

Emerging Nicotine Technologies

Niharika Khanna, MBBS, MD, DGO

Professor Family and Community Medicine



UNIVERSITY *of* MARYLAND
SCHOOL OF MEDICINE

University of Maryland Tobacco team



Family and Community Medicine

Niharika Khanna, MD – PI

Elena Klyushnenkova, PhD – Statistician

Michael Dark, DrPH – Clinical Research Manager

Carissa Kwan, MPH – Data Analyst

Colleen Kernan, MPH – Senior Research Program Coordinator

Psychiatry

Melanie Bennett, PhD – Co-I

Pulmonary and Critical Care Medicine

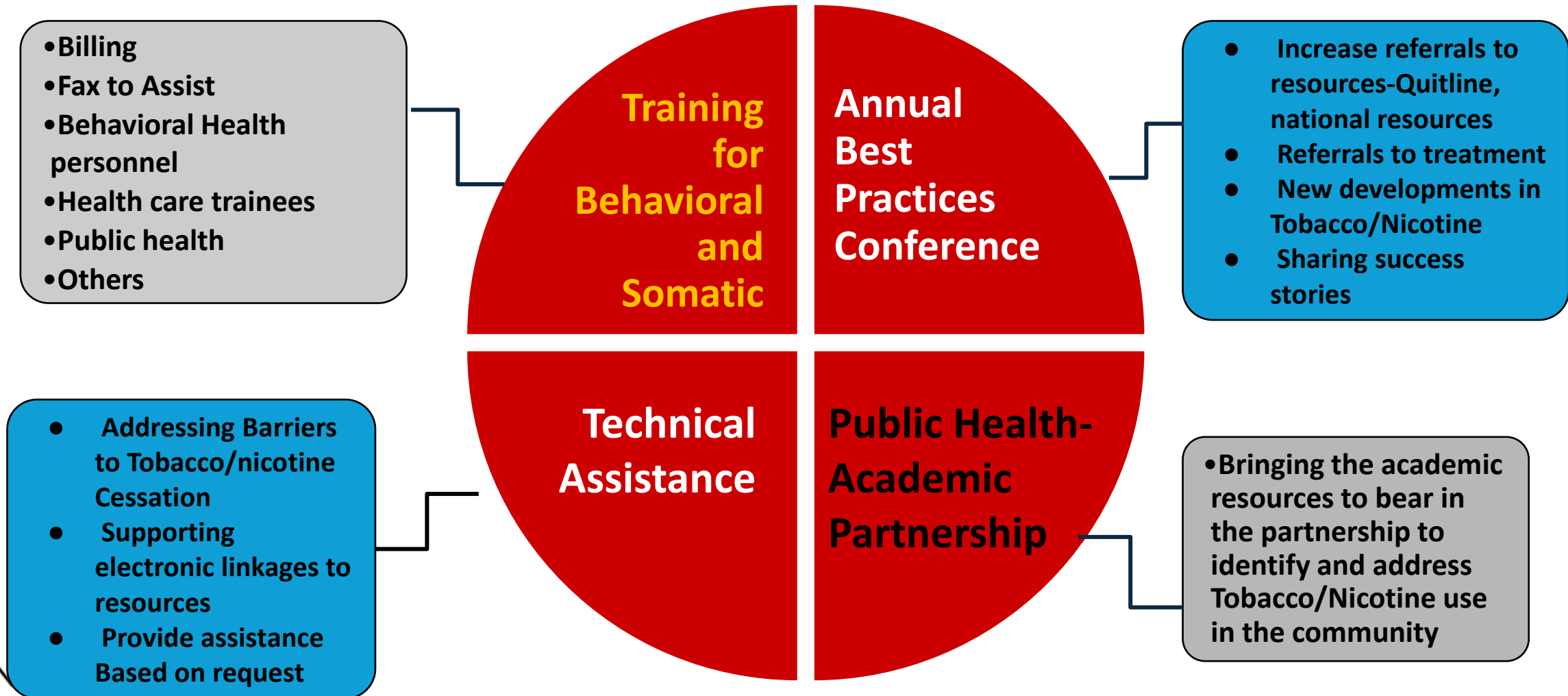
Janaki Deepak, MD – Co-I

Julia Melamed, RN – Nurse/Certified Tobacco Treatment Specialist



I have no Disclosures

Maryland Tobacco Control Resource Center



E-Cigarettes advertisements targeting youth

Dekang Vapor Flavor e-liquids advertisement. The ad is divided into four quadrants, each showing a different flavor: Peach, Banana, Apple, and Orange. Each quadrant includes a small bottle of e-liquid, a box, and images of the corresponding fruit. The Dekang logo and 'MADE IN THE USA' seal are visible in each quadrant.

Flavor Vapes advertisement. A green vapor pen with the brand name 'Flavor Vapes' is shown diagonally. Below it are several slices of a red and green apple. The background is a soft, glowing green.

Witches' Brew E-Liquid advertisement. The text reads 'WITCHES' BREW E-LIQUID™ GOURMET E JUICES AND BREWS™'. The main image is a large, sliced kiwi fruit. Below the kiwi, it says 'New Zealand Kiwi'. The background is a light green with a subtle pattern.

Plum & Room advertisement. The ad features a variety of fresh fruit slices including watermelon, cantaloupe, and honeydew. A circular seal in the bottom right corner reads 'Spiritual Choice Award For Outstanding Flavor - Vapor - The Great Hit - 2013'. The Plum & Room logo is at the bottom left.

Fruit Stripes advertisement. The top part shows a box of 'MASTERS E-LIQUID TECHNICOLOR' with a colorful striped design. The bottom part shows a box of 'FRUIT STRIPES' with 'VAPES IN ACTION' and 'TASTY INSIDE' text.

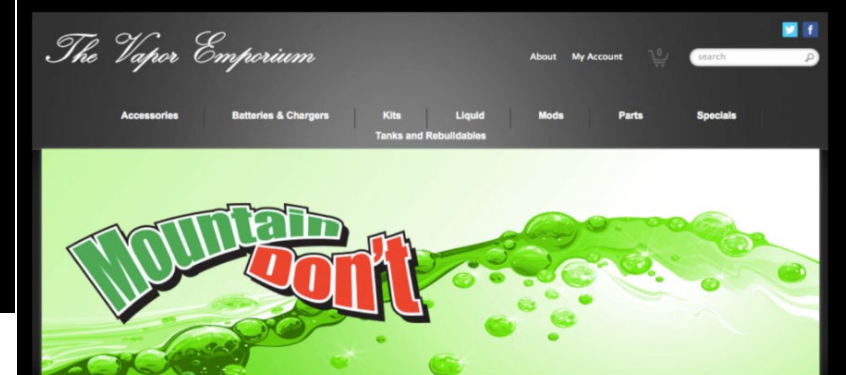
Cubana USA AquaVMax advertisement. The text reads 'Cubana USA AquaVMax Premium USA Made eLiquid'. The image shows two peeled bananas resting on a pile of dark brown tobacco. The background is white with a faint circular logo.

just Pear advertisement. A large, realistic pear is the central focus. To its right is a white bottle of 'FLUX' e-liquid. The text 'just Pear' is written in a stylized font, with 'just' in white and 'Pear' in yellow.

Vapor Vapes advertisement. The text reads 'Vapor Vapes Mountain Dew Burst'. The image shows a clear glass filled with green Mountain Dew, lime slices, and a sprig of mint. Surrounding the glass are several slices of oranges and peaches.

Nirvana Vapor advertisement. The text lists flavors: 'Double Apple', 'Mango Peach', 'Melon Delicious', and 'Citrus Twist'. A red banner says 'New Flavors'. Below, it lists 'Pomegranate Lychee Lama'. The image shows a variety of fresh fruits like pomegranates, lychees, and raspberries. The Nirvana Vapor logo is at the bottom left.

ENDS advertisements targeting young adults



JUUL

VAPORIZED

VAPORIZED

JUUL

JUUL

VAPORIZED

JUUL

VAPORIZED

#SMOKINGEVOLVED

#SMOKINGEVOLVED

JUULvapor.com

#SMOKINGEVOLVED

#SMOKINGEVOLVED

Vaporized

Among U.S. middle and high school students:

E-cigarette use declined from **7.7%** in 2023 to **5.9%** in 2024



Nicotine pouch use remained low (**1.8%**) in 2024



Youth use of any tobacco product is unsafe

Talk with youth about the harms of tobacco product use



bit.ly/mm7335a3

SEPTEMBER 5, 2024

* Data from the 2024 National Youth Tobacco Survey

MMWR

What is a SOCIAL media influencer?

- They aren't traditional pitch people. Think of them more like the coolest kids on the block. They establish a following thanks to their personality, experience or expertise. They share how they're feeling, they share what they're thinking about, they share stuff they like — and sometimes they're paid by the company behind a product and sometimes they're not. They're incentivized to increase their following and, in turn, often their bank accounts. Young people are particularly susceptible to this kind of promotion because their relationship with influencers is akin to the intimacy of a close friend.

https://www.nytimes.com/2024/01/12/opinion/children-nicotine-zyn-social-media.html?unlocked_article_code=1.WU0.1cIT.5XTFgyGWMA5H&smid=url-share



ZYN Influencers

Tucker Carlson and Zyn Advertising Video

Anti-Woke juggernaut Joe Rogan and Shane Gillis

Nelk Boys- Full Send Hosts and more!

New Term MascuZynity

Teens report seeking relief from stress, anxiety, and depression as top reasons for substance use*

Clinicians and public health professionals:
Promote interventions that

REDUCE STRESS



TEACH HEALTHY COPING SKILLS



IMPROVE MENTAL HEALTH




*Self-reported by U.S. adolescents (aged 13-18 years old) who were assessed for substance use disorder treatment from 2014-2022

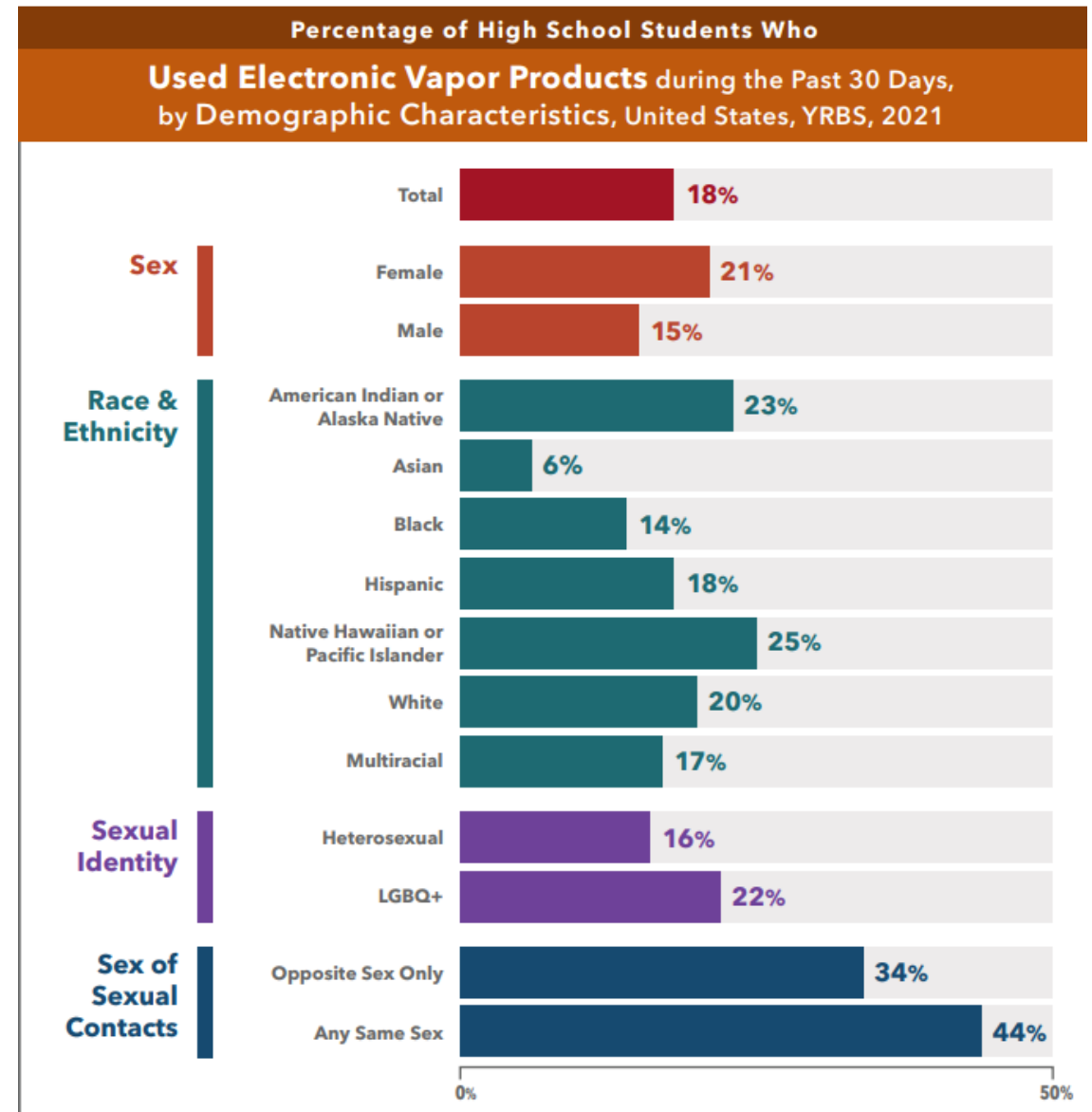
bit.ly/mm7305a1

FEBRUARY 8, 2024

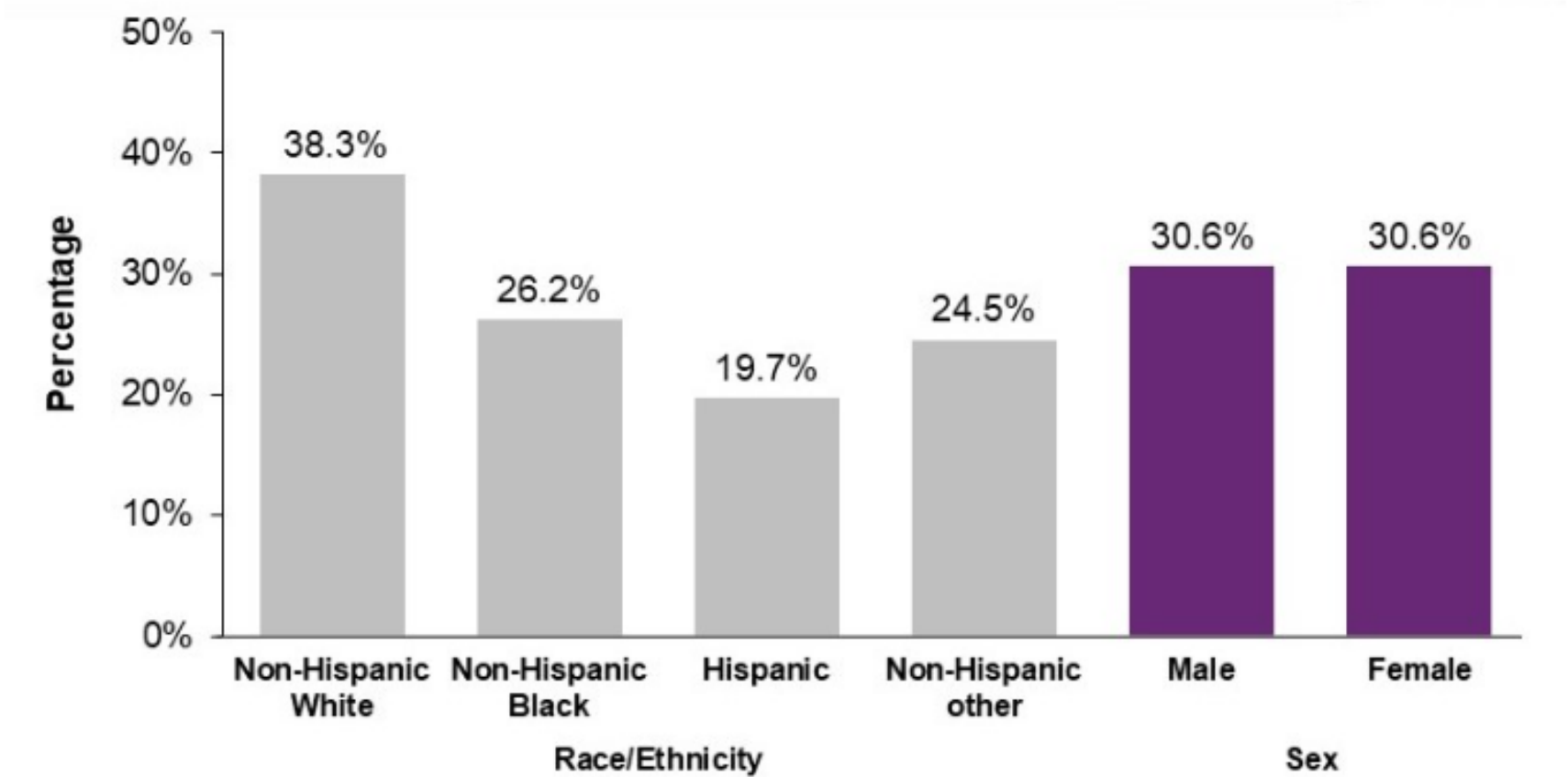
2022-2023 Maryland YRBS/YTS High School Health Disparities by Race/Ethnicity

 2022-2023 MD YRBS/YTS Indicators	RACE & ETHNICITY					
	MD Statewide	Asian	Black	Hispanic/Latino	American Indian Alaska Native	White
<i>Injury and Violence</i>						
Who were in a physical fight on school property	9.9%	4.1%	13.2%	9.4%	17.8%	7.6%
Who were electronically bullied	12.4%	9.9%	10.2%	10.1%	19.0%	15.4%
Did not go to school because they felt unsafe at school or on their way to/from school (past 30 days)	9.8%	5.9%	11.3%	12.5%	18.1%	7.2%
<i>Mental Health</i>						
Actually attempted suicide (one or more times in the past year)	9.4%	6.5%	11.2%	10.0%	12.1%	7.1%
Mental health was most of the time/always not good (past 30 days)	28.1%	21.7%	26.2%	26.0%	26.3%	31.2%
<i>Tobacco, Alcohol, and Other Drug Use</i>						
Students who currently used electronic vapor products frequently	3.9%	1.2%	2.2%	2.8%	6.1%	6.3%
Ever used an electronic vapor product to smoke marijuana	13.9%	3.1%	12.6%	12.7%	17.1%	17.0%
Currently drank alcohol (past 30 days)	17.8%	9.0%	12.0%	14.8%	25.5%	26.1%
Students who currently used marijuana	14.4%	3.5%	17.0%	12.2%	15.5%	14.6%

Vapor Product Use Last 30 Days (High School Students) YRBS



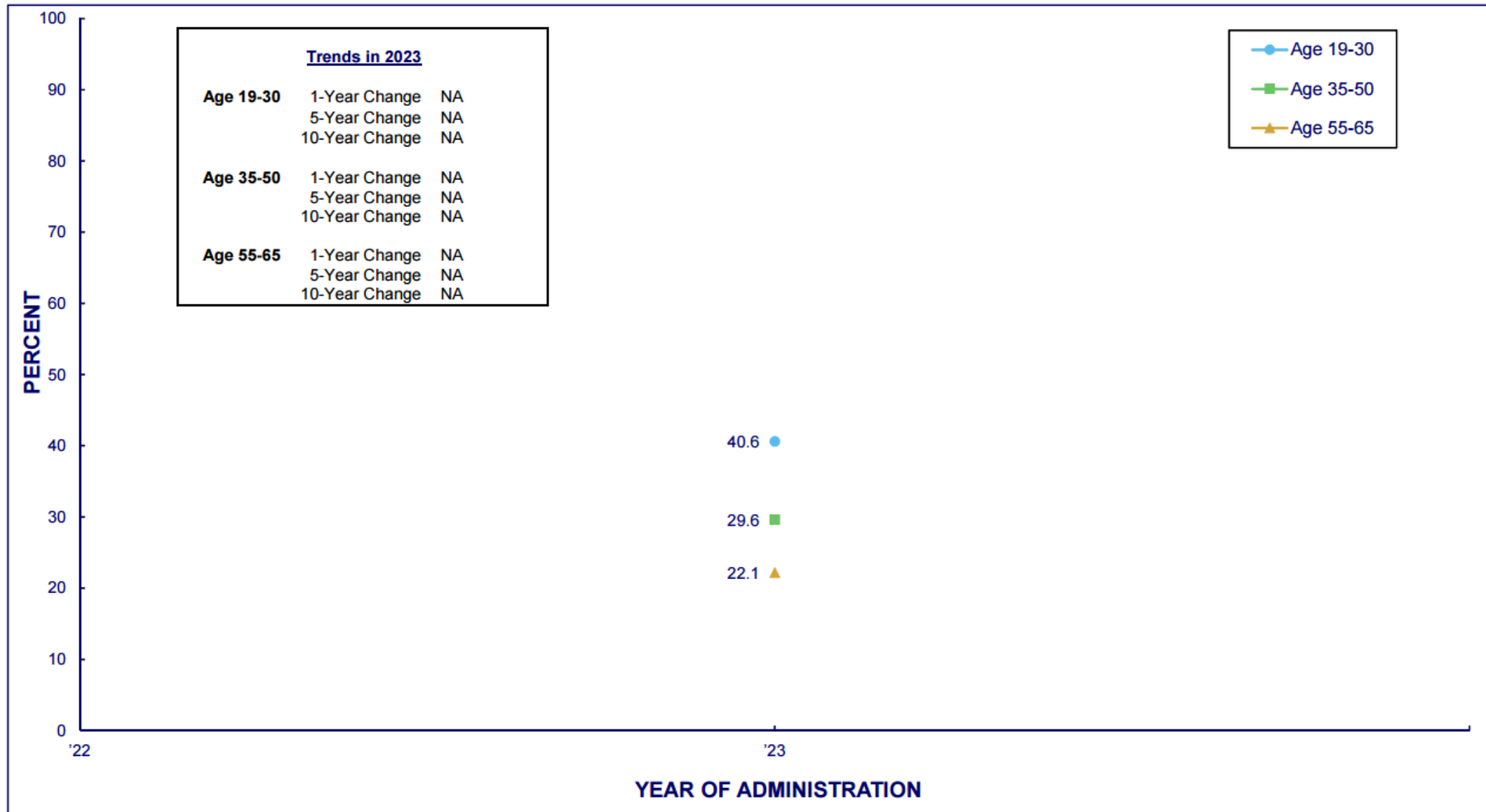
Percentage of young adults (aged 18-24) who had ever used an electronic nicotine product, by race/ethnicity and sex, 2021



Soni, A. and Decker, S. L. *Characteristics of Young Adults Aged 18-24 Who Had Ever Used an Electronic Nicotine Product, 2021*. Statistical Brief #554. February 2024. Agency for Healthcare Research and Quality, Rockville, MD. https://meps.ahrq.gov/data_files/publications/st541/stat554.shtml

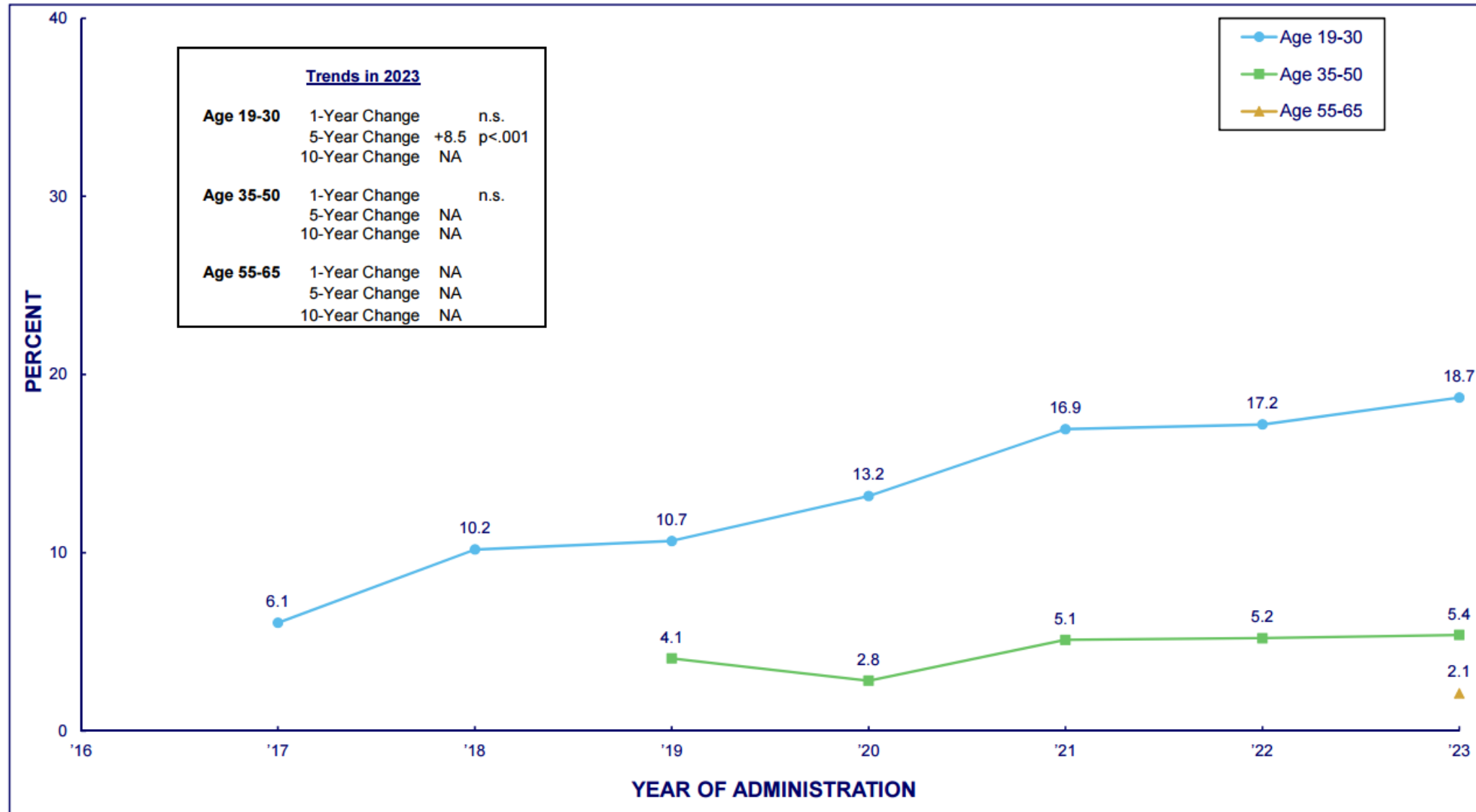
ANY NICOTINE USE¹

Trends in 12-Month Prevalence among Respondents of Modal Ages 19 through 65, by Age Group

¹Includes use of cigarettes, large cigars, small cigars, tobacco using a hookah, smokeless tobacco, or vaping nicotine.

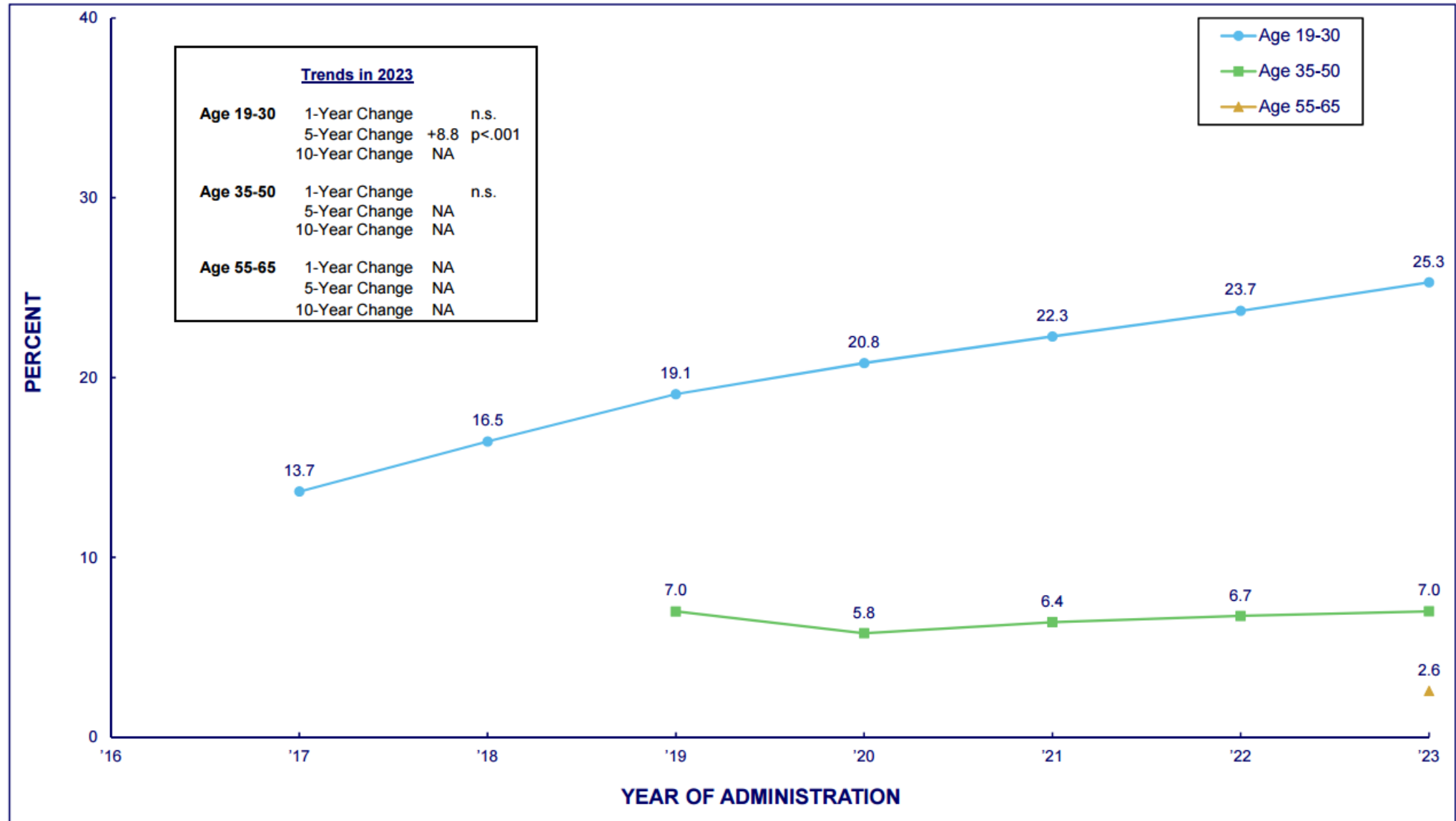
TABLE/FIGURE 37
VAPING NICOTINE

Trends in 30-Day Prevalence among Respondents of Modal Ages 19 through 65, by Age Group

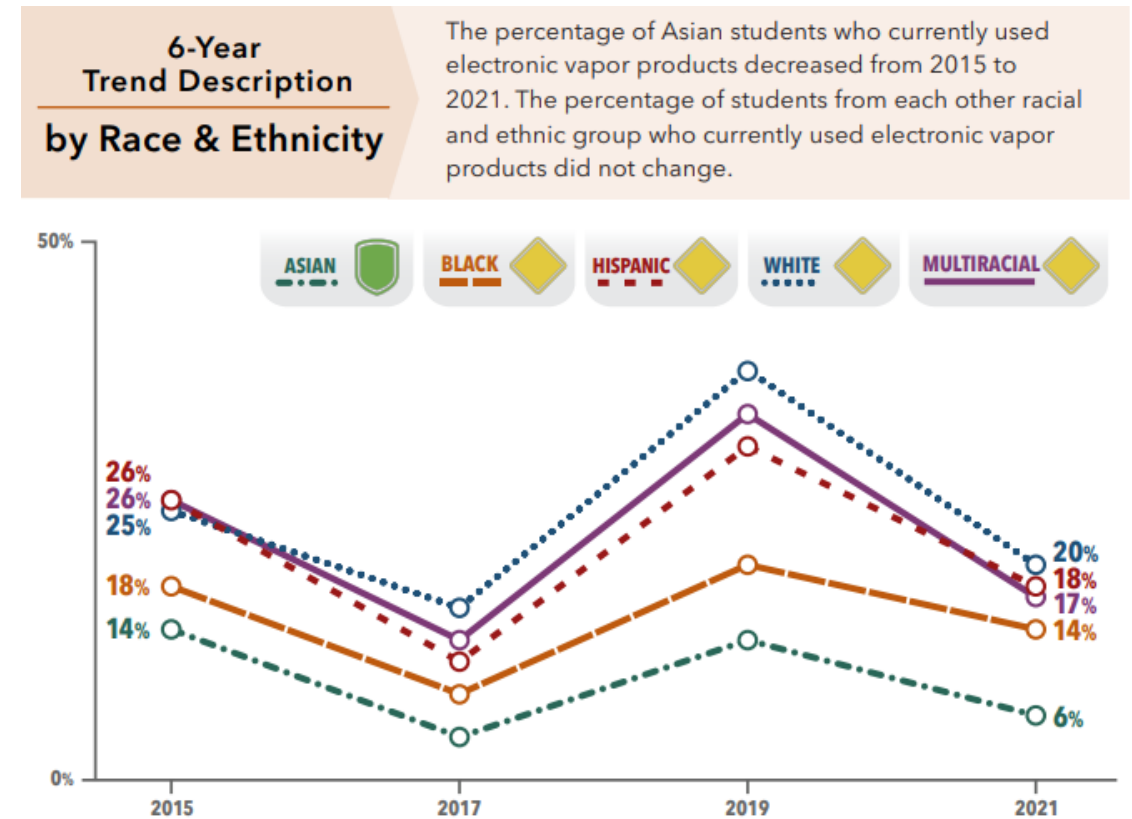
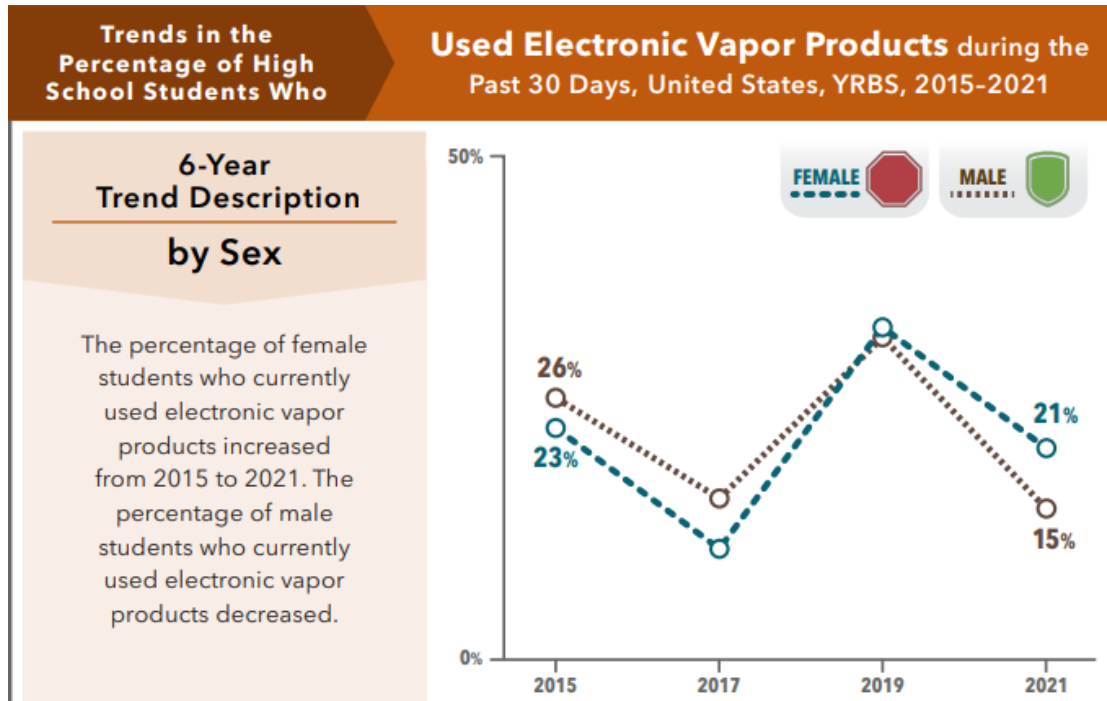


TABLE/FIGURE 35
VAPING NICOTINE

Trends in 12-Month Prevalence among Respondents of Modal Ages 19 through 65, by Age Group



Vapor Product Use by Sex and Race/Ethnicity



Substances in e-cigarette aerosol

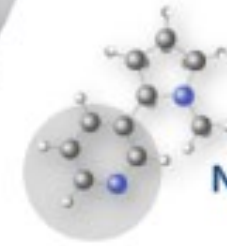
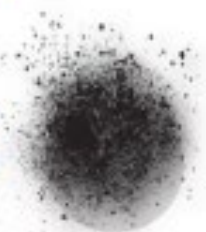


Volatile
organic
compounds



Flavorings

Ultrafine
particles



Nicotine

Cancer-causing
chemicals



Heavy metals
such as nickel,
tin, and lead

Source: U.S. Surgeon General Report, 2016

CDC.gov/Vaping





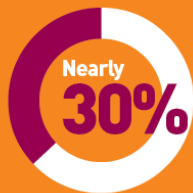
MENTHOL

The chemical compound menthol makes cigarettes easier to smoke and harder to quit.

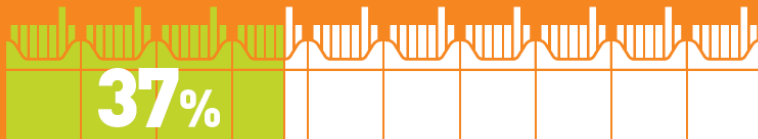


In 2021, 150,000 middle and high school students used menthol cigarettes

From 2018–2020, 56% of Black American adolescents who had smoked in the past 30 days used menthol cigarettes, compared with 47% for all other adolescents.

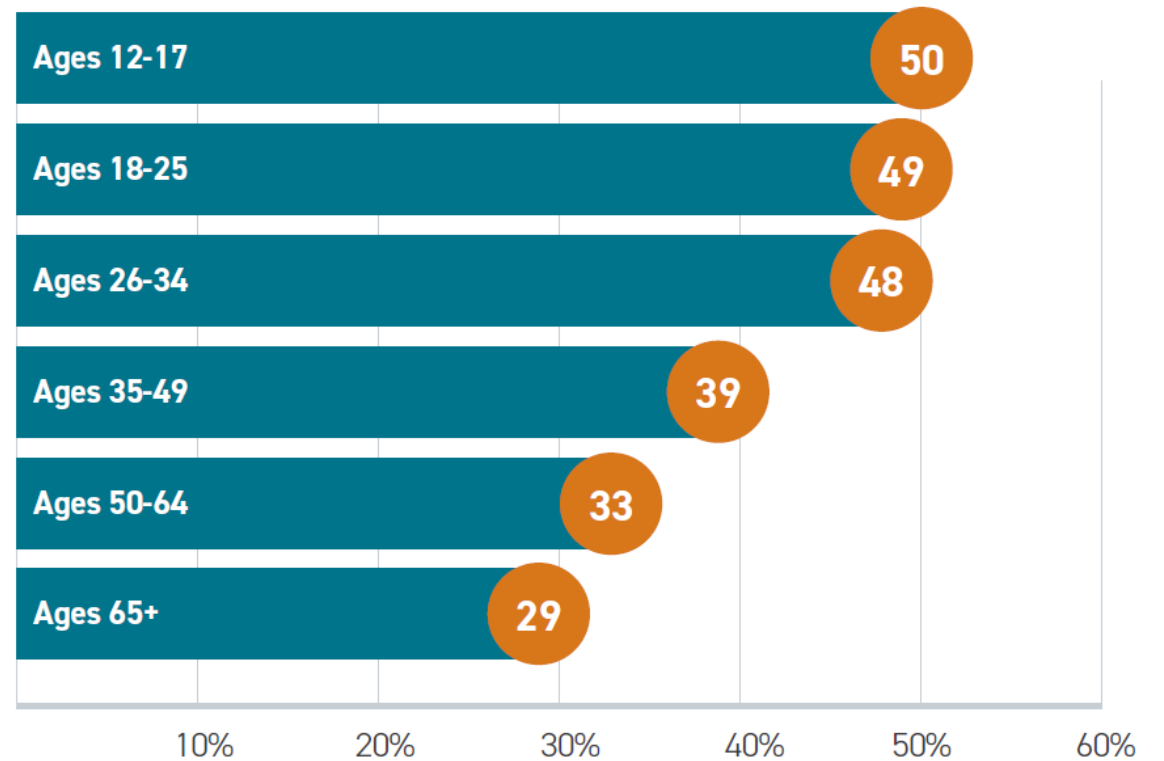


Nearly 30% of high school students who used flavored e-cigarettes vaped menthol in 2021.



Menthol makes up a large portion — 37% in 2020 — of the cigarette market in the U.S.

Menthol cigarette preference among cigarette smokers in the U.S by age, 2018



Source: Tobacco control⁹

Maryland Menthol

US State Menthol Fact Sheets 2023

- Number of Adults who smoke 452,802
- Number of Adults who smoke Menthol cigarettes 214,495 (47.93%)
- Number of Non-Hispanic Black Adults who smoke 113,311
- Number of Non-Hispanic Black Adults who Smoke Menthol cigarettes 84,044 (74.16%)

- Number of Localities prohibiting Menthol sales 0
- Number of Adults Who Currently Smoke and Are Seriously Considering Quitting Within the Next 6 Months 211,516 (50.99%)

Anatomy of an E-Cigarette

THE E-CIGARETTE



THE CARTRIDGE

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

THE ATOMIZER

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

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 BATTERY

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



Mod Box

It is a 3rd generation device that is modifiable ("Mod") allowing users to change the voltage, coils and wicks.



Sub-Ohm Tank

It is made of plastic or metal with transparent casing so liquid levels can be seen. It contains a lower resistance coil that allows the liquid to heat up faster.



Cartridge

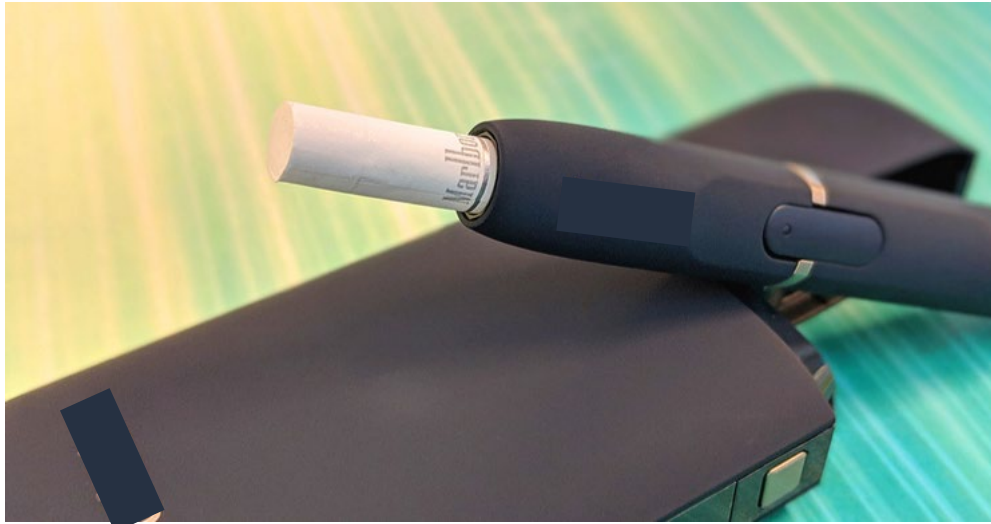
It is made of plastic or metal with transparent casing so liquid levels can be seen. It contains an atomizer that heats up the e-liquid.



E-Liquid

E-liquid is contained in a pod, cartridge or tank. It is made up of a mixture of substances that includes nicotine, cannabis, and/or flavoring.

Nicotine delivery devices



<https://www.ccjm.org/content/86/12/789>, <https://truthinitiative.org/research-resources/emerging-tobacco-products/more-e-cigarettes-are-entering-market-increasingly>, <https://truthinitiative.org/research-resources/emerging-tobacco-products/what-zyn-and-what-are-oral-nicotine-pouches>, <https://truthinitiative.org/research-resources/emerging-tobacco-products/6-important-things-know-about-iqos-new-heated>,

Zyn-made by Swedish Match are Nicotine Pouches Swedish Match was bought by Phillip Morris for \$ 16 Billion



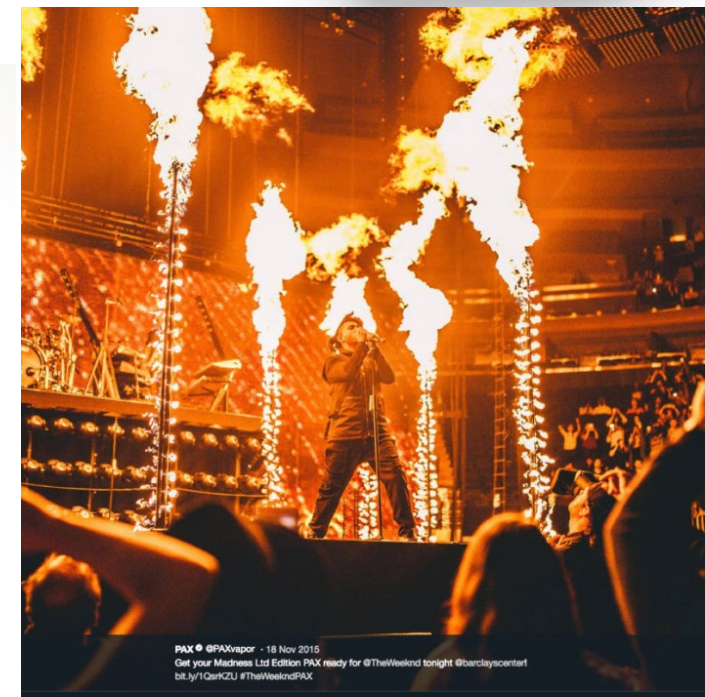
ZYN (nicotine pouches), General (snus), Longhorn (moist snuff), Onico (pouch products with neither tobacco nor nicotine), America's Best Chew (chewing tobacco), Thunder (chew bags), Oliver Twist (tobacco bits), White Owl (HTL, homogenized tobacco leaf cigars), Game (natural leaf cigars), Fiat Lux (matches), and Cricket (lighters)



Heated Tobacco



HEATBAR™-Gebrauchsanweisung



Top 10 Vapor Product Brands in the US



Example of how NYTS data is used by Tobacco Industry

POPULATION HARM REDUCTION

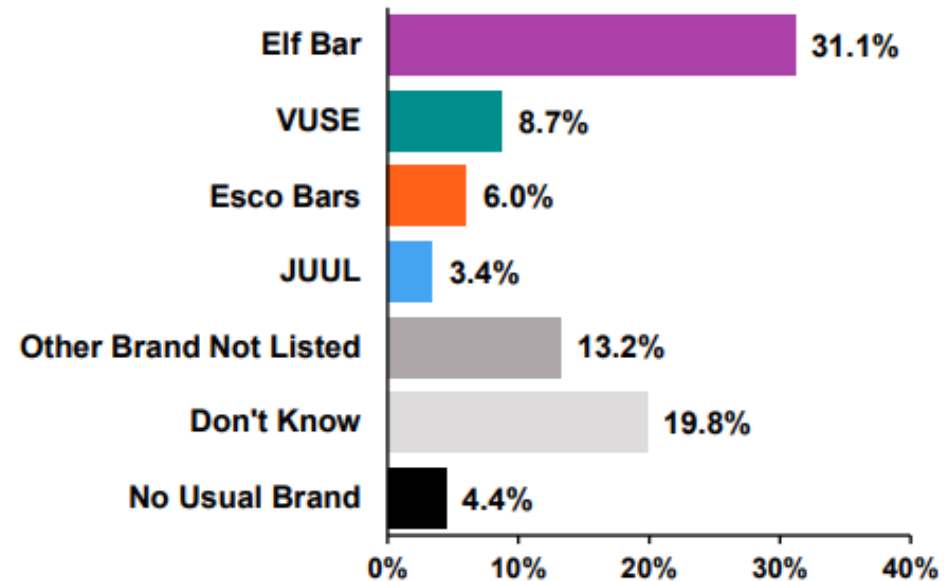
NJOY Brand Detection Trends in NYTS

NYTS	NJOY Usual Brand Used Among Middle and High School E-Cigarette Users	Last 30-Day ENDS Use % (95% CI)
2021	NA ^a	11.3 (9.7–13.0)
2022	NA ^a	14.1 (12.4–16.0)
2023	NA ^a	10.0 (8.8–11.4)

^aData not shown because responses were too low to determine statistically reliable estimates

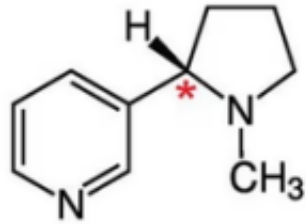
Sources: Cullen et al., 2019; Wang et al., 2020; Park-Lee et al., 2021; Cooper et al., 2022; Birdsey et al., 2023
 NYTS=National Youth Tobacco Survey; CI=confidence interval; ENDS=electronic nicotine delivery system; NA=not applicable

2023 Usual Brand Used Among Middle and High School Current E-Cigarette Users



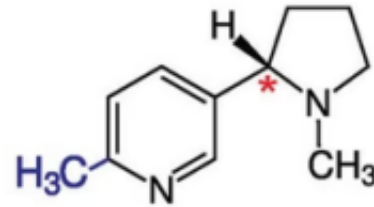
National Youth Tobacco Survey, 2023. MMWR Morb Mortal Wkly Rep 2023;72:1173–1182.
 DOI: <http://dx.doi.org/10.15585/mmwr.mm7244a1>

Exploiting Loopholes - 6-Methyl Nicotine



NICOTINE

- Well established and researched molecule
- Exempt from the UK psychoactive substances act*
- Marketed via the US PMTA pathway



6-METHYL NICOTINE

- Extremely limited research into safety and efficacy
- Banned in the UK via the psychoactive substances act
- Currently not illegal for sale in the US and not a deemed tobacco product

Thalidomide (R)-enantiomer = Sedative

Thalidomide (S)-enantiomer = Teratogenic

*The 2016 Psychoactive Substances Act bans the production, supply or possession of any substance capable of producing a psychoactive effect, with the exception of caffeine, alcohol, foods, medicines and nicotine/tobacco.



6-Methyl Nicotine - Examples



US - SPREE BAR - Metatine™

“An undefinable urge to go on a spree lives in all of us”

- Nicotine tax exempt in many states
- Legal across nearly all 50 states
- PMTA exempt

*As per spreebar.com website (June 2024)



UK - Aroma King Pouches - NoNic™

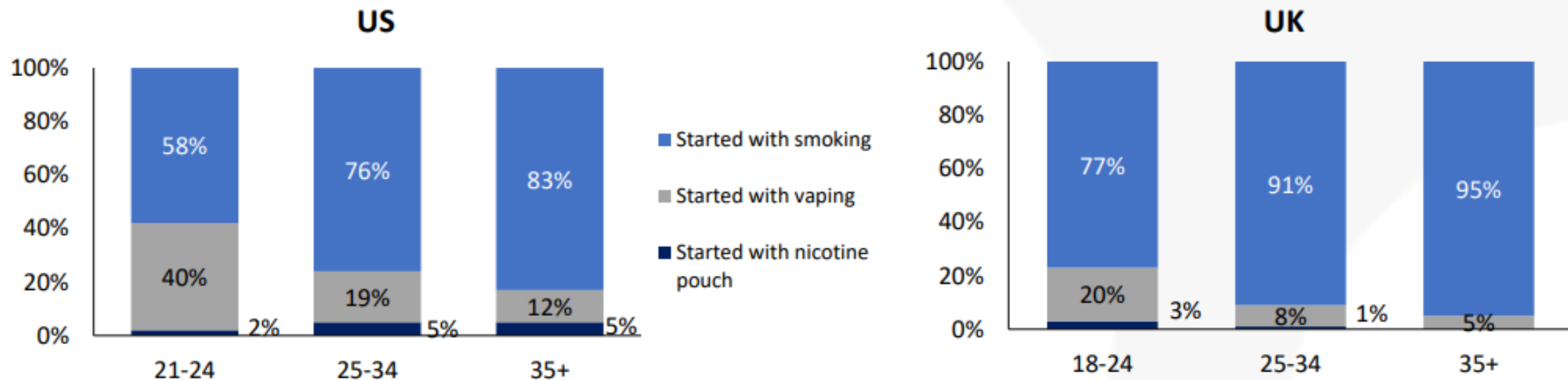
“NoNic™ is a non-toxic, non-addictive and non-psychoactive substance, and has an effect just like nicotine.”

*As per mkpodplug.co.uk website (June 2024)

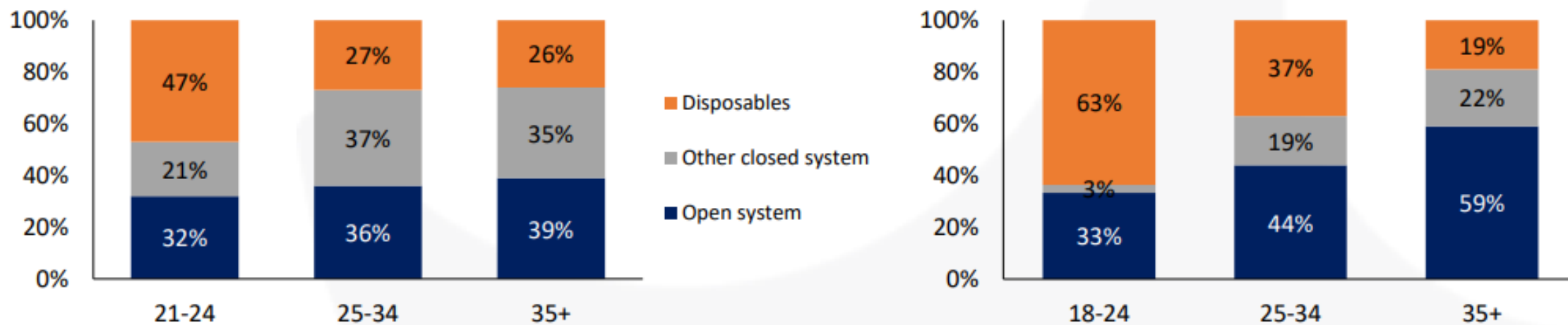


Initiation of tobacco/nicotine with vaping

Ex and current vapers – entry to nicotine consumption



Most used current device type who started with vape

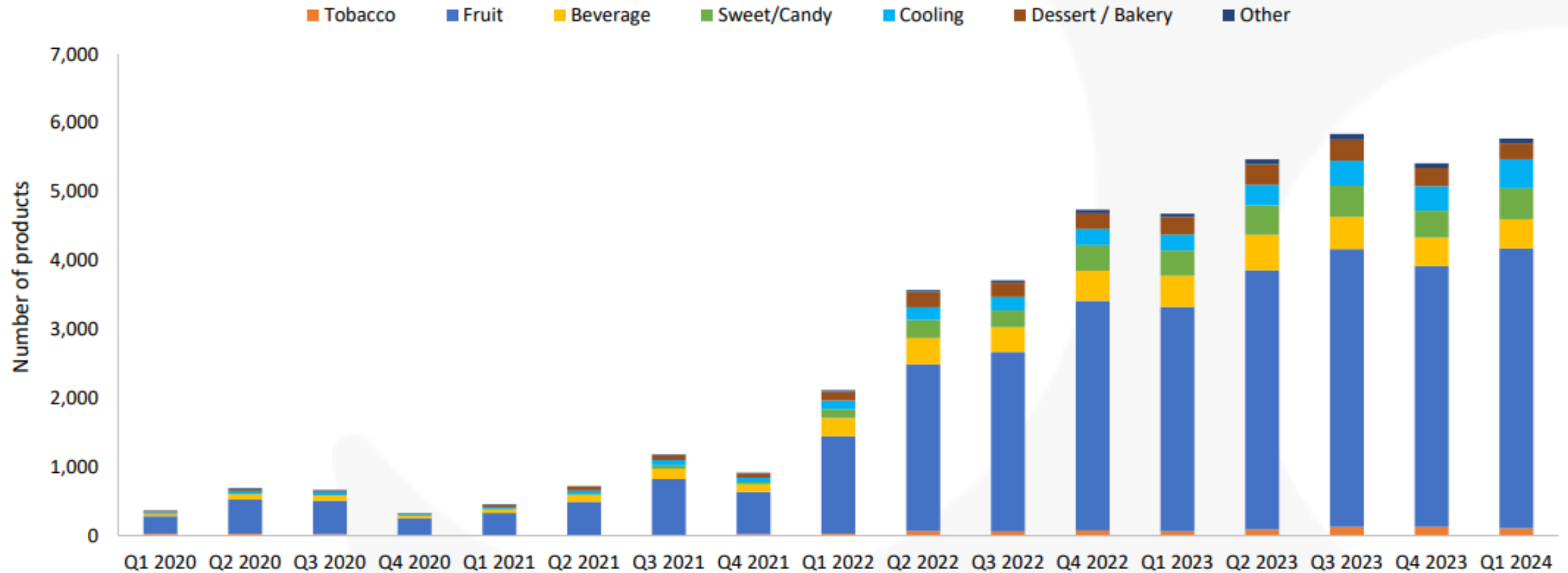


Notes: ex and current vapers: US: 21-24: n=199, 25-34: n=469, 35+: n=1160, UK: 18-24: n=123, 25-34: n=312, 35+: n=598

Source: ECigIntelligence vaper consumer survey, August 2022

US Disposables: only 2% of products are tobacco flavoured

Flavour category of disposable e-cigarettes in the US
(top 5 online retailers)



GENOTOXICITY HAZARD ID: TOOLS FOR WEIGHT OF EVIDENCE (WOE) EVALUATION OF DATA-POOR CHEMICALS

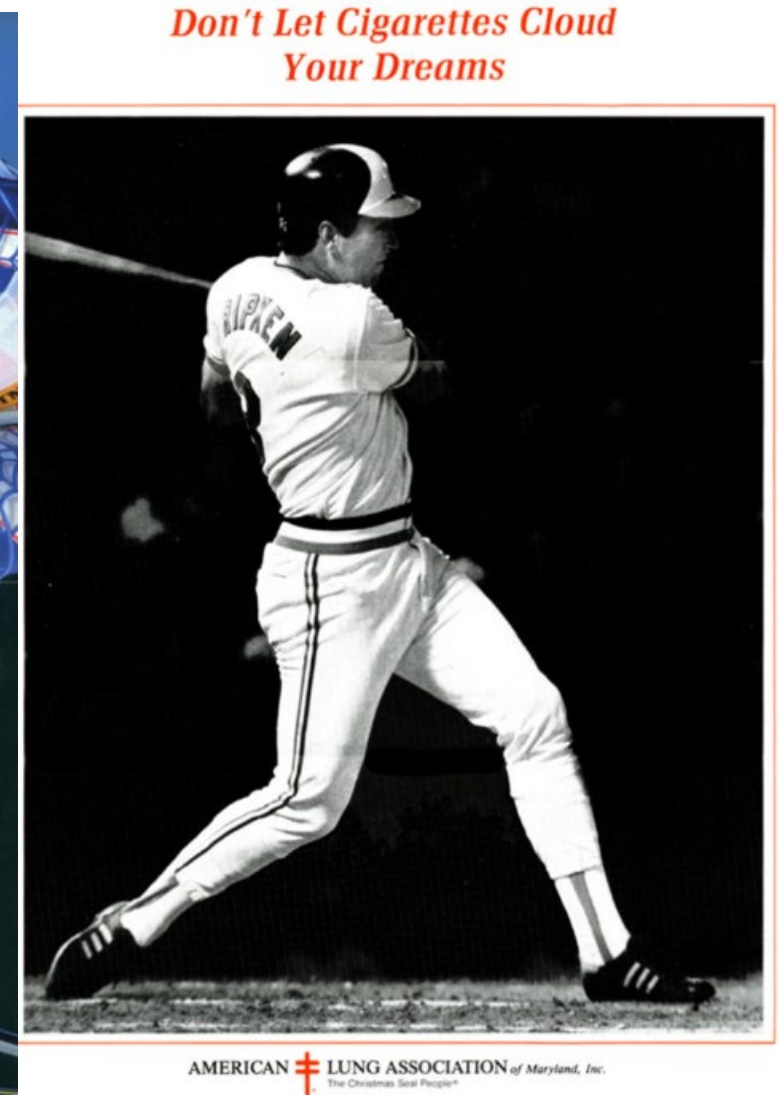
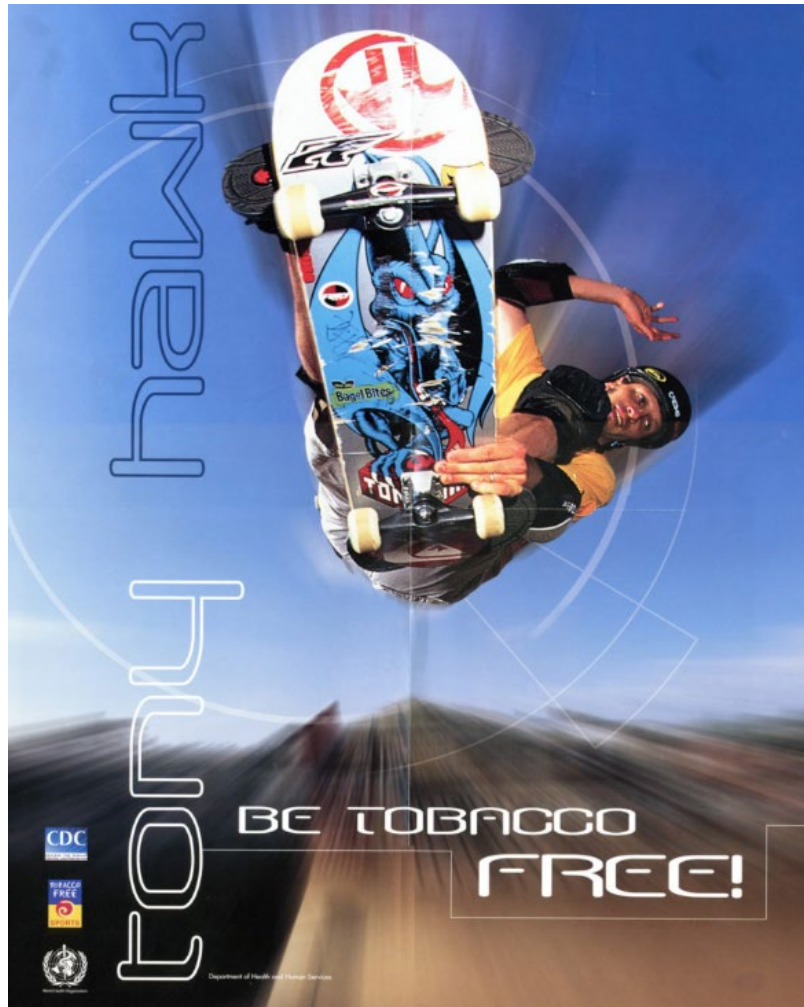


- Data-poor chemicals
 - Chemicals with no information
 - Conflicting genotoxicity results (e.g., clear positive and negative)
 - Studies with positive results that have methodological issues that prevent a confident conclusion (e.g., issues with study design or statistical power) may be considered as data-poor chemicals
- New Approach Methods (NAMS), such as 'Computational Toxicology' tools may be used for identifying genotoxicity in data-poor chemicals:
 - Predicted by (Q)SAR to be Ames positive using computational approaches
 - Predicted positive using read across from a known carcinogen
 - High throughput clastogenicity screening (Hung, 2020)

COHORT STUDY CONSIDERATIONS: EXPOSURE

- Typically, in observational studies, participants do not receive additional instructions on product use
- **Flavor use can be dynamic** over the duration of a study. Assessments of flavors used at each point of follow-up might include:
 - Exclusive use of any one flavor
 - Primary use of any one flavor
 - Roughly equal use of two or more flavors
 - Experimentation with any flavors
 - All flavors used
- Analyses should adjust appropriately (e.g., for use of other tobacco or cessation products)
- Assessments of flavors and products used should be **quantitative and justified**

Smoking Cessation advertising



How to Interpret Patient History

What nicotine wants you to think	The truth
"I'm not addicted. I can stop whenever I want."	Nicotine makes the patient feel in control but never able to stop right now. "Maybe next time, I'm really stressed right now."
"If I stop smoking, my anxiety and irritability will make me miserable."	These are withdrawal symptoms that make tobacco use a chronic, relapsing disorder. Tobacco relieves the immediate symptoms but exacerbates them long-term.
"The meds are dangerous."	Nicotine wants the patient to be more afraid of the treatment than the dependence. The meds are safe and effective when used correctly.
"Vapes are safer than cigarettes, so I'll switch." The truth	There is no safe level of exposure to a tobacco product. Switching can expose patients to additional health risks, and they may become addicted to the new product.

Patient Conversations

- Have you ever used vaping devices before, like Juul or Elf Bar?
- During the past 30 days, how many days did you use a vaping device?
- Do you use any flavoring, like fruit, menthol etc. when using a vaping device?
- Have you ever used nicotine pouches, like Zyn?
- During the past 30 days, how many days did you use a nicotine pouch?
- During the past 12 months, did you ever try to quit using all tobacco products?
- Do you use a vaping device for smoking cessation?
- Do any of your friends or family use a vaping device, like Juul or Elf Bar?

Can't patients stop cold turkey?

- Nicotine dependence can be even harder to treat than opioid dependence
- Nicotine hijacks the brain into only feeling safe when it is exposed to nicotine. It "tells" the patient common myths and promotes self-sabotage



How to Quit Resources

- Live Vape Free
 - <https://quitnow.net/LVFMD?client=LVFMD&clientId=11501449>
- Maryland Quitline: 1-800-Quit-Now (1-800-784-8669)
 - Spanish: 1-800-335-3569
 - Mandarin and Cantonese: 1-800-838-8917
 - Korean: 1-800-556-5564
 - Vietnamese: 1-800-778-8440
- University of Maryland Medical Center Tobacco Health Practice
 - <https://www.umms.org/midtown/health-services/pulmonary-health/quit-smoking/tobacco-health>

UMMC Tobacco Health Practice

- Director: pulmonologist Dr. Janaki Deepak
- Clinic is integrated with pulmonary clinic to provide comprehensive lung health exam
- Lung Cancer Screening
- Free sample meds
- Combination med therapies + coaching
- Most insurances accepted, no referral needed
- Appointments: call 410-328-8141 or email Sherri Webster:
SWebster@som.umaryland.edu



UMMC THP is located at the Midtown Campus: 800 Linden Ave,
9th Floor, Baltimore, MD 21201

FDA- approved medications

**Combine
controller &
rescue types for
best results**

- **Controllers: long-acting meds to make tobacco less satisfying**
 - Varenicline (CHANTIX)
 - Bupropion (Wellbutrin)
 - Nicotine Patch
- **Rescues: short-acting meds to be used throughout the day for quick relief**
 - Nicotine lozenge
 - Nicotine gum
 - Nicotine nasal spray
 - ~~Nicotine inhaler~~ - *recently discontinued due to supply shortage*

Patients should start meds BEFORE stopping tobacco.

Continue meds for at least 3-6 months of abstinence, then wean slowly. Patients who stop meds early are more likely to relapse.

The Vape Experiment

EXPERIMENT# 20-A
RESULTS:
Vaping nicotine can permanently change your brain.



Nicotine use can lead to shorter attention span and make it harder to remember things.

WHEN YOU'RE READY TO QUIT, WE'RE READY TO HELP.
TEXT 'VAPEFREE' TO 875-373
TheVapeExperiment.com


EXPERIMENT# 009
RESULTS:
It's not harmless water vapor.
It's aerosol filled with toxic chemicals.



Inhaling chemicals in vapes, including flavors, may make it hard for you to breathe. Permanently.

WHEN YOU'RE READY TO QUIT, WE'RE READY TO HELP.
TEXT 'VAPEFREE' TO 875-373
TheVapeExperiment.com

EXPERIMENT# 011
RESULTS:
Inhaling formaldehyde (aka embalming fluid) can be deadly.
And you're vaping it.



Inhaling the same chemical used in preserving dead bodies can cause nausea, asthma, even cancer.

WHEN YOU'RE READY TO QUIT, WE'RE READY TO HELP.
TEXT 'VAPEFREE' TO 875-373
TheVapeExperiment.com

EXPERIMENT# 0525
RESULTS:
Ingredients in vapes can cause illness and death.



Nicotine poisoning, organ damage, even death. If you think vaping is harmless, think again.

WHEN YOU'RE READY TO QUIT, WE'RE READY TO HELP.
TEXT 'VAPEFREE' TO 875-373
TheVapeExperiment.com

www.TheVapeExperiment.com

truth
initiative
SMITHSONIAN INSTITUTION
NATIONAL ACADEMIES OF SCIENCES

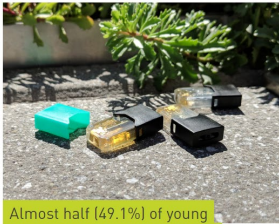
A toxic, plastic problem

E-cigarette waste and the environment

Vaping, still at epidemic levels among youth with about one in five high school students using e-cigarettes in 2020, generates a significant amount of toxic and plastic waste. Many popular e-cigarettes, like JUUL, are pod-based with single-use plastic cartridges containing nicotine. Generating even more waste are disposable e-cigarettes like Puff Bar, which are designed entirely for one-time use and have skyrocketed in popularity with a 1,000% increase in use among high school students between 2019 and 2020.²

With a 399.73% increase in retail e-cigarette sales (excluding internet sales and tobacco-specialty stores) from 2015 through 2020, the environmental consequences of e-cigarette waste are enormous. Instead of taking responsibility for the disposal of their products, tobacco companies engage in clean-up initiatives designed to make them appear "green" — just one of many tactics designed to overhaul their reputations (read the Truth Initiative report "Seeing Through Big Tobacco's Spin").

More than half (51%) of young e-cigarette users reported disposing of used e-cigarette pods or empty



Almost half (49.1%) of young people don't know what to do with used e-cigarette pods and disposable devices.

disposal methods for e-cigarettes and e-liquid



Tips for Safe Disposal of E-Cigarettes and E-Liquid Waste

E-cigarettes, including rechargeable batteries and the cartridges and bottles that contain e-liquids (liquid nicotine mixtures), can pose a threat to human health and to the environment if they are not disposed of properly. E-cigarette and e-liquid waste



Resources

- The Vape Experiment
 - <https://www.smokingstopshere.com/vape/>
- E-cigarette Visual Dictionary
 - https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/ecigarette-or-vaping-products-visual-dictionary-508.pdf
- Live Vape Free
 - <https://quitnow.net/LVFMD?client=LVFMD&clientId=11501449>
- Talk with Your Teens: Tip Sheet
 - <https://www.cdc.gov/tobacco/e-cigarettes/youth.html>

*THERE IS NO SAFE TOBACCO/NICOTINE PRODUCT-
INCLUDING E-CIGARETTES*

Thank you! Questions?

The Maryland Tobacco Control Resource Center is supported by Maryland Department of Health (MDH) Interagency Agreement PHPA-1991/OCMP#24-22180-G, awarded to the University of Maryland Baltimore by the MDH Center for Tobacco Prevention and Control. Paid for (in part) by Maryland Cigarette Restitution Funds.



References

- Stanford Research into the Impact of Tobacco Advertising Accessed 08072024
<https://tobacco.stanford.edu/ecigs/flavors/fruits/>
- Allen, C. (2024, 06). *Insights into youth access prevention through age-gating technology* [PowerPoint slides]. Broughton Group.
- Baude, T. (2024, 06). *The global regulatory challenge* [PowerPoint slides]. Imperial Brands.
- Cecil, T.L. (2024, 06). *FDA regulation update* [PowerPoint slides]. Food and Drug Administration: Center for Tobacco Products.
- Darnell, J. (2024, 06). *Market insights and trends in the novel nicotine industry* [PowerPoint slides]. ECigIntelligence.
- Hong, J. (2024, 06). *Ploom System: The harm reduction opportunity for heated tobacco in the U.S.* [PowerPoint slides]. Altria Client Services.
- Vergara, K. (2024, 06). *Advancing harm reduction for adults who smoke* [PowerPoint slides]. Altria Client Services.