

# Understanding Flavored E-Cigarette/Vaping Product Use Among Youth and Young Adults

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# Goals of Today's Presentation

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1. Provide an overview of currently marketed flavored electronic cigarettes
  2. Inform how flavoring in e-cigarettes increases product appeal and how flavors impact the product sensory experience
  3. Disseminate current trends in tobacco product use among youth and young adults
  4. Learn about the co-occurrence of tobacco and cannabis use behaviors among youth/young adults
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## About Me

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- Assistant Professor in the Department of Psychiatry at the Yale School of Medicine
- Research I am a part of at Yale includes...
  - Youth and Young Adult Tobacco Use Research
    - Surveys and focus groups to assess youth/young adult use behavior
    - Develop treatments for youth and young adult nicotine users
    - Some examination of cannabis use behaviors in these populations
  - Tobacco Regulatory Science
    - Inform government decision and policies about tobacco
    - Human lab research examining flavors and nicotine in e-cigarettes to understand their role in use behavior
    - Examine sex differences in response to e-cigarette flavors

# Our Team



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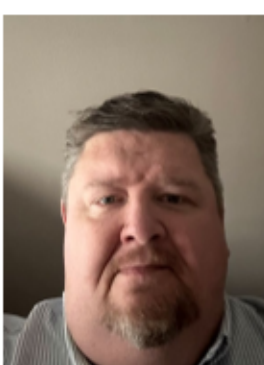
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# Overview of Tobacco & Nicotine Products

## Combusted



## Non-Combusted

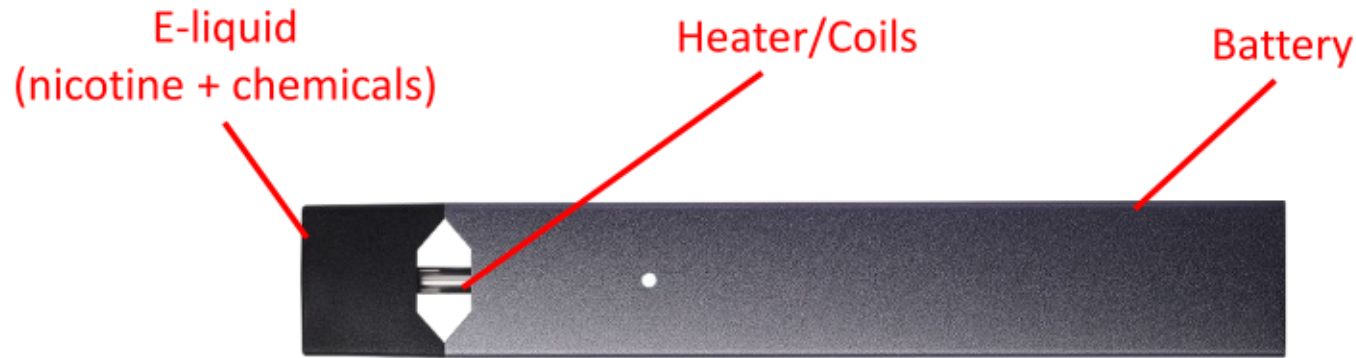


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# Nicotine E-Cigarettes

# E-Cigarettes

- Battery operate devices used to inhale aerosol that may contain nicotine, flavorings, and other chemicals.



1. The user breathes in or pushes a button

2. The heater turns on and boils the e-liquid

3. The “vapor” forms inside the device

4. The user breathes in the nicotine “vapor” and then exhales (just like with smoking)

# Evolution of E-Cigarette Device Types

First generation E-cigarettes  
“Cig-a-likes”



Second generation E-cigarettes  
“Vape pens”



Third generation E-cigarettes  
“Mods/APVs”





# Evolution of E-Cigarette Device Types

## JUUL Devices

- Popularity rose in 2017-2018
- Had the largest retail sales in 2018
- Have pods pre-filled with e-juice
- Use nicotine salt which makes it easier to inhale higher levels of nicotine



## Other “Pod” Type Devices

- Designed to look similar to JUUL
- Used pre-filled pods
- Use nicotine salt which makes it easier to inhale higher levels of nicotine



# Evolution of E-Cigarette Device Types

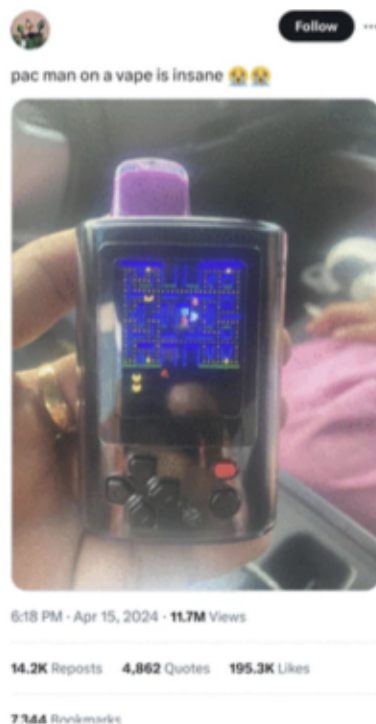
## Disposable Devices

- Taken over the market as the most common device type
- Low cost (~\$10.00-\$15.00)
- Contain more e-liquid compared to older device types
- Higher average nicotine concentration, primarily nicotine salt
- Wide range of flavors, including multi-component flavors
- Transient marketplace



# Evolution of E-Cigarette Device Types

- New e-cigarette devices continue to emerge on the marketplace, like ‘Smart Vapes’.
- Like the majority of other e-cigarettes/vapes, illegally marketed and sold



# Other Vaping Device Types



**THC Vapes**



**CBD Vapes**



**Delta-8, -10**

# What is in a Nicotine E-Cigarette?

- Propylene Glycol (throat hit)
- Vegetable Glycerin (clouds)
- Nicotine
- Flavors
- Other Additives

*The majority of youth JUUL users are unaware of its high nicotine concentration (Morean et al., 2019)*

## Freebase nicotine

- Labeled as mg/ml
- Typically freebase levels in e-cigs ~3mg/ml to 18mg/ml



## Nicotine Salt

- Freebase nic + acid
- Described in %
- Common commercial level ~5% (~50mg/ml)
- Data suggest less irritating, easier to inhale than freebase





## Nicotine Effects

- Many popular e-cigarettes have **very high** nicotine levels
- Nicotine is quickly addictive
- Nicotine is harmful for young brains



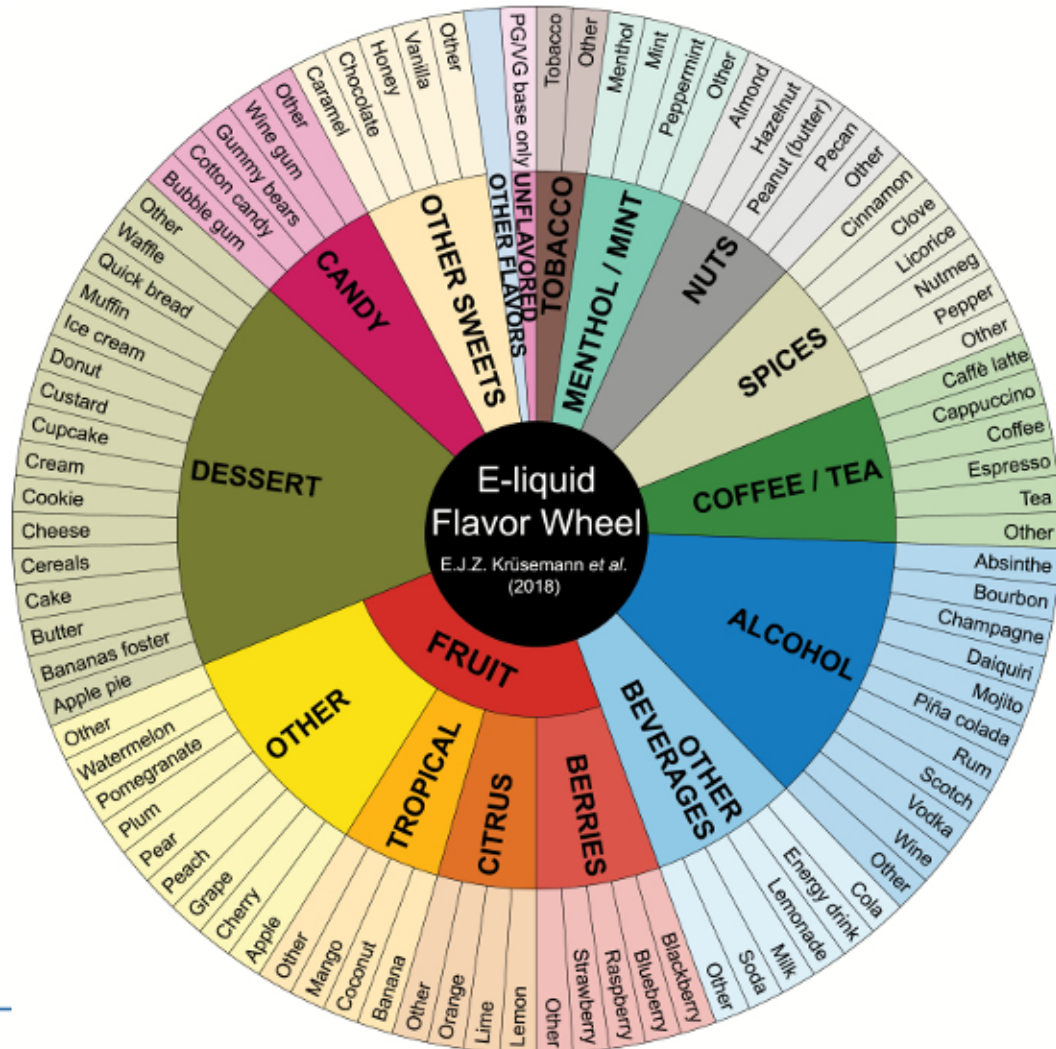
**IMPULSIVE**

## What is in an E-Cigarette?

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- Propylene Glycol (throat hit)
- Vegetable Glycerin (clouds)
- Other chemicals
- Nicotine
- **Flavors**

# E-liquid Flavors



- E-liquid flavors are numerous (14,000+)
- Flavors are often multi-component combining two or more palatable flavors
- Established major source of appeal among youth and young adults



# E-liquid Flavors

- There are thousands of different flavors and many ingredients used to create these flavors
- Some flavorants say they are “GRAS” or “Generally Recognized as Safe” but this is not tested for inhalation
- Some flavors, like coolants, have unique effects on e-cigarette use

Sweet/Dessert Type Flavoring Examples	Cooling Type Flavoring Examples
Vanillin	Menthol
Acetoin	Carvone
Diacetyl	Menthone
Pentanedione	Wilkinson-Sword (WS) -3
Cinnamaldehyde	WS-23
Furfural	
Maltol	
Coumarin	
Benzaldehyde	

# Cooling E-liquid Flavors

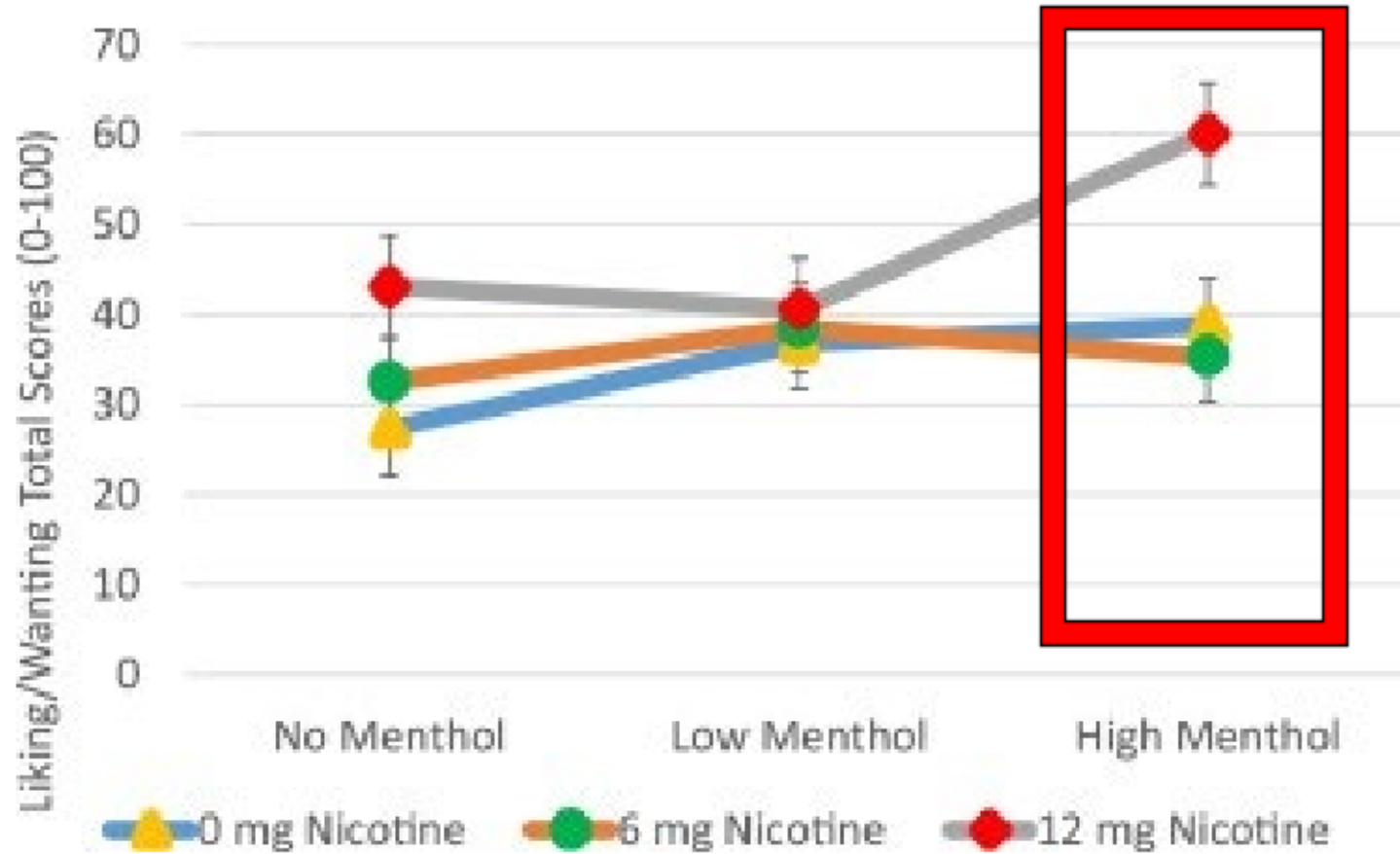
- Many tobacco products, including e-cigarettes, use cooling flavors to enhance e-cigarette appeal
- Cooling can reduce irritation, make it easier to inhale nicotine, and improve taste
- E-cigs that do and do not advertise cooling often contain coolants

## Cooling Type Flavoring Examples

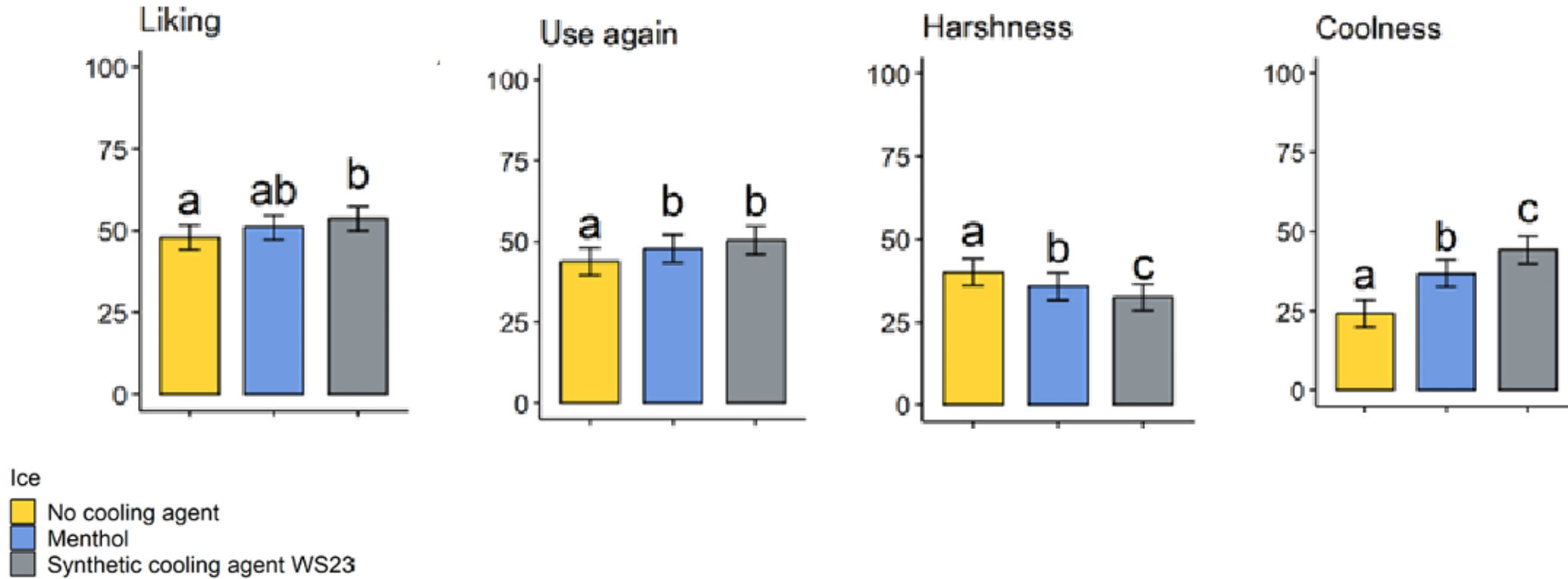
Menthol  
Carvone  
Menthone  
Wilkinson-Sword (WS) -3  
WS-23



# Cooling E-Liquid Enhances Drug Reward at Higher Nicotine



# E-liquid Flavors: Cooling



# E-liquid Flavors: Cooling

- Cooling flavor is linked to heavier use & dependence
- In a sample of high schoolers, those that use cooling flavors were more likely to have higher **nicotine dependence** and **use e-cigarettes more frequently**
- Young adults with 'ice' use were more likely to have **greater dependence symptoms.**



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# Youth & Young Adult Tobacco Product Use

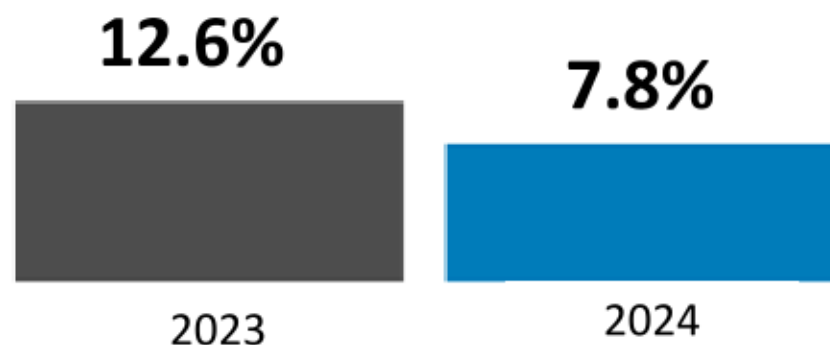
# NYTS

## 2024

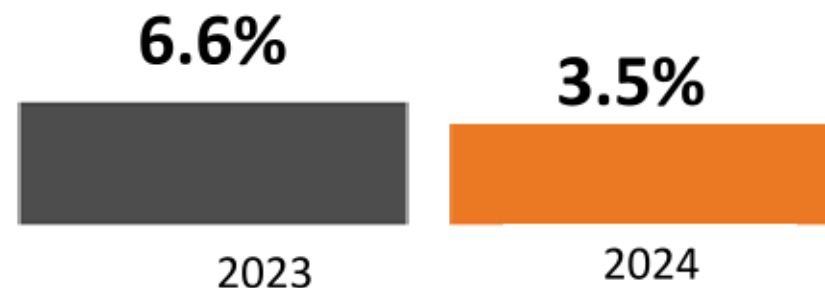
# 1.63 million

youth currently use any tobacco product

Any tobacco use **decreased** among high school students



Any tobacco use **decreased** among middle school students



Driven by a **drop** in high school e-cigarette use





**E-cigarette and nicotine pouch use among U.S. middle and high school students in 2024:**



**E-cigarettes  
5.9%**

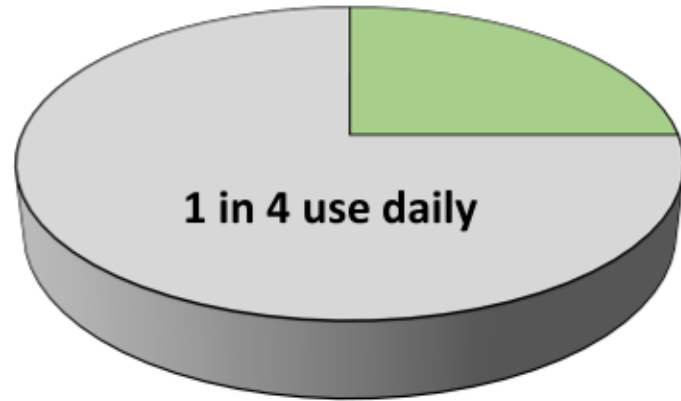


**Nicotine pouches  
1.8%**

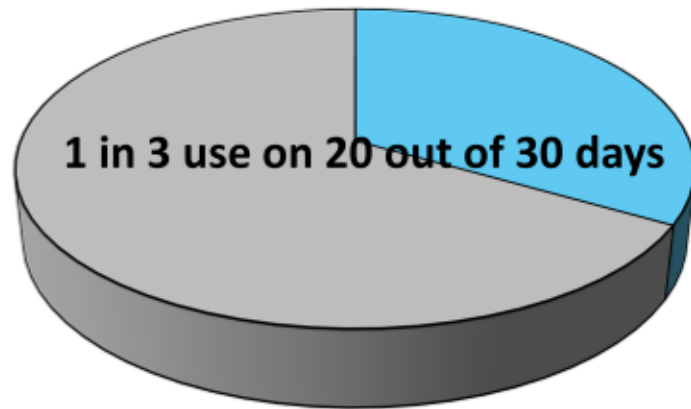
Source: National Youth Tobacco Survey, 2024



Of youth who currently use an e-cigarette:



**Almost 90% use a flavored e-cigarette**



**Over half use 'ice' products**

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# Nicotine & Cannabis Co-Use

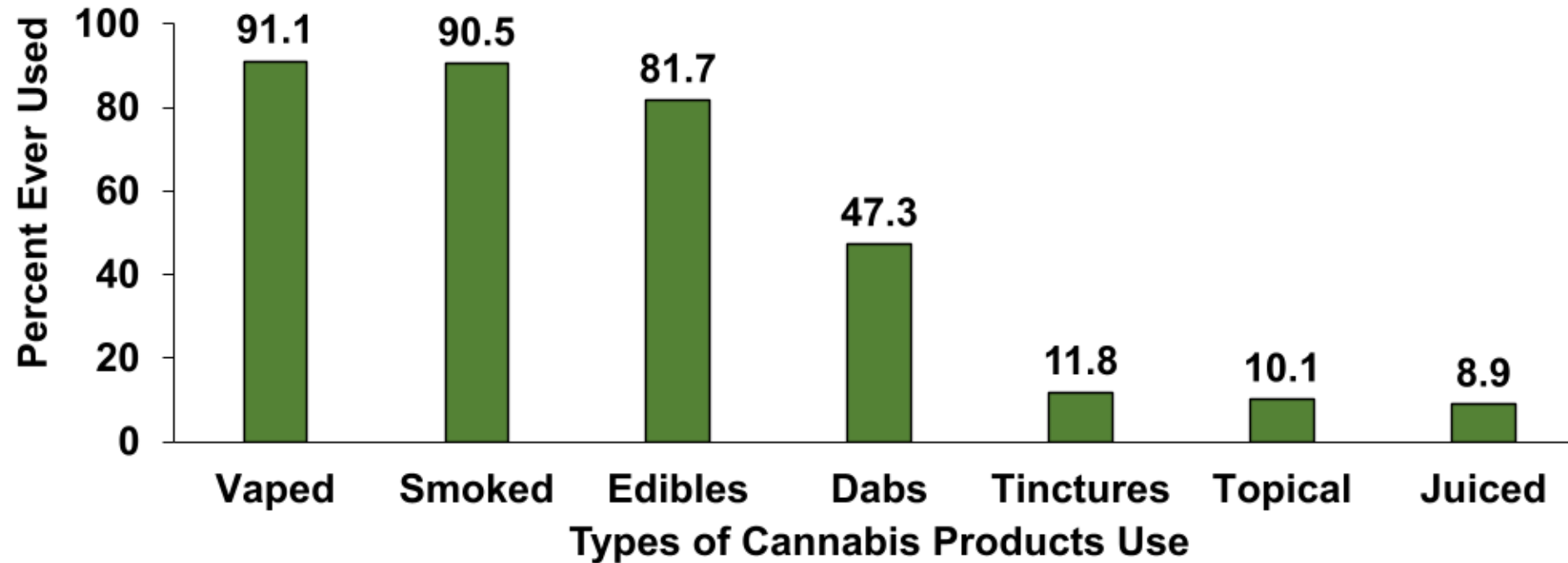
## Nicotine & Cannabis

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- Historically nicotine & cannabis co-use is common.
- With the rise of nicotine and cannabis vaping, as well as shifting cannabis legalization, it is unclear how patterns of co-use will look.
- Among youth who vape nicotine and were looking to quit nicotine, we saw...
  - >90% had tried cannabis
  - 69% had used in the past-month

# Nicotine & Cannabis

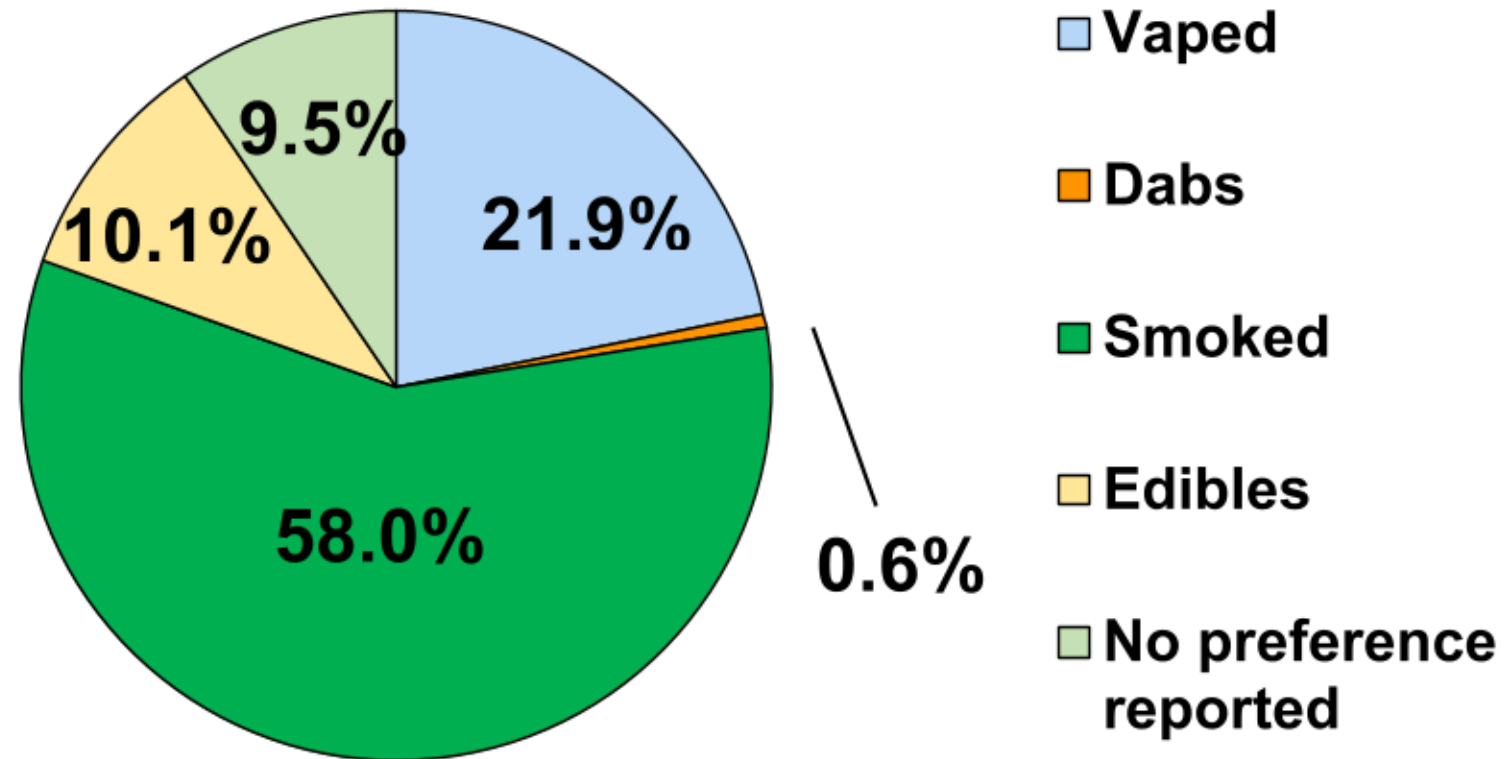
## Cannabis Products Used by Youth who Vape Nicotine



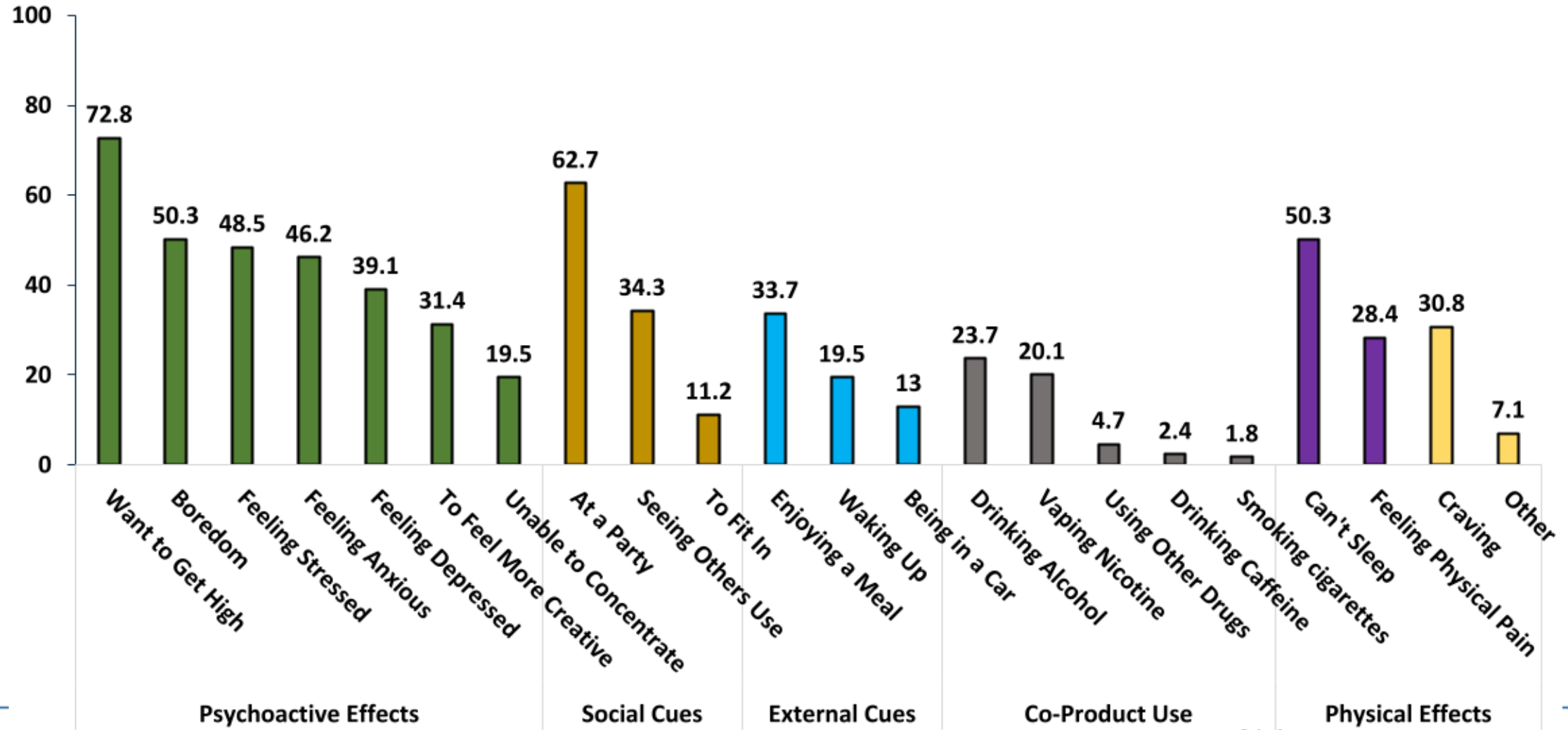


## Nicotine & Cannabis

### Preferred Cannabis Product for Youth Vaping Nicotine



# Nicotine & Cannabis



## Conclusions

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- Nicotine vaping is the most commonly used tobacco product by youth and young adults.
- Flavors, nicotine concentration, and device are all features that can be manipulated to enhance appeal
- Particular flavors, like coolants, may have unique impacts on appeal
- Among youth who vape nicotine, cannabis use may be common and understanding the intersection of these substances is important.