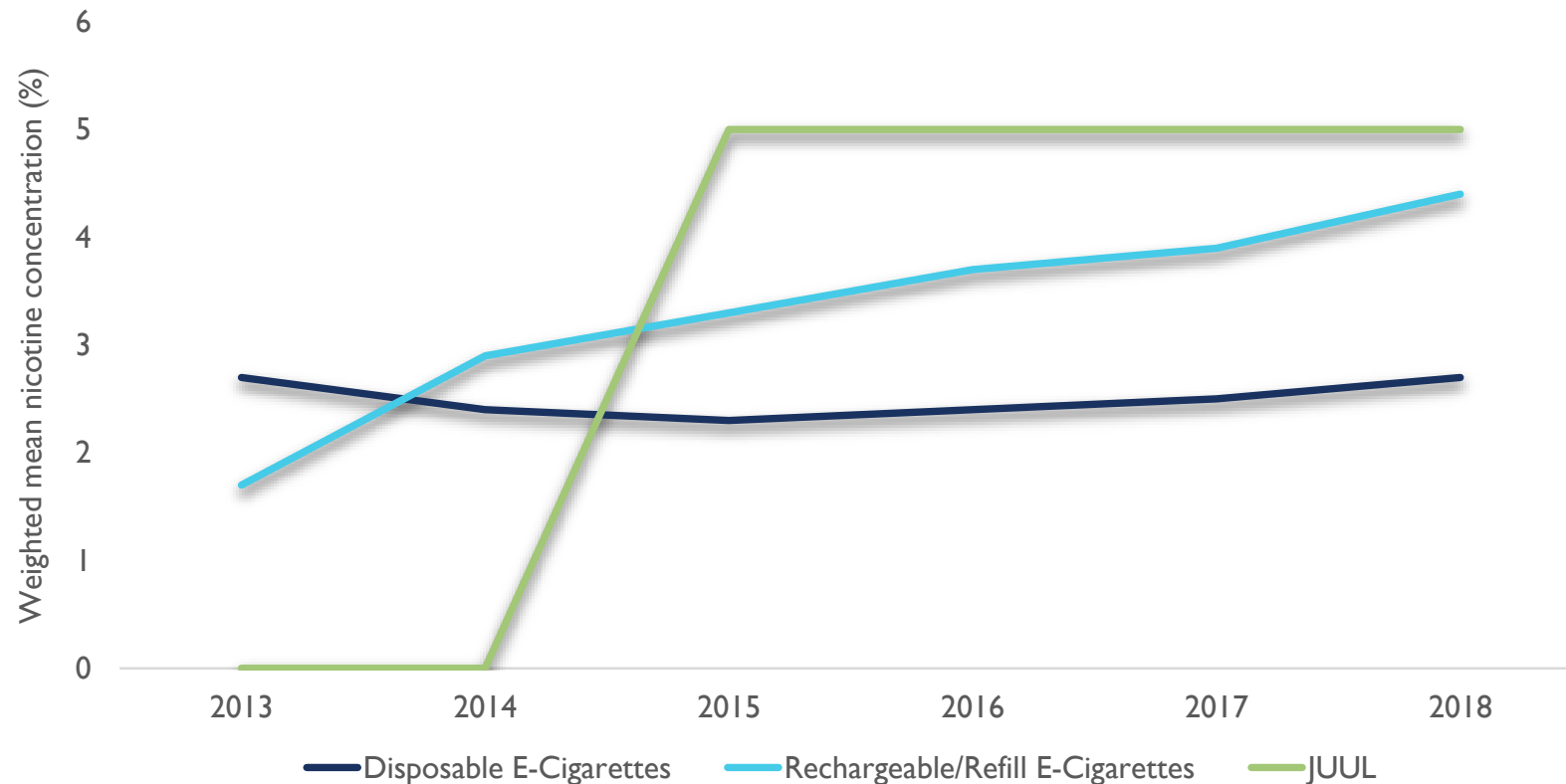
- 99.6% of disposable e-cigarette sales
- 100% of rechargeable sales
- 99.5% of refill sales

Percentage that contained nicotine by product type

- 99.6% of all e-cigarette products sold
- 99.4% of flavored e-cigarette products
- 99.9% of non-flavored e-cigarette products

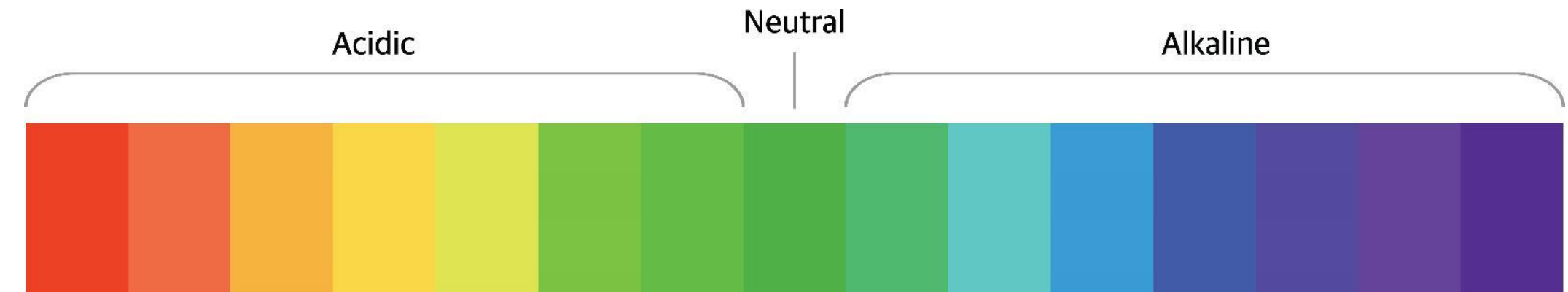


# NICOTINE CONCENTRATION IN E-CIGARETTES, 2013–2018

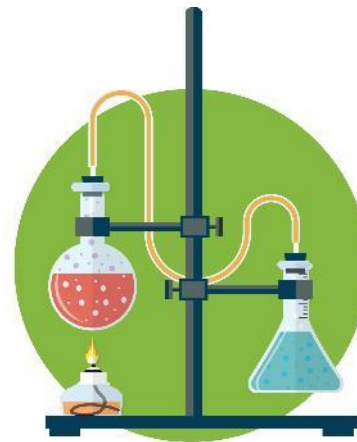


According to the manufacturer of JUUL, a single pod contains as much nicotine as a pack of 20 regular cigarettes.

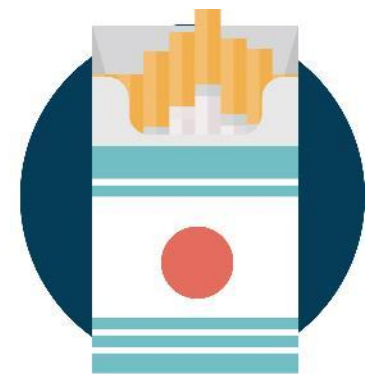
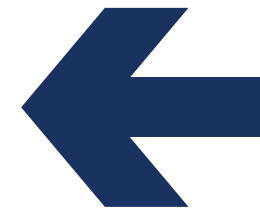
# NICOTINE SALTS ALLOW HIGH LEVELS OF NICOTINE TO BE INHALED MORE EASILY



Nicotine Salts



Benzoic Acid



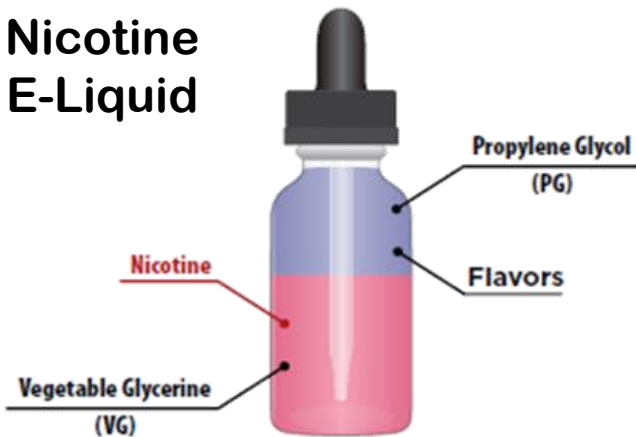
Free Base Nicotine

# E-CIGARETTE, OR VAPING, PRODUCTS, CAN CONTAIN OTHER SUBSTANCES

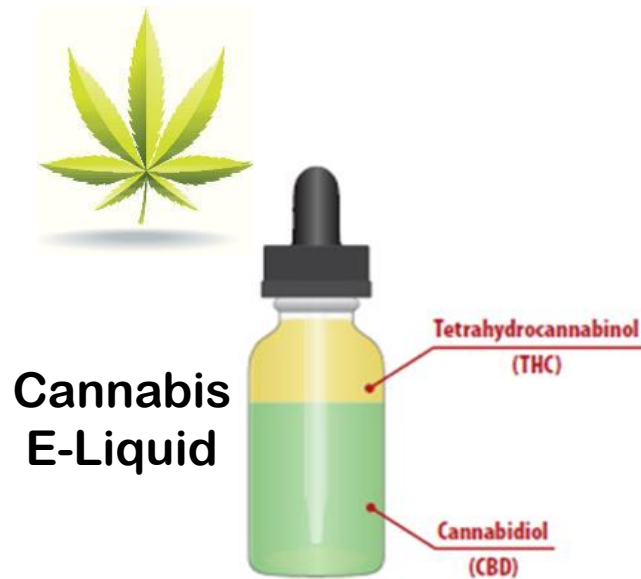
## NOT JUST FLAVORING

E-liquid is typically a mixture of water, food grade flavoring, nicotine, propylene glycol or vegetable glycerin.

### Nicotine E-Liquid



E-liquid can also contain cannabinoids (THC, CBD).



### Cannabis E-Liquid

E-cigarette, or vaping, products can be hacked or modified to deliver illicit drugs.



# WHO IS USING E-CIGARETTES?

1

What are e-cigarettes?



2

Who is using them?



**ADULT USE**

3

Implications:  
Health & Public Health

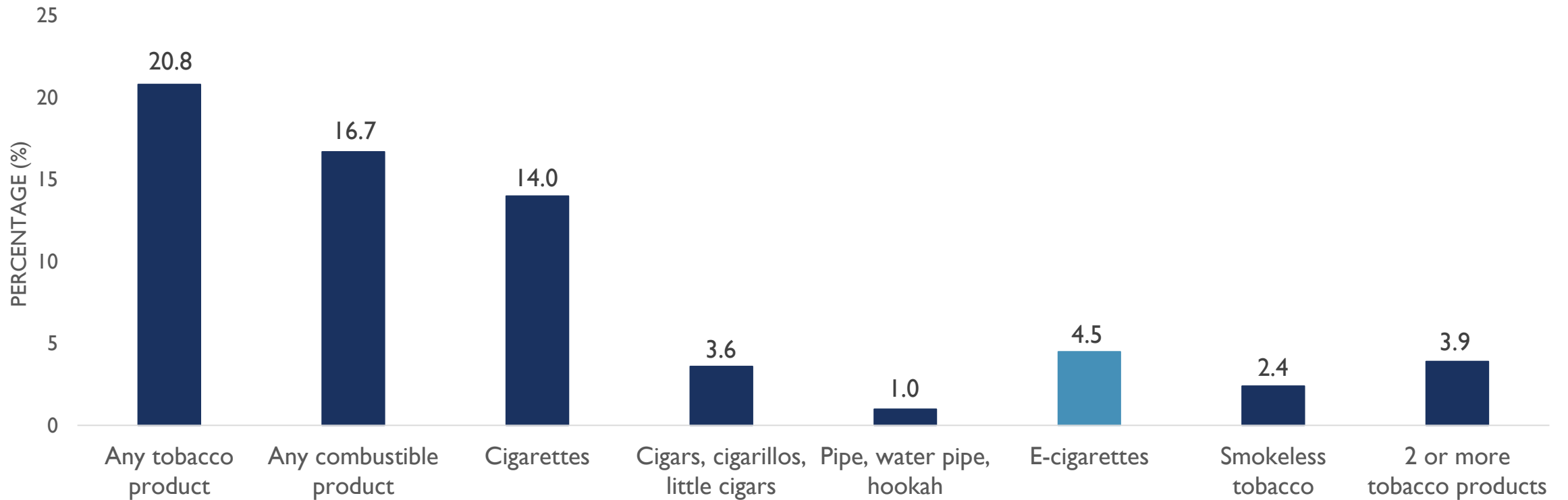


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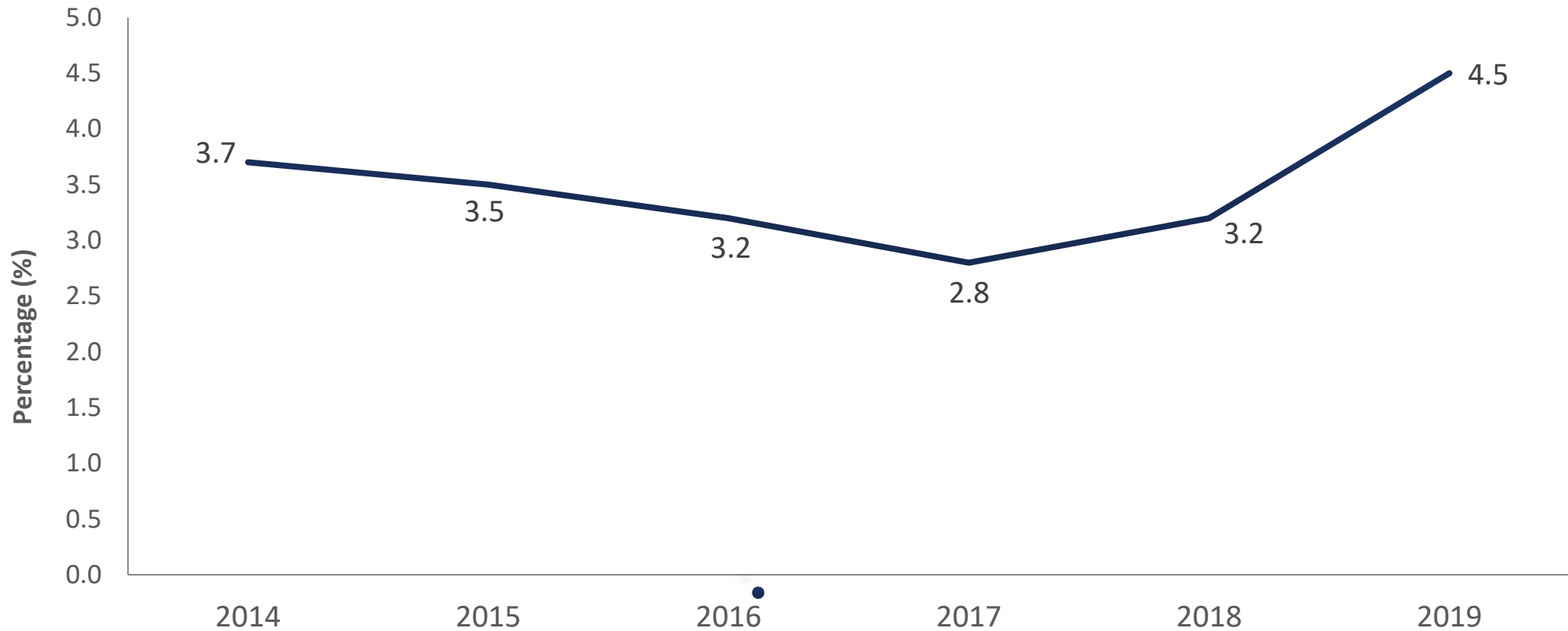
Actions to Take



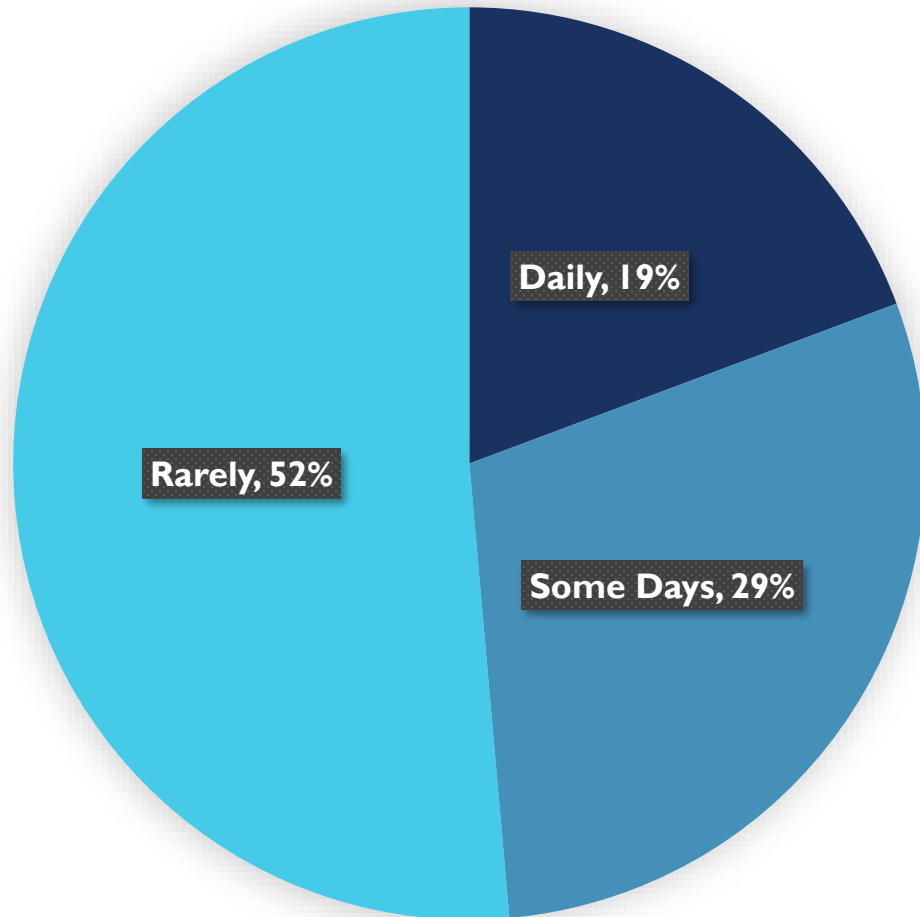
# TOBACCO PRODUCT USE AMONG U.S. ADULTS, BY TOBACCO PRODUCT, 2019



# CURRENT E-CIGARETTE USE AMONG U.S. ADULTS, 2014–2019

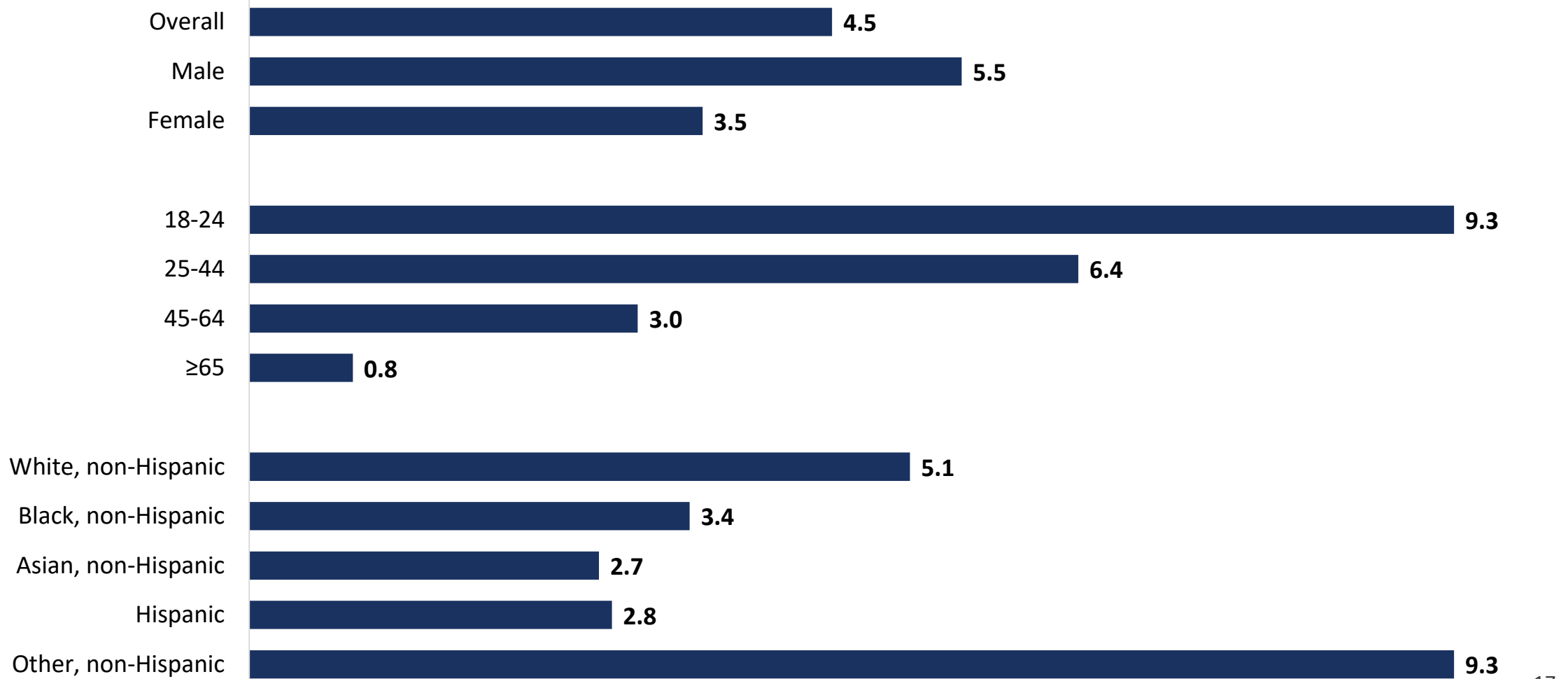


# FREQUENCY OF CURRENT E-CIGARETTE USE AMONG U.S. ADULTS, 2012-2014

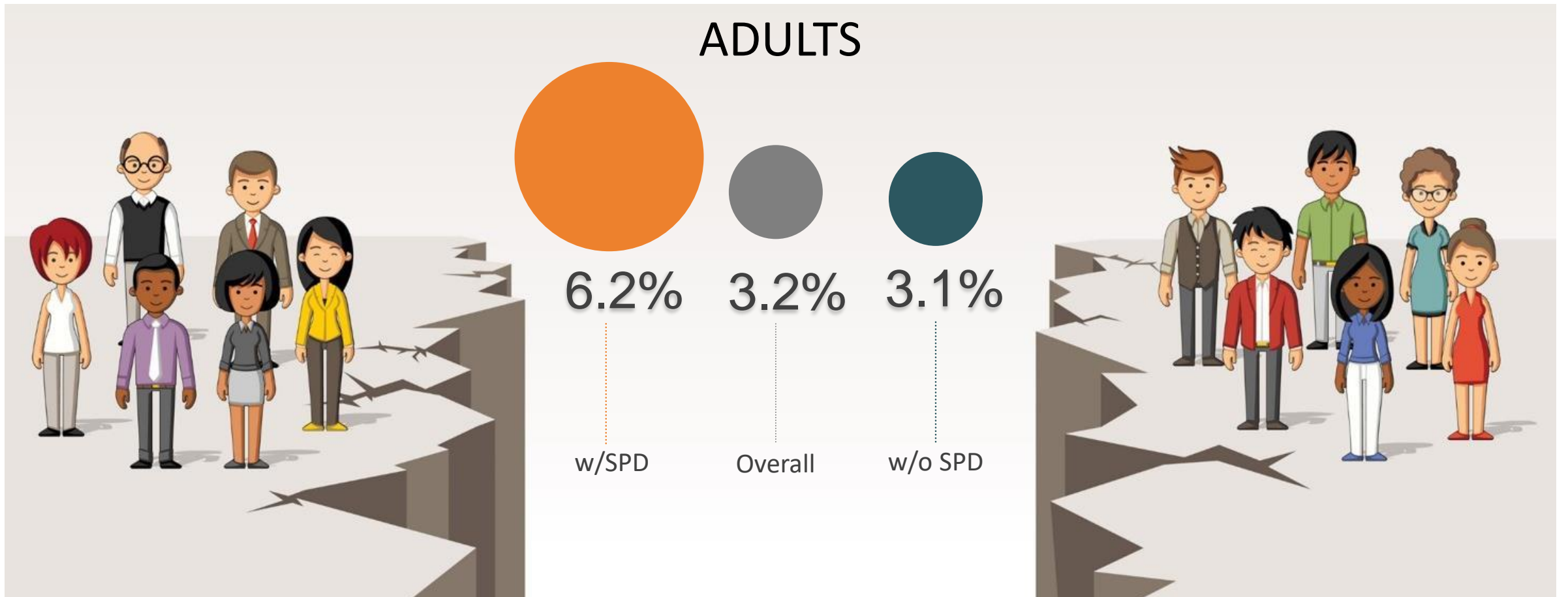




# PERCENTAGE OF U.S. ADULTS REPORTED E-CIGARETTE USE “EVERY DAY” OR “SOME DAYS,” 2019

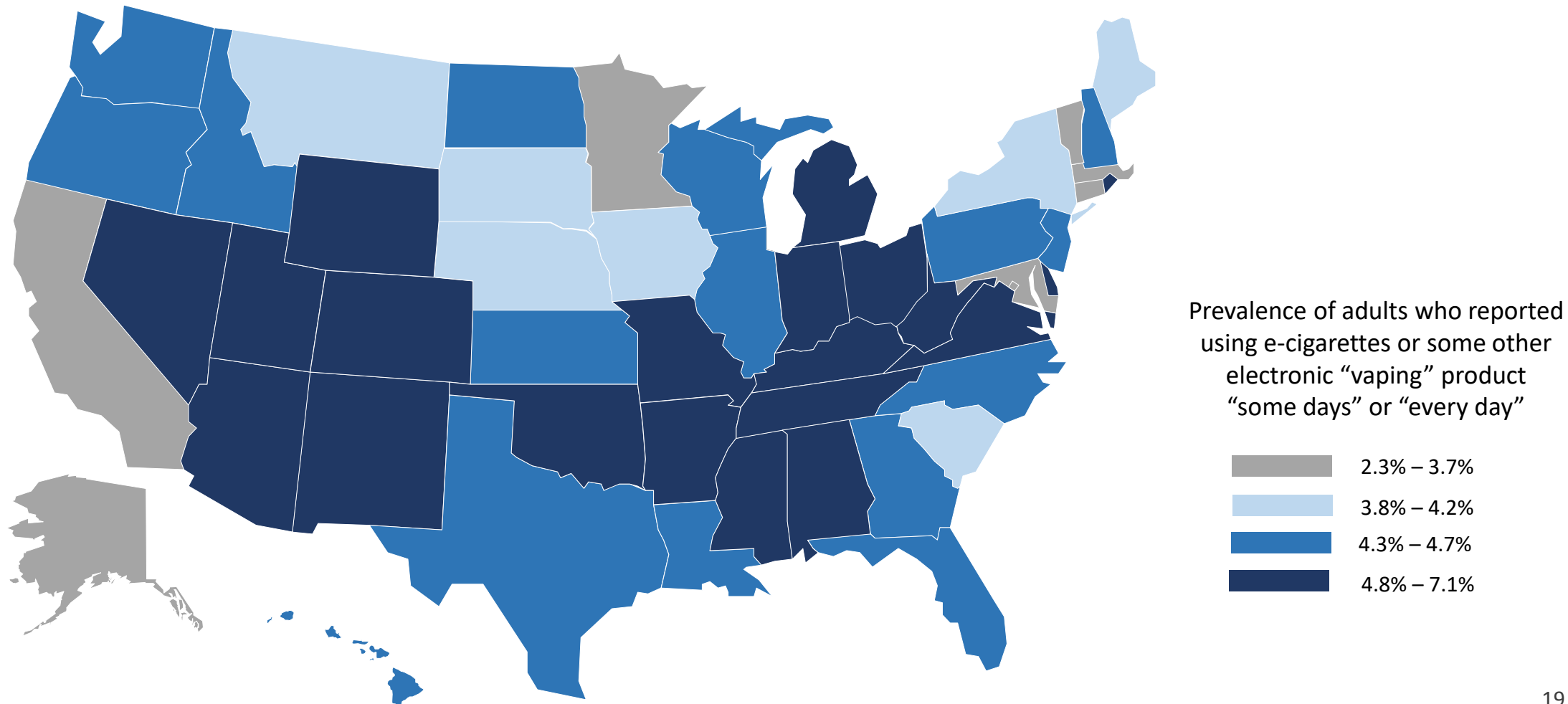


# A DIVIDE: PREVALENCE OF E-CIGARETTE USE AMONG ADULTS OVERALL AND BY SERIOUS PSYCHOLOGICAL DISTRESS,\* NHIS, 2018



\*Serious psychological distress is a composite measure based on six questions that ask about feelings of sadness, nervousness, restlessness, worthlessness, and feeling like everything is an effort in the past 30 days. 18

# CURRENT E-CIGARETTE USE AMONG U.S. ADULTS, BRFSS, 2017

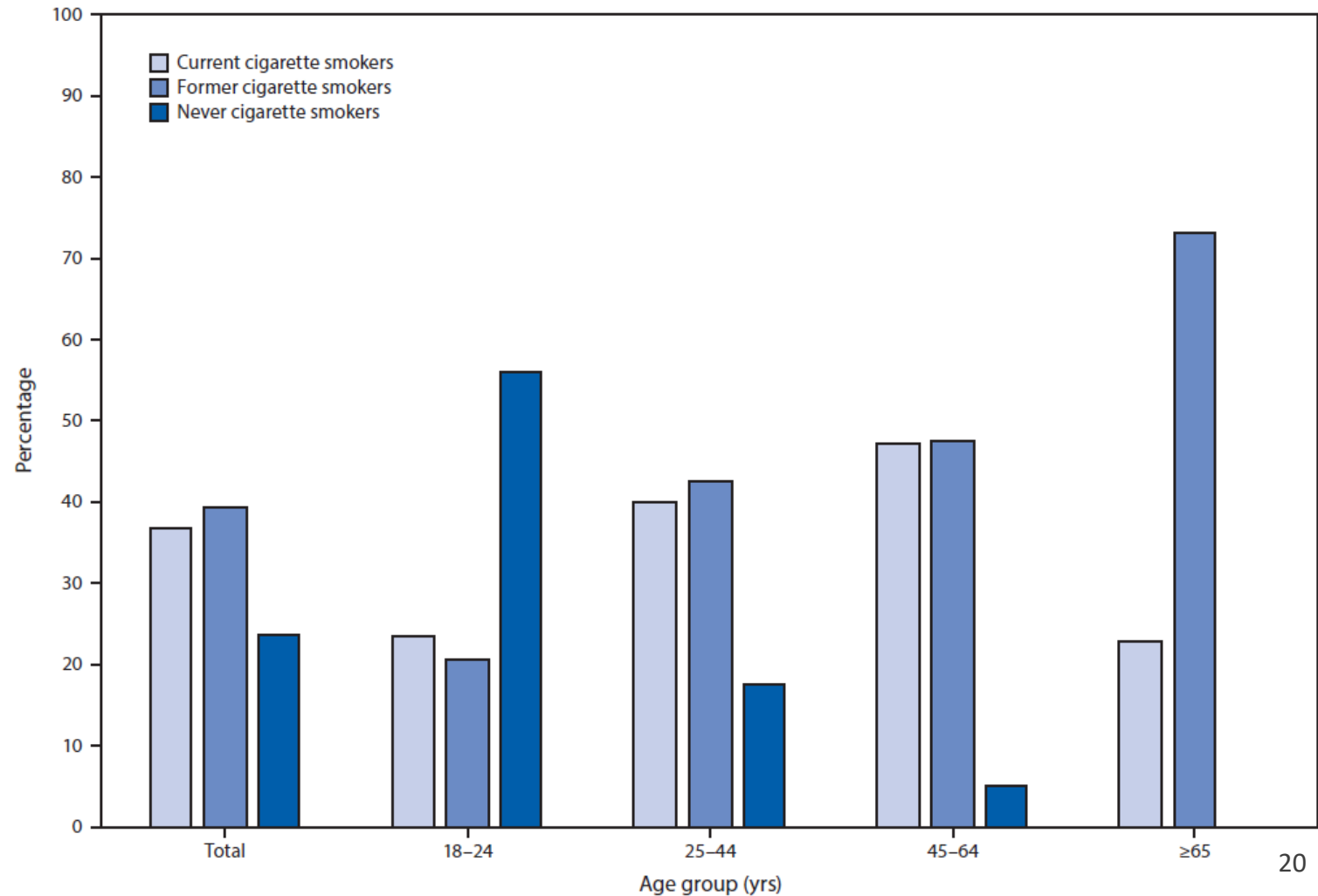




## Cigarette Smoking Status Among Current Adult E-cigarette Users, by Age Group — National Health Interview Survey, United States, 2019

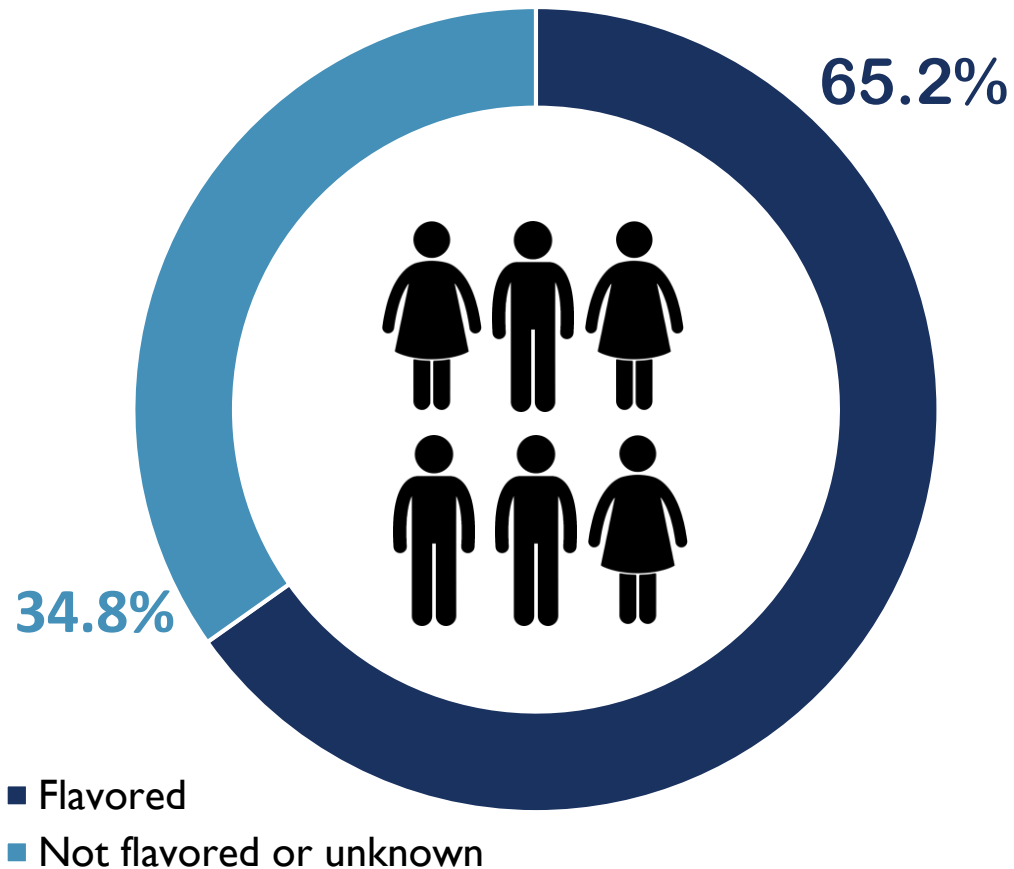
**MANY ADULTS WHO  
USE E-CIGARETTES  
ALSO USE  
CONVENTIONAL  
CIGARETTES**

**Source:** Cornelius ME, Wang TW, Jamal A, Loretan CG, Neff LJ. Tobacco Product Use Among Adults — United States, 2019. *MMWR Morb Mortal Wkly Rep* 2020;69:1736–1742.



# ADULT FLAVORED PRODUCT USE

## TOBACCO USE SUPPLEMENT TO THE CURRENT POPULATION SURVEY, 2014-2015

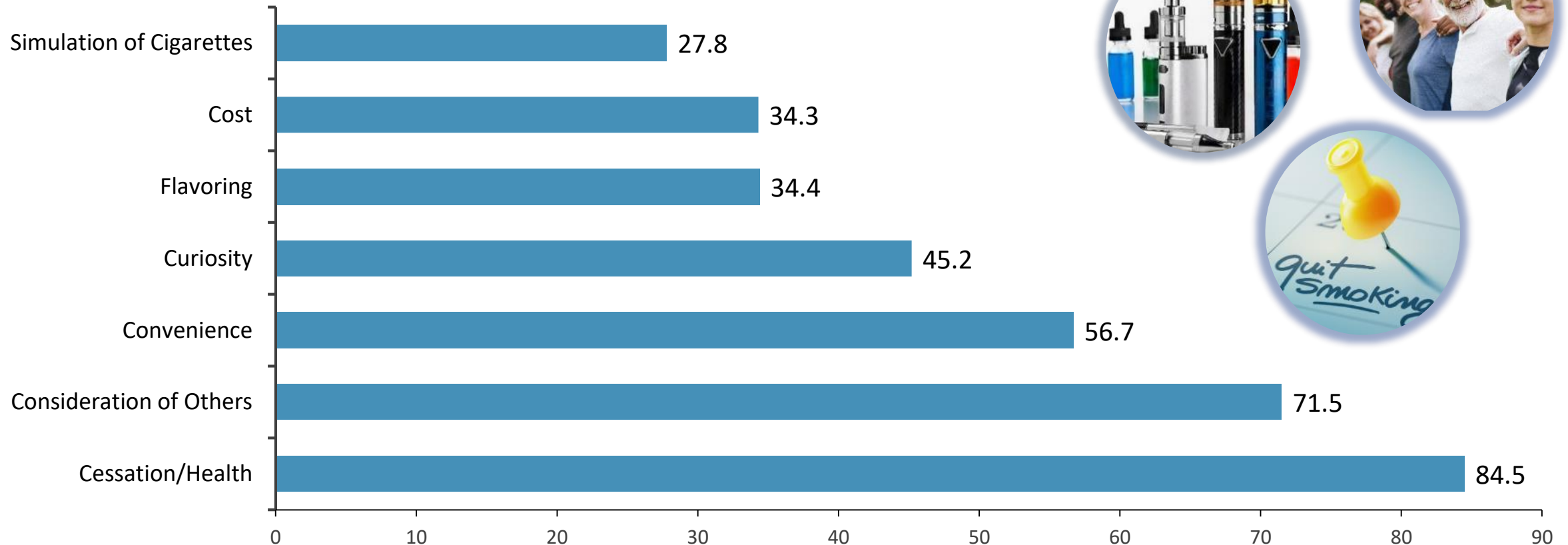


Most adults who use e-cigarettes report using flavored products.

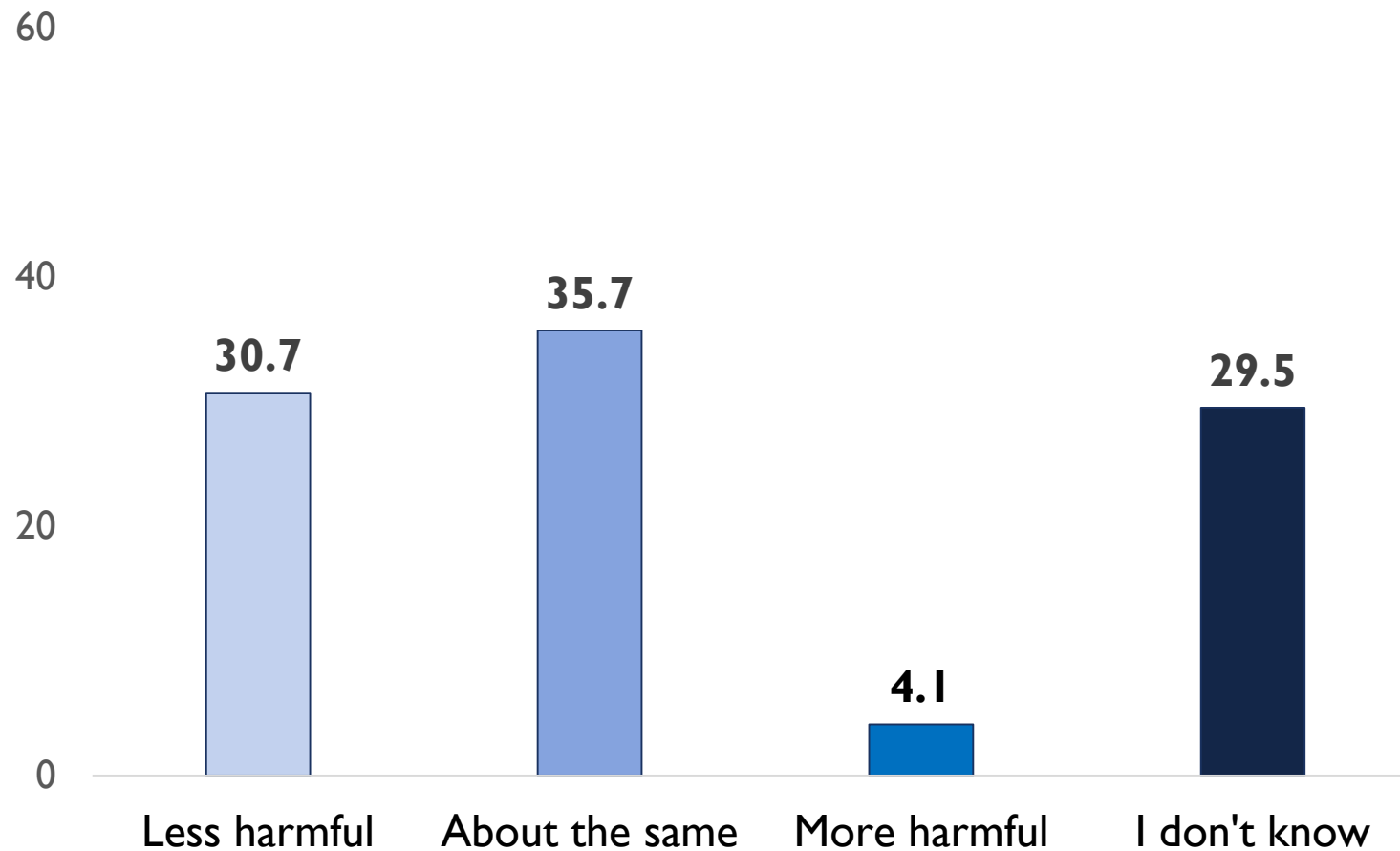


# ADULT REASONS FOR E-CIGARETTE USE

## Primary reasons for using e-cigarettes among U.S. adults with current use, April–June 2014



## Harm perceptions of e-cigarettes relative to cigarettes, 2015



ADULT  
PERCEPTION OF  
TOBACCO  
PRODUCT USE  
HARM

# WHO IS USING E-CIGARETTES?

1

What are e-cigarettes?



2

Who is using them?



**YOUTH USE**

3

Implications:  
Health & Public Health



4

Actions to Take





# A NEW EPIDEMIC AMONG U.S. YOUTH



**U.S. Surgeon General** @Surgeon\_General · Dec 18

Today, I am officially declaring e-cigarette use among youth an epidemic in the United States #NoEcigs4Kids (December 2018)

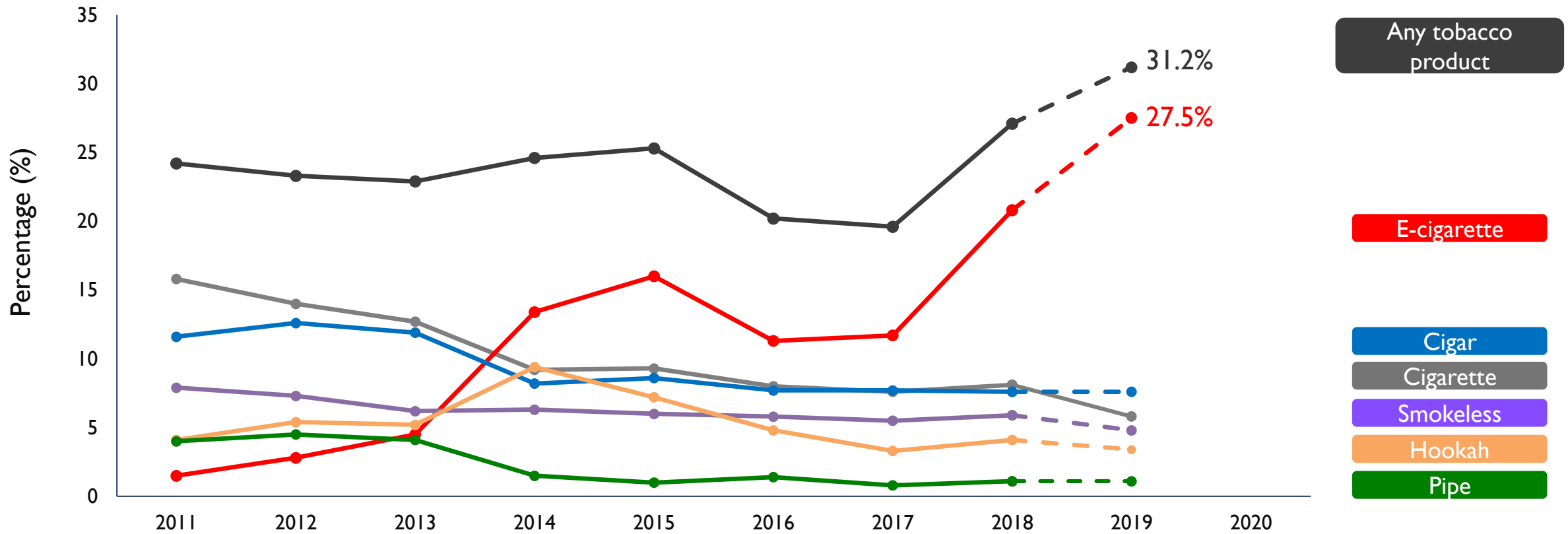


168 1.7K 3.4K

## The Surgeon General's Advisory on E-cigarette Use Among Youth

*"I... am emphasizing the importance of protecting our children from a lifetime of nicotine addiction and associated health risks by immediately addressing the epidemic of youth e-cigarette use... We must take action now to protect the health of our nation's young people."*

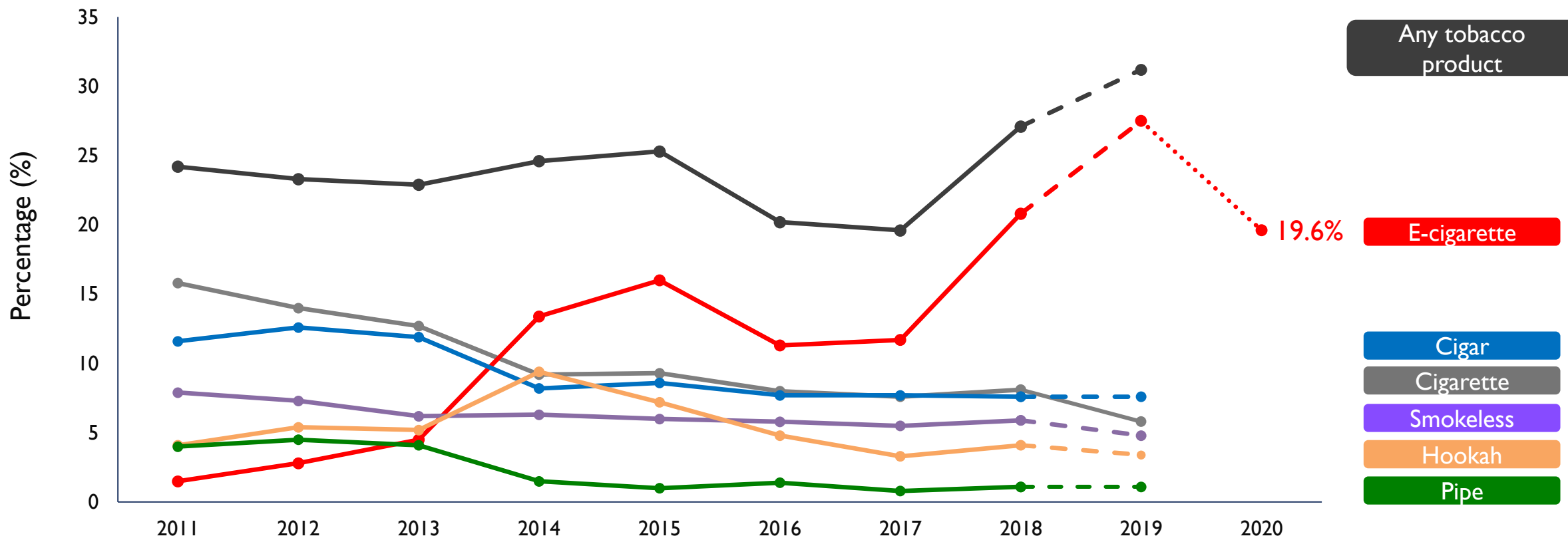
# CURRENT TOBACCO PRODUCT USE AMONG HIGH SCHOOL STUDENTS – UNITED STATES, 2011–2020



**Note:** Dashed lines represent change in the mode of survey administration. Dotted line indicates that 2020 survey fielding time was truncated (January 16 – March 16) due to COVID-19.

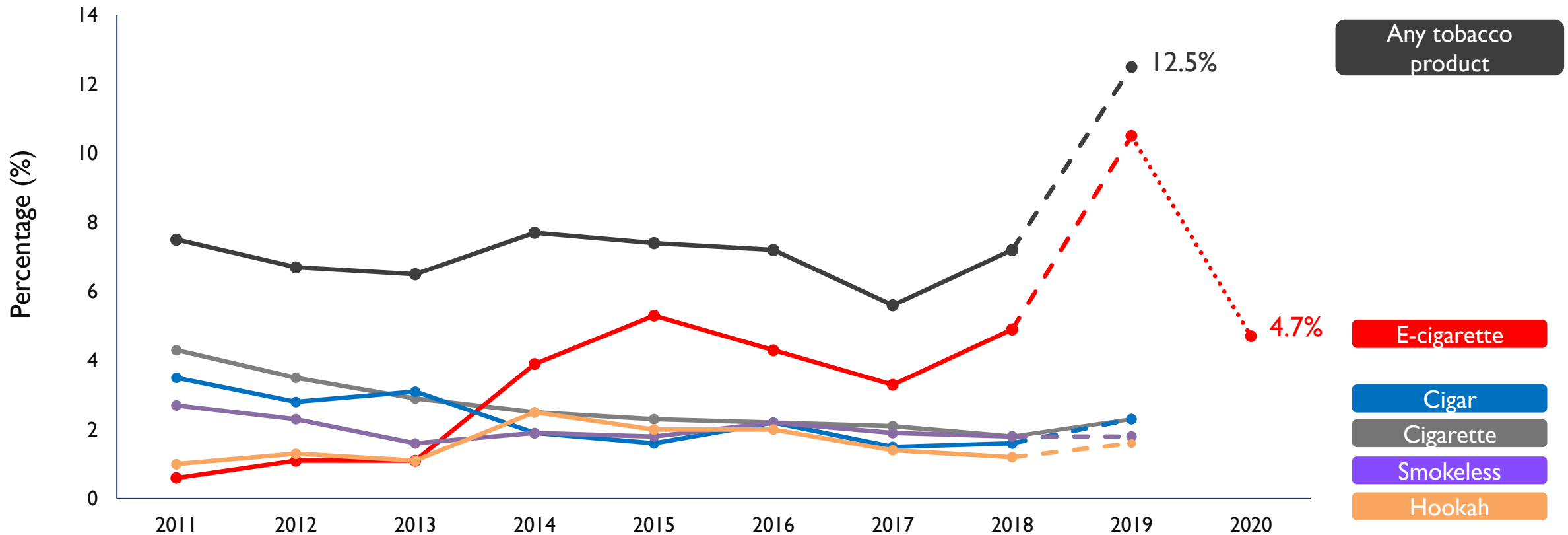
Source: National Youth Tobacco Survey.

# CURRENT TOBACCO PRODUCT USE AMONG HIGH SCHOOL STUDENTS – UNITED STATES, 2011–2020



**Note:** Dashed lines represent change in the mode of survey administration. Dotted line indicates that 2020 survey fielding time was truncated (January 16 – March 16) due to COVID-19.

# CURRENT TOBACCO PRODUCT USE AMONG MIDDLE SCHOOL STUDENTS – UNITED STATES, 2011–2020



**Note:** Dashed lines represent change in the mode of survey administration. Dotted line indicates that 2020 survey fielding time was truncated (January 16 – March 16) due to COVID-19.

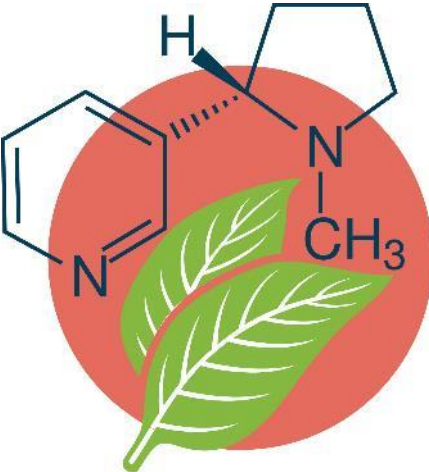
# WHAT CAUSES YOUTH E-CIGARETTE USE?



Advertising



Flavors



Nicotine



# MOST U.S. YOUTH ARE EXPOSED TO E-CIGARETTE ADVERTISING

## TOBACCO PRODUCT ADVERTISING

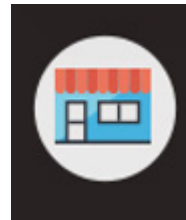
REACHES NEARLY

**9 IN 10**

US MIDDLE AND HIGH SCHOOL STUDENTS  
(86.3%, 22.9 MILLION)

## E-CIGARETTE ADVERTISING:

**69.3%** OF MIDDLE AND HIGH SCHOOL STUDENTS



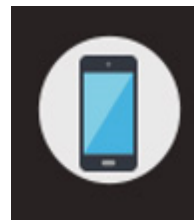
### RETAIL STORES

58.4%  
15 MILLION



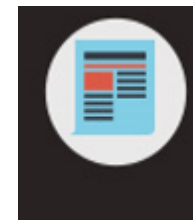
### TELEVISION, STREAMING SERVICES, OR MOVIES

26.2%  
6.6 MILLION



### INTERNET

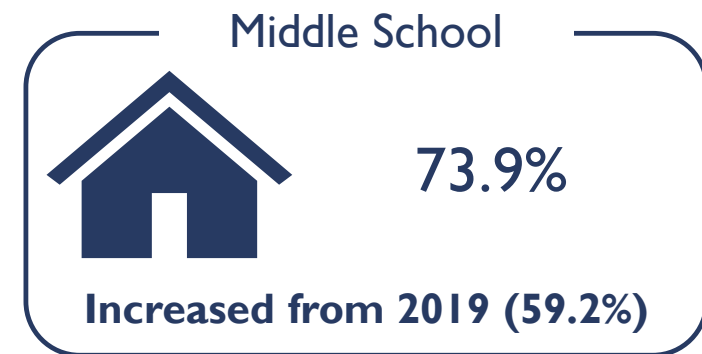
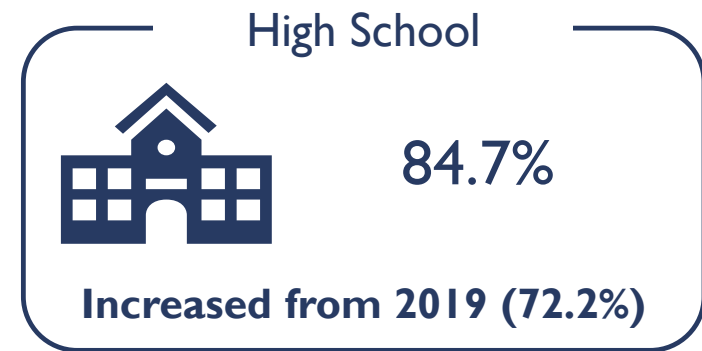
44.6%  
11.5 MILLION



### NEWSPAPER OR MAGAZINES

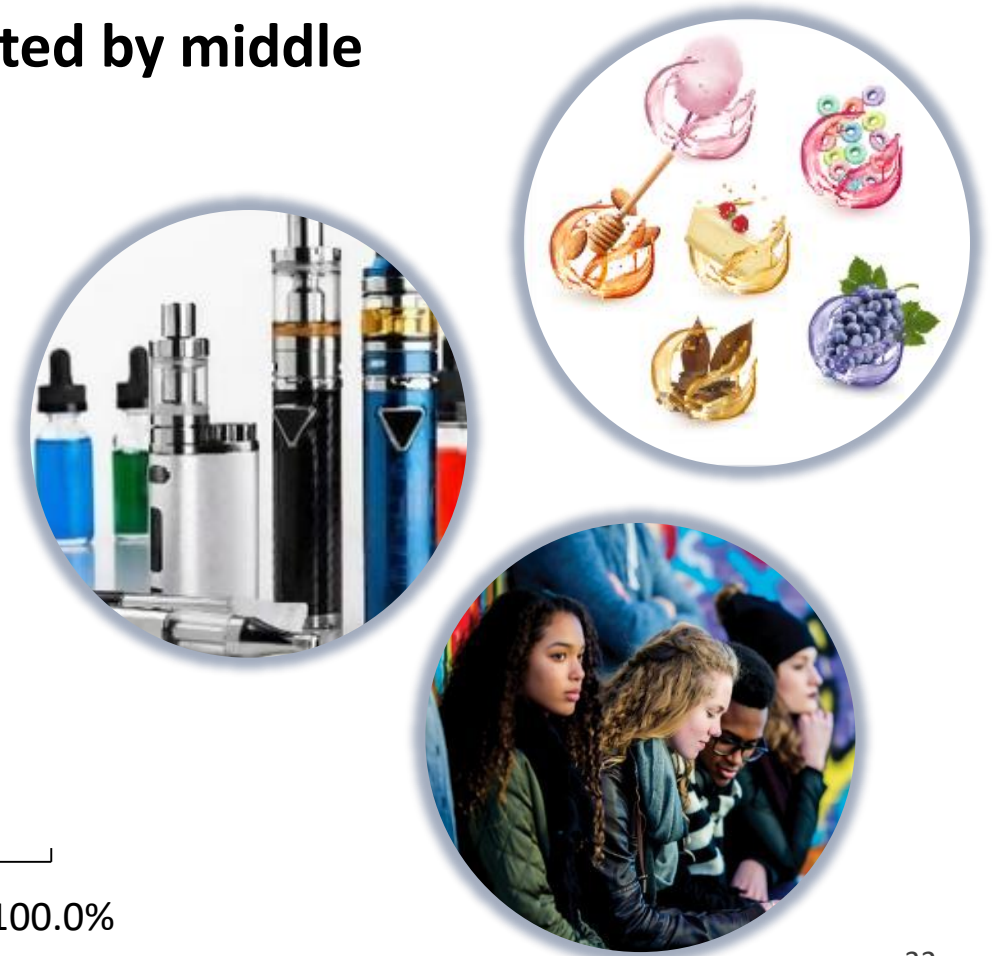
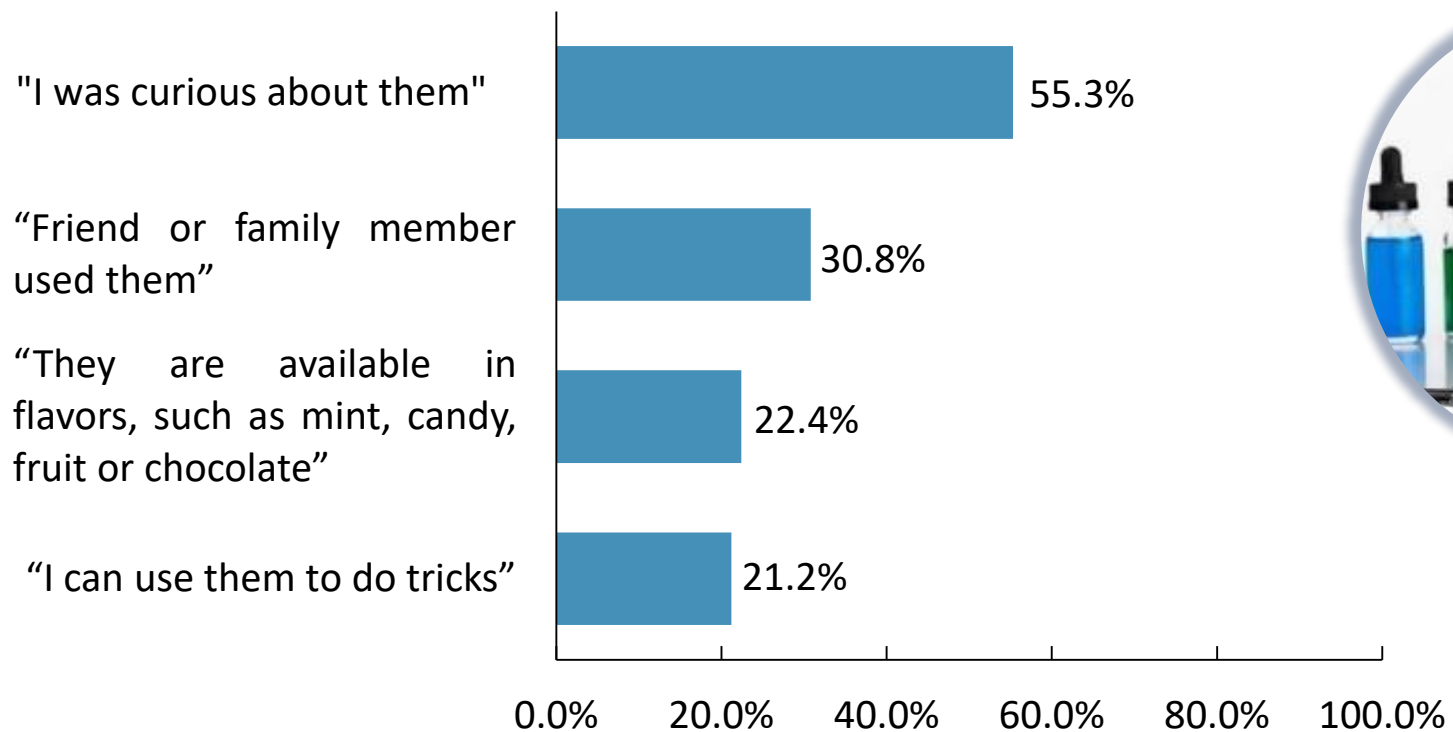
34.8%  
5.1 MILLION

# FLAVORED E-CIGARETTE USE AMONG U.S. YOUTH (2020)



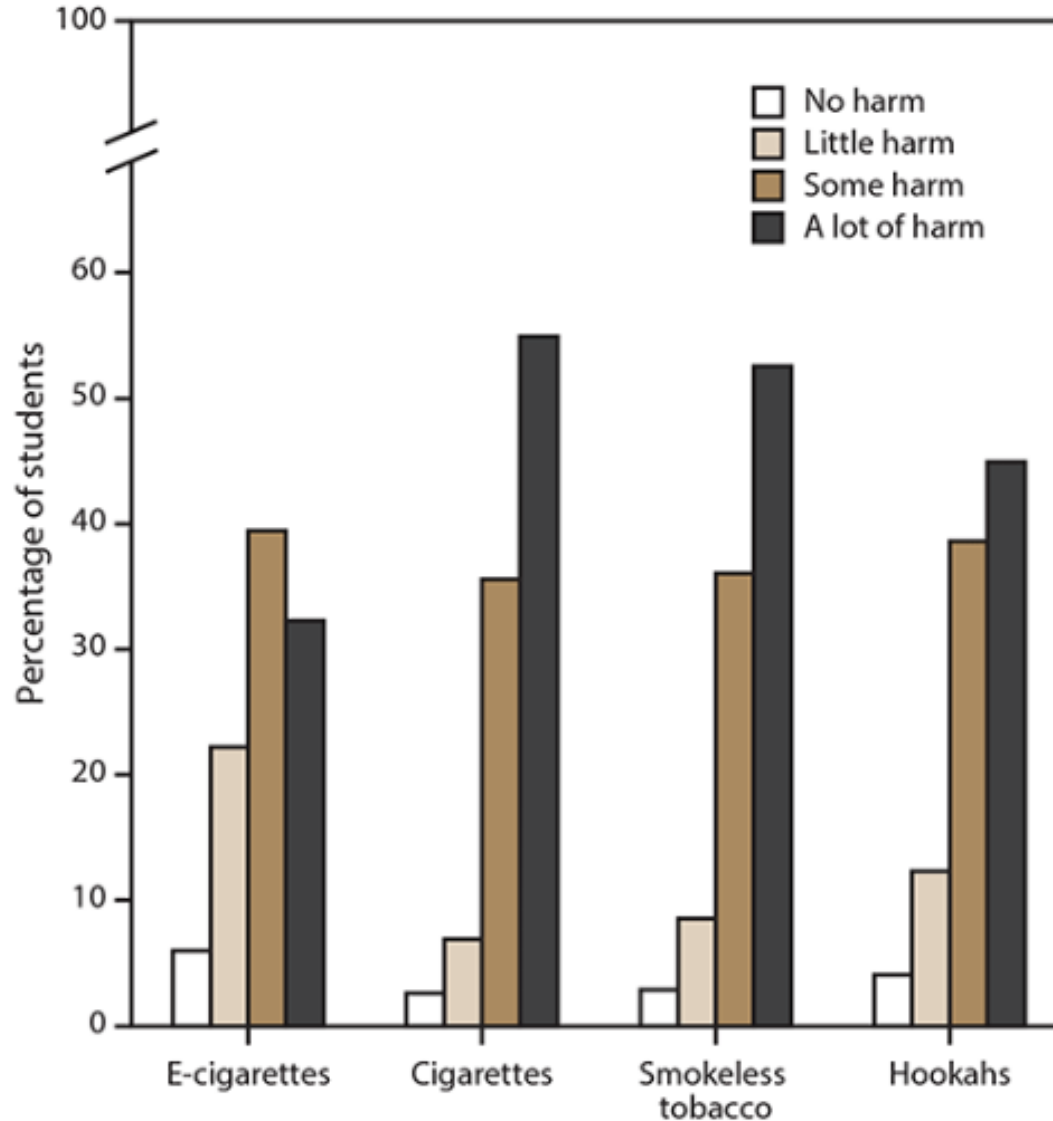
# YOUTH REASONS FOR E-CIGARETTE USE

## Most common reasons for using e-cigarettes reported by middle and high school students, NYTS 2019





## Harm perceptions of intermittent use of tobacco products reported by middle and high school students, NYTS 2019



YOUTH  
PERCEPTION OF  
TOBACCO  
PRODUCT USE  
HARM

# IMPLICATIONS

1

What are e-cigarettes?



2

Who is using them?



3

Implications:  
Health & Public Health

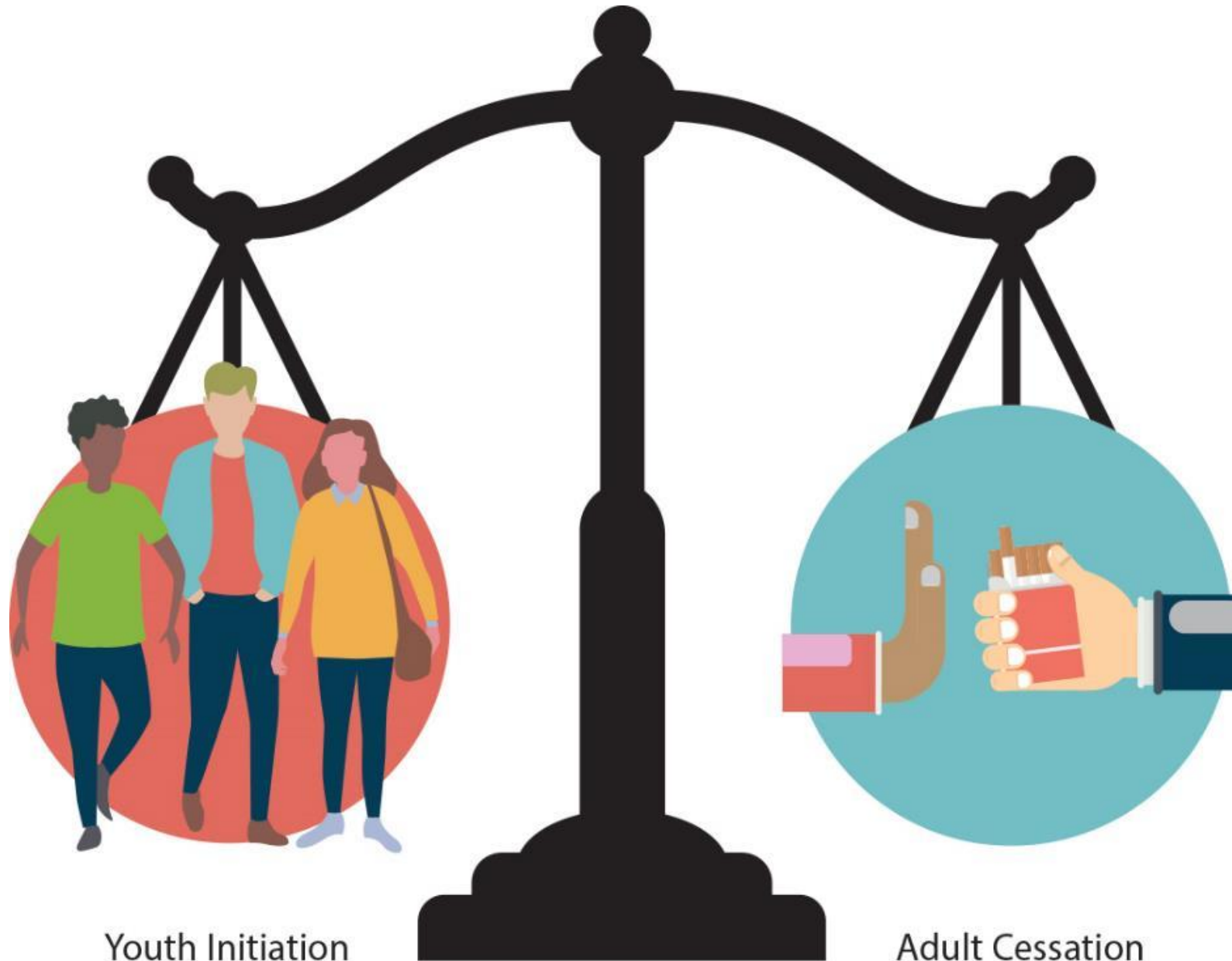


4

Actions to Take



NET PUBLIC  
HEALTH  
BENEFIT OR  
HARM?



Youth Initiation

Adult Cessation

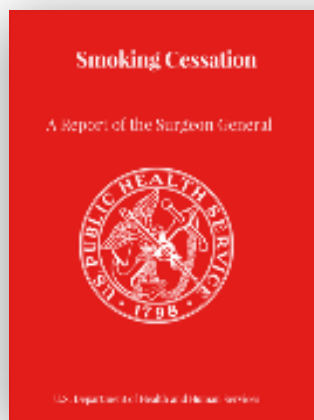
# E-CIGARETTE USE AS A SMOKING CESSATION TOOL AMONG ADULTS



Conclusion 17-1. “Overall, there is limited evidence that e-cigarettes may be effective aids to promote smoking cessation.”



“Overall, the USPSTF found the evidence on the use of ENDS as a smoking cessation tool in adults, including pregnant women, and adolescents to be insufficient.”



Conclusion 6-10. “The evidence is inadequate to infer that e-cigarettes, in general, increase smoking cessation. However, the evidence is suggestive but not sufficient to infer that the use of e-cigarettes containing nicotine is associated with increased smoking cessation compared with the use of e-cigarettes not containing nicotine.”



“There is moderate-certainty evidence that ECs with nicotine increase quit rates compared to ECs without nicotine and compared to NRT. Evidence comparing nicotine EC with usual care/no treatment also suggests benefit, but is less certain.”

# POTENTIAL HARMS OF E-CIGARETTES



Leads to initiation of combustible tobacco use among non-smokers, particularly children



Leads to relapse among former smokers



Diminishes the chances that a smoker will quit



Discourages smokers from using proven quit methods



Exposes children, pregnant women, and non-users to secondhand aerosol



Glamorizes or renormalizes tobacco use

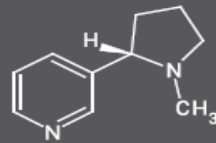


Results in poisonings among users or non-users

# E-CIGARETTE AEROSOL IS NOT HARMLESS



**VOLATILE  
ORGANIC  
COMPOUNDS**



**NICOTINE**

**ULTRAFINE  
PARTICLES**



**HEAVY METALS SUCH AS  
NICKEL, TIN, AND LEAD**



**CANCER-CAUSING  
CHEMICALS**

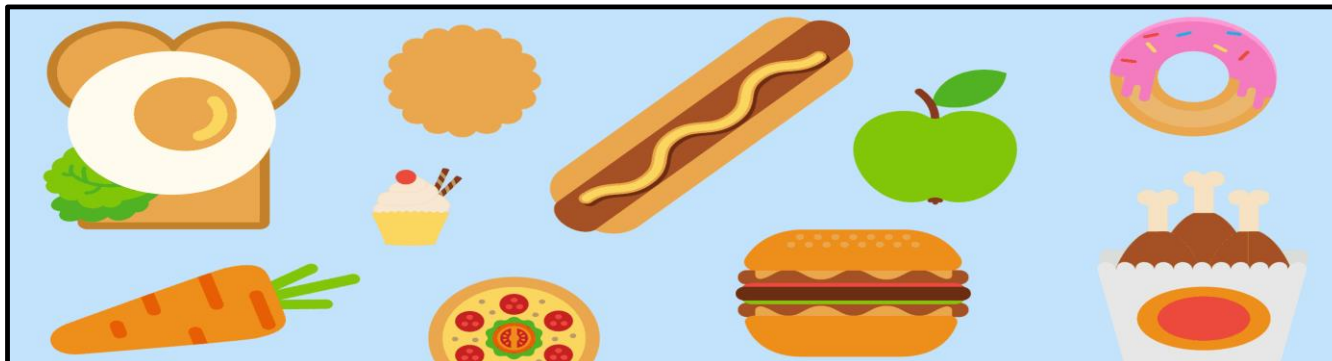
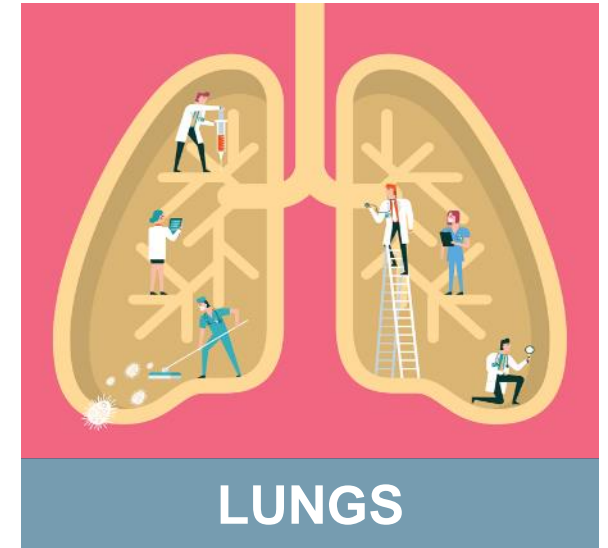
**FLAVORING SUCH AS  
DIACETYL, A CHEMICAL  
LINKED TO A SERIOUS  
LUNG DISEASE**



# SOME FLAVORS CAN ALSO BE HARMFUL WHEN INHALED

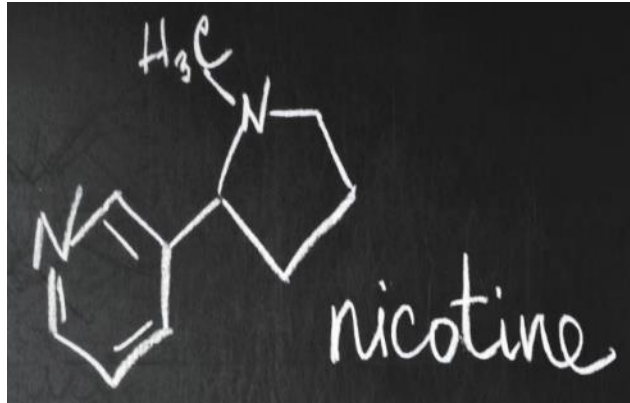


Some e-cigarette manufacturers claim flavorings are safe because they meet the FDA definition of “Generally Recognized as Safe” (“GRAS”)



**GRAS does not apply to products that are not food**

# MOST E-CIGARETTES SOLD CONTAIN NICOTINE



Source: Marynak et al. American Journal of Public Health 107(5): 702-705, May 2017.



**WARNING:**  
This product contains  
nicotine. Nicotine is an  
addictive chemical.

Nicotine is highly addictive.

Nicotine can harm brain  
development, which continues until  
about age 25.



**NICOTINE IS NOT HARMLESS**

Source: US DHHS, E-Cigarette Use Among Youth and Young Adults, SGR, 2016





# WHAT ARE THE KNOWN HEALTH EFFECTS OF E-CIGARETTES?

## CVD:

- **Conclusion 9-1.** No available evidence whether e-cigarette use is associated with clinical cardiovascular outcomes and subclinical atherosclerosis.
- **Conclusion 9-4.** Limited evidence associated with a short-term increase in systolic blood pressure, changes in biomarkers of oxidative stress, increased endothelial dysfunction and arterial stiffness, and autonomic control.
- **Conclusion 9-5.** Insufficient evidence that e-cigarette use is associated with long-term changes in heart rate, blood pressure, and cardiac geometry and function.

## Cancer:

- **Conclusion 10-1.** No available evidence whether e-cigarette use is associated with intermediate cancer endpoints in humans.
- **Conclusion 10-3.** Limited evidence that e-cigarette aerosol can be mutagenic or cause DNA damage in humans, animal models, and human cells in culture.

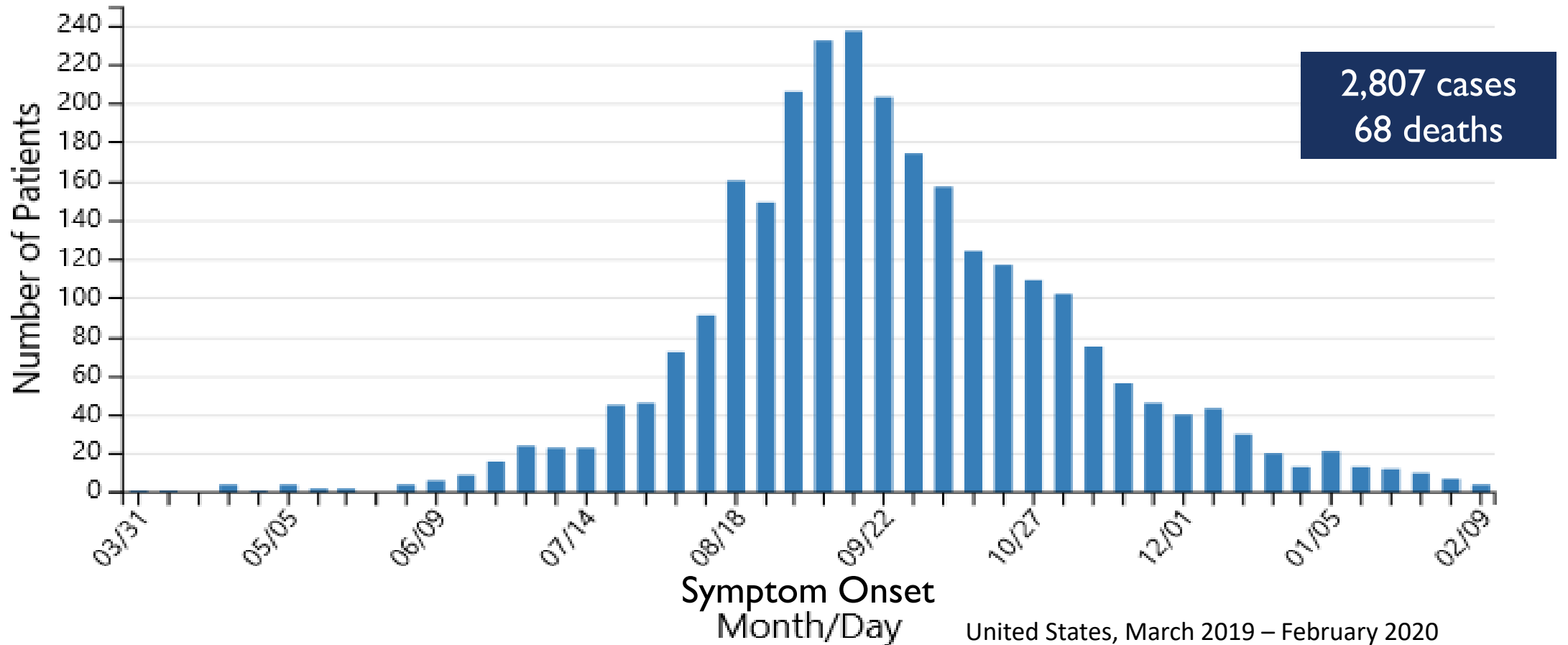
## Respiratory:

- **Conclusion 11-1.** No available evidence whether e-cigarettes cause respiratory diseases in humans.
- **Conclusion 11-4.** Moderate evidence for increased cough and wheeze in adolescents who use e-cigarettes and an association with e-cigarette use and an increase in asthma exacerbations.



# E-CIGARETTE, OR VAPING, PRODUCT USE-ASSOCIATED LUNG INJURY (EVALI)

Cases reported to CDC as of February 18, 2020



# THE IMPLICATION OF VITAMIN E ACETATE IN EVALI

- Vitamin E acetate was found in **product samples** used by EVALI patients.
- Vitamin E acetate was detected in 48 of 51 of case patient **BAL samples** but not in a healthy comparator group.
  - Results for plant oils, MCT oil, petroleum distillates, and diluent terpenes were all below levels of detection.



# IS THERE A POTENTIAL BENEFIT FOR E-CIGARETTES? ANSWER: UNDER CERTAIN CIRCUMSTANCES

Complete long-term substitution  
by established smokers



Assist in rapid transition to a society with little or  
no use of combustible products

Short-term use if shown to  
produce successful &  
permanent cessation of  
combustible products



**“Cutting back” is not enough; even a few cigarettes per day is dangerous**

# THERE IS NO SAFE TOBACCO PRODUCT. ALL TOBACCO PRODUCTS CARRY A RISK.



# ACTIONS TO TAKE

1

What are e-cigarettes?



2

Who is using them?



3

Implications:  
Health & Public Health

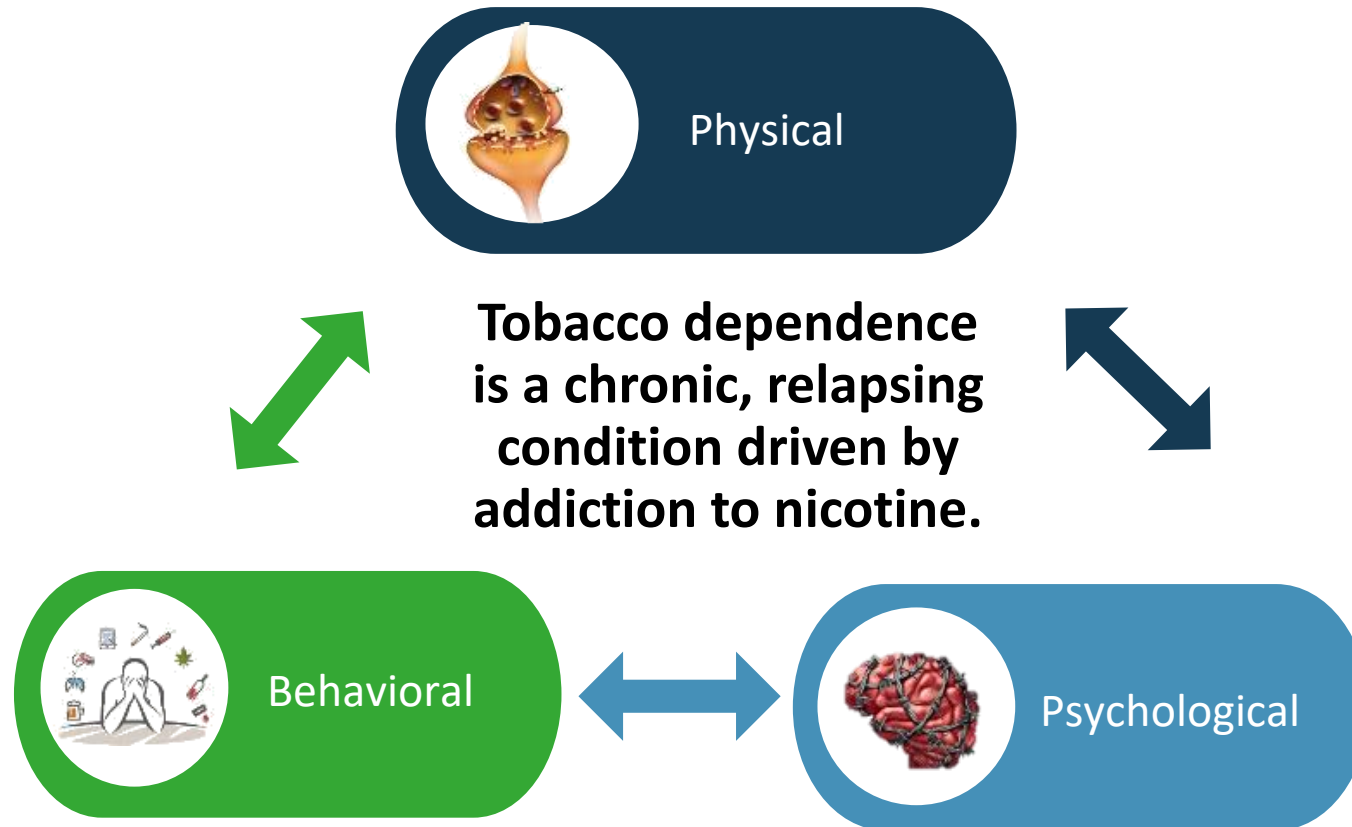


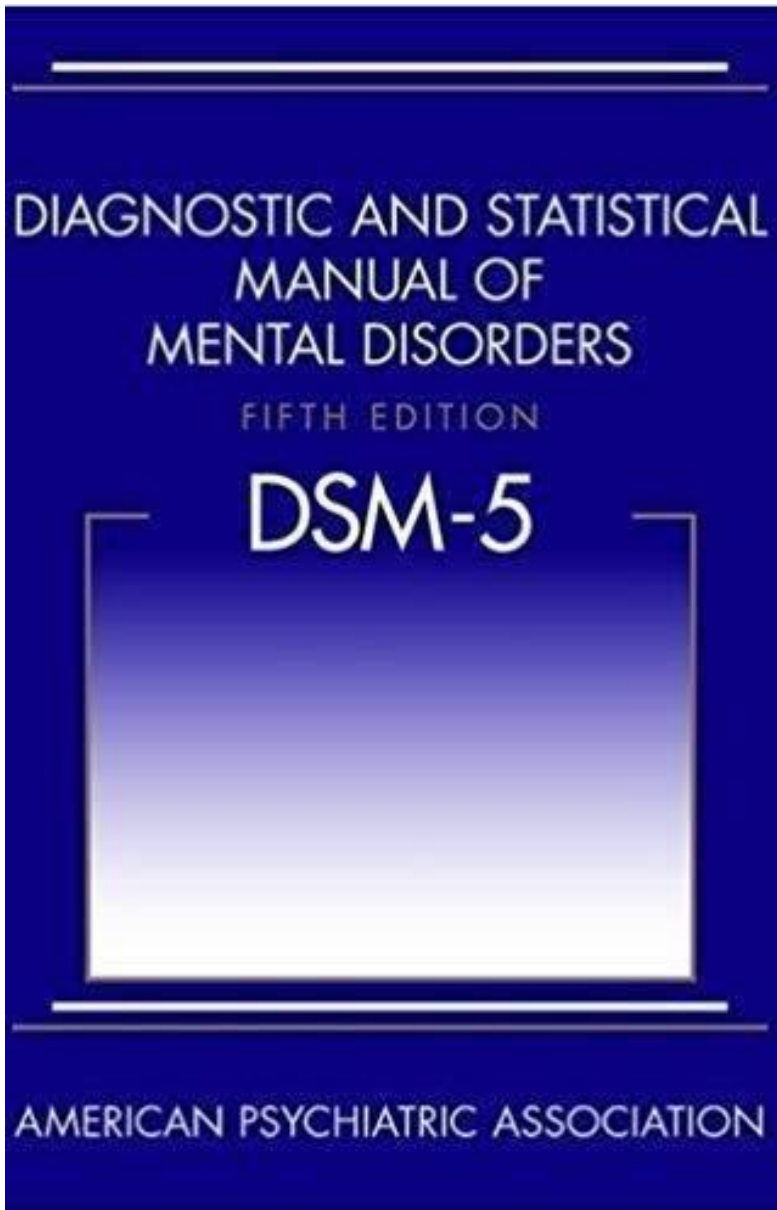
4

Actions to Take



# BACK TO BASICS: CONTEMPORIZING OUR CLINICAL APPROACH





## DSM-5 CRITERIA FOR TOBACCO USE DISORDER

**≥2 criteria within 12-months:**

- Larger amounts, longer time period than intended
- Persistent desire or effort to cut down
- Great deal of time obtaining substance
- Strong craving, desire, urge to use
- Interference with life (home, school, work)
- Continued use despite social or interpersonal problems
- Important social, occupational activities given up
- Use in situations where it's hazardous (i.e., bed)
- Use despite knowledge of substance-associated problem (physical, psychological)
- Tolerance
- Withdrawal



# CLINICAL HISTORY ELEMENTS IMPORTANT IN CONSIDERING A TREATMENT PLAN

1

Use status and  
duration of use

2

Product

3

Substance

4

Use frequency  
and intensity



# PATIENTS WANT SUPPORT, RESPECT, AND GUIDANCE

- Be straightforward and non-judgmental.
- Have a clear, strong, personalized message.
- Be empathetic and supportive.
- No lecture, no negative framing, no finger-wagging.
- Craft your 30 seconds: be supportive, offer help, and open the door.

# WHAT YOU SAY SETS THE TONE

You don't smoke/vape....do you?

Are you a smoker?  
Do you *still* smoke/vape?

You know that stuff will kill you....

If you quit smoking/vaping, your  
cough would get better.

Have you ever smoked cigarettes or used  
other tobacco products like e-cigarettes?

The first few weeks after quitting can be  
hard. Have you felt the urge to smoke/vape?

Quitting using tobacco is one of the most  
important things you can do for your  
health.

I understand quitting can be hard. I am  
here to support you. There are resources  
that can help.

I'd like to hear your thoughts about  
stopping smoking/vaping.

# IT'S OKAY IF THEY AREN'T READY

## Set the stage for the future:

- Explore ambivalence, build discrepancy (Motivational Interviewing)
- Offer encouragement
- Offer informational materials

## Leave the door open:

- You are available to help when they are ready
- You will follow-up in the future

## Follow-up:

- You never know when “now” will be right



# CLINICAL HISTORY ELEMENTS IMPORTANT IN CONSIDERING A TREATMENT PLAN

1

Use status and  
duration of use

2

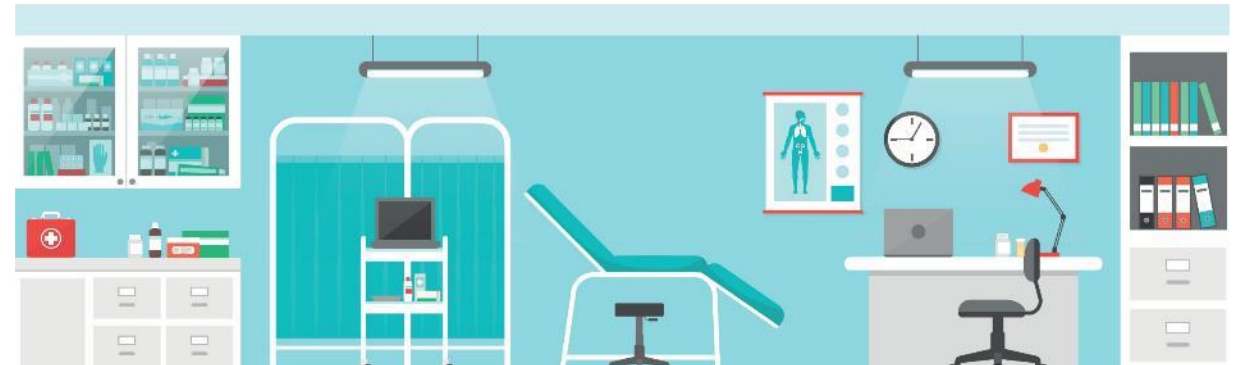
Product

3

Substance

4

Use frequency  
and intensity





## NOT YOUR FATHER'S FAGERSTROM SCALE

Multiple variables can impact use intensity

- substance concentration
- device elements
- device modification
- patient behavior
- patient knowledge



## DSM-5 CRITERIA FOR TOBACCO WITHDRAWAL

Cessation or use reduction results in  $\geq 4$  **symptoms** which cause functional impairment or distress:

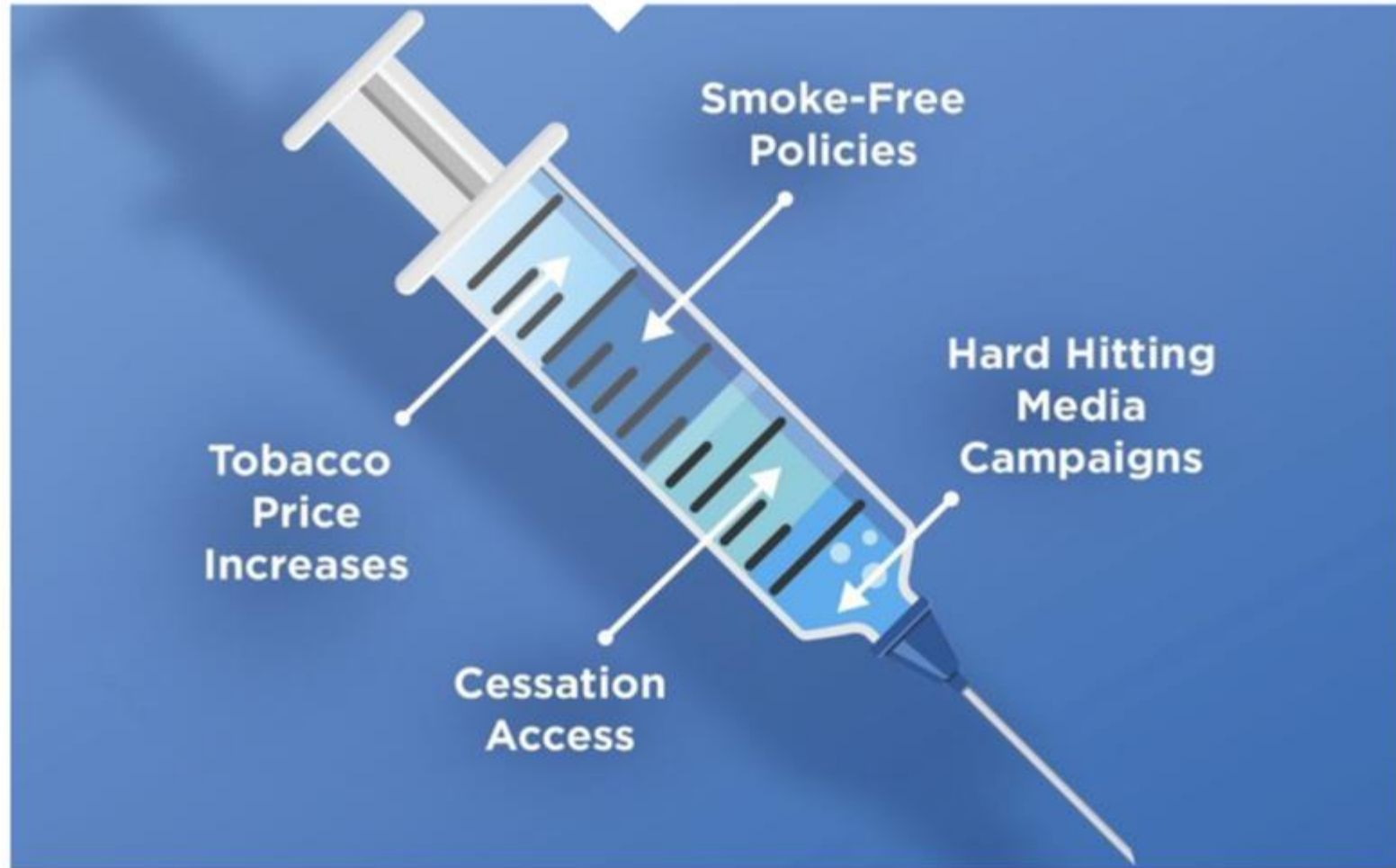
- Irritability, frustration, or anger
- Anxiety
- Difficulty concentrating
- Increased appetite
- Restlessness
- Depressed mood
- Insomnia

DIAGNOSTIC AND STATISTICAL  
MANUAL OF  
MENTAL DISORDERS  
FIFTH EDITION

DSM-5

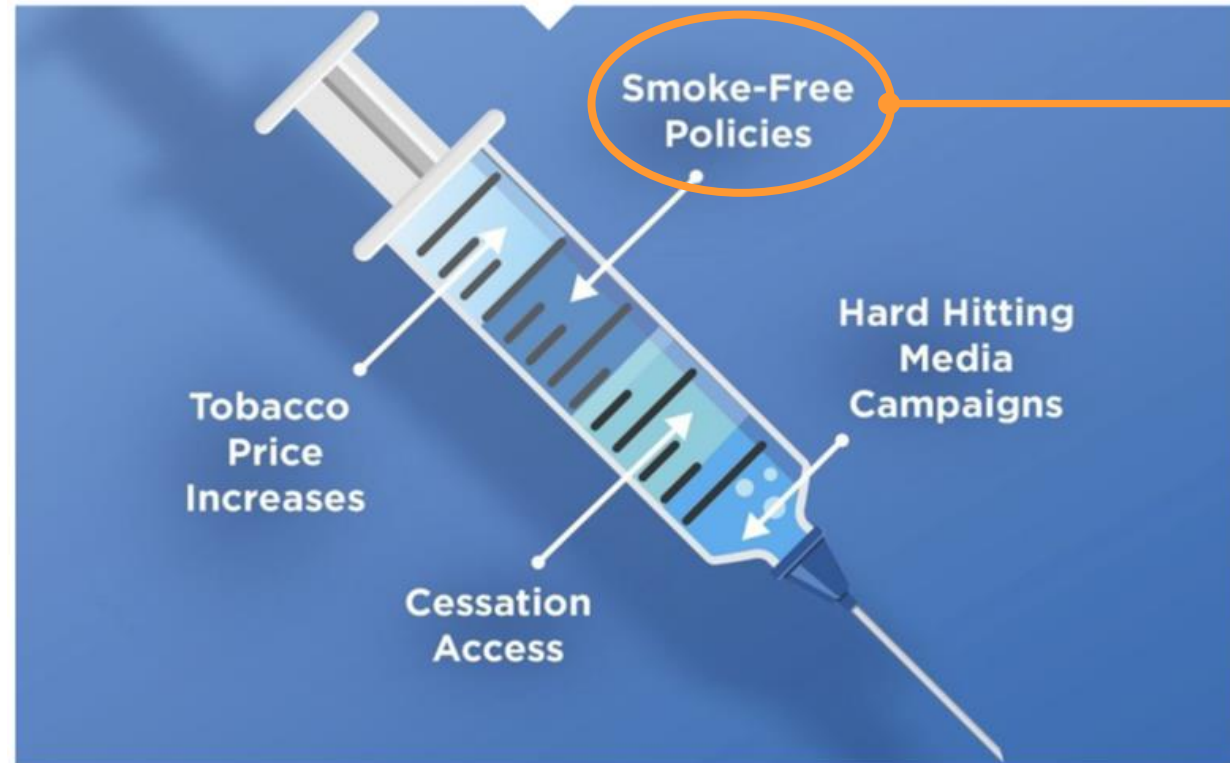
AMERICAN PSYCHIATRIC ASSOCIATION

# THE TOBACCO CONTROL VACCINE





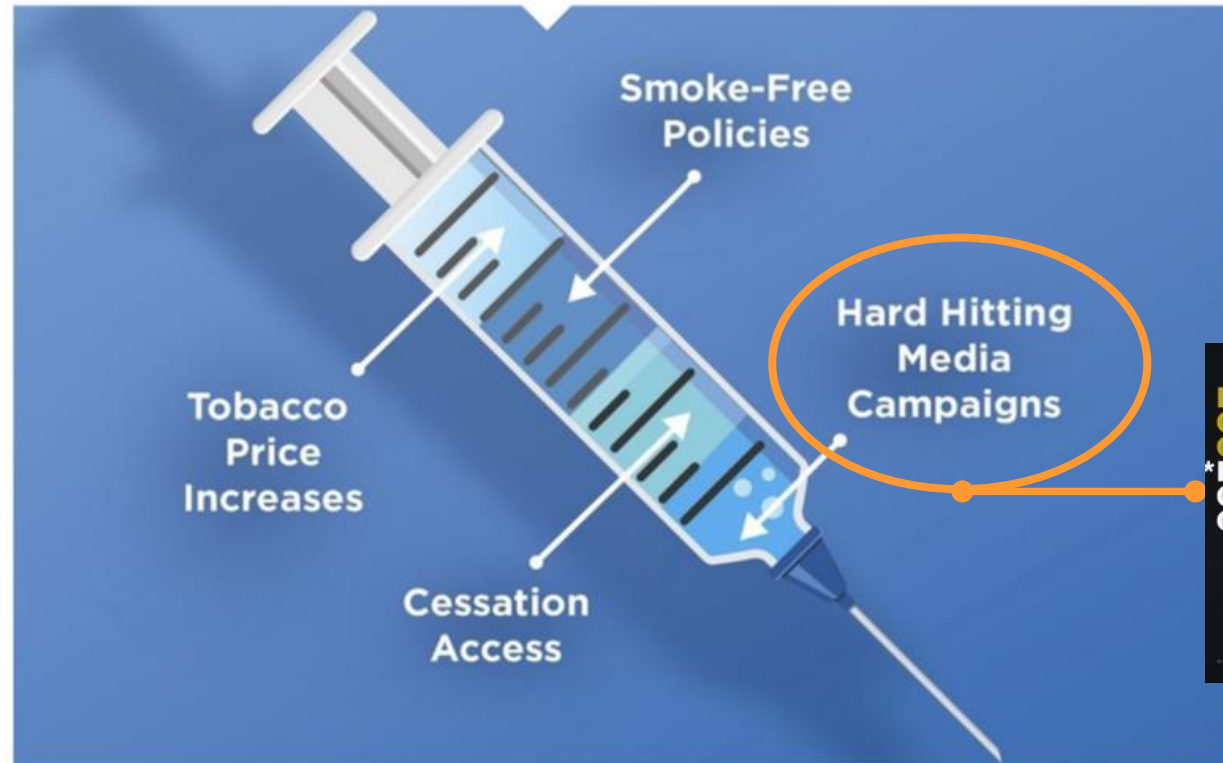
# THE *Contemporized* TOBACCO CONTROL VACCINE



Incorporate e-cigarettes into **smoke-free policies**.



# THE *Contemporized* TOBACCO CONTROL VACCINE

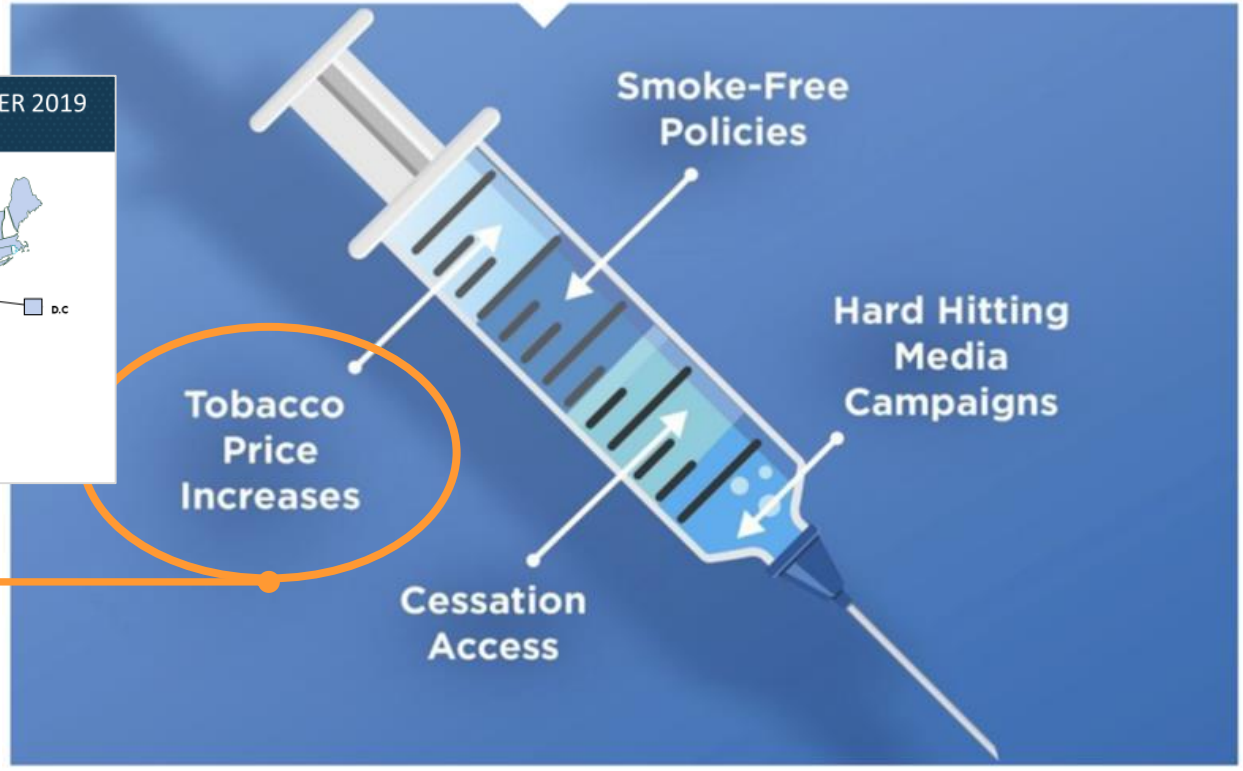
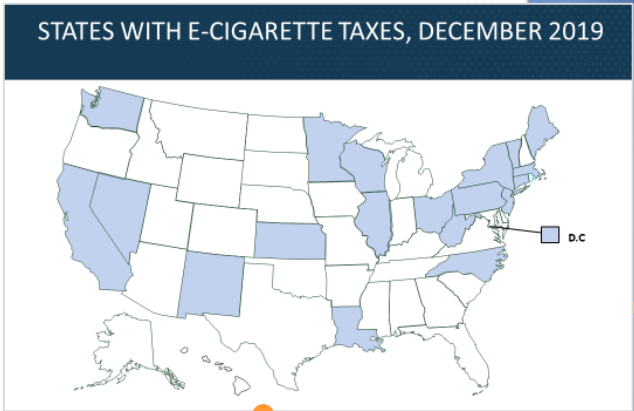


Include e-cigarettes into **educational initiatives** targeting youth and young adults.



# THE *Contemporized* TOBACCO CONTROL VACCINE

## Set price and tax policies.



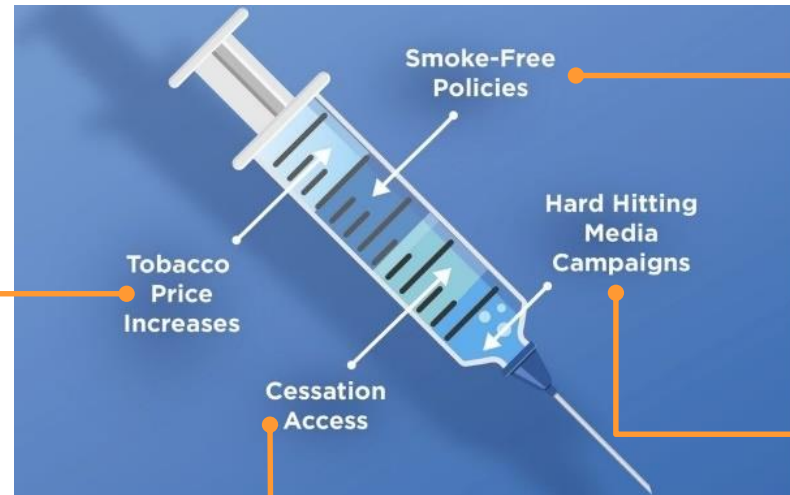
# THE *Contemporized* TOBACCO CONTROL VACCINE



Extend **treatment for** and explore **research on treating** novel tobacco product use.

# THE *Contemporized* TOBACCO CONTROL VACCINE

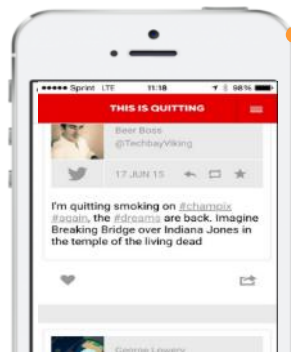
Set price and tax policies.



Include e-cigarettes into smoke-free policies.



Include e-cigarettes into educational initiatives targeting youth and young adults.



Extend treatment for and explore research on treating novel tobacco product use.

**Additional approaches:** Restrict youth access to e-cigarettes in retail settings, license retailers, regulate e-cigarette marketing likely to attract youth, and establish specific package requirements.



## *KEEP THE CONVERSATION GOING*

“

**I wish I had known** how much strength I really had in me.

”

-Smokefree Michele

Brenna VanFrank, MD, MSPH  
Office on Smoking and Health  
bvanfrank@cdc.gov



CDC E-CIGARETTES FACTS  
[www.cdc.gov/e-cigarettes](http://www.cdc.gov/e-cigarettes)



SURGEON GENERAL'S "KNOW THE RISKS"  
[E-cigarettes.SurgeonGeneral.gov](http://E-cigarettes.SurgeonGeneral.gov)



CDC LUNG INJURY RESPONSE  
[www.cdc.gov/lunginjury](http://www.cdc.gov/lunginjury)