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Funded by Substance Abuse and Mental Health Services Administration

# ADOLESCENT SUBSTANCE USE: AN EVIDENCE UPDATE

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Center for Alcohol and Addiction Studies  
Brown University School of Public Health



# DISCLOSURES

The development of these training materials were supported by grant H79 TI080209 (PI: S. Becker) from the Center for Substance Abuse Treatment, Substance Abuse and Mental Health Services Administration, United States Department of Health and Human Services. The views and opinions contained within this document do not necessarily reflect those of the US Department of Health and Human Services, and should not be construed as such.



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# WHICH OF THE FOLLOWING IS USED MOST BY HIGH SCHOOL STUDENTS?

- A. Alcohol
- B. Cannabis (weed, pot, marijuana)
- C. Cigarettes (tobacco)
- D. Prescription opioids
- E. Club drugs (Ecstasy, Molly, LSD)
- F. E-Cigarettes (nicotine)





**CONTRARY TO POPULAR BELIEF,  
ALCOHOL  
CONTINUES TO BE THE SUBSTANCE  
USED MOST OFTEN BY US HIGH  
SCHOOL STUDENTS**



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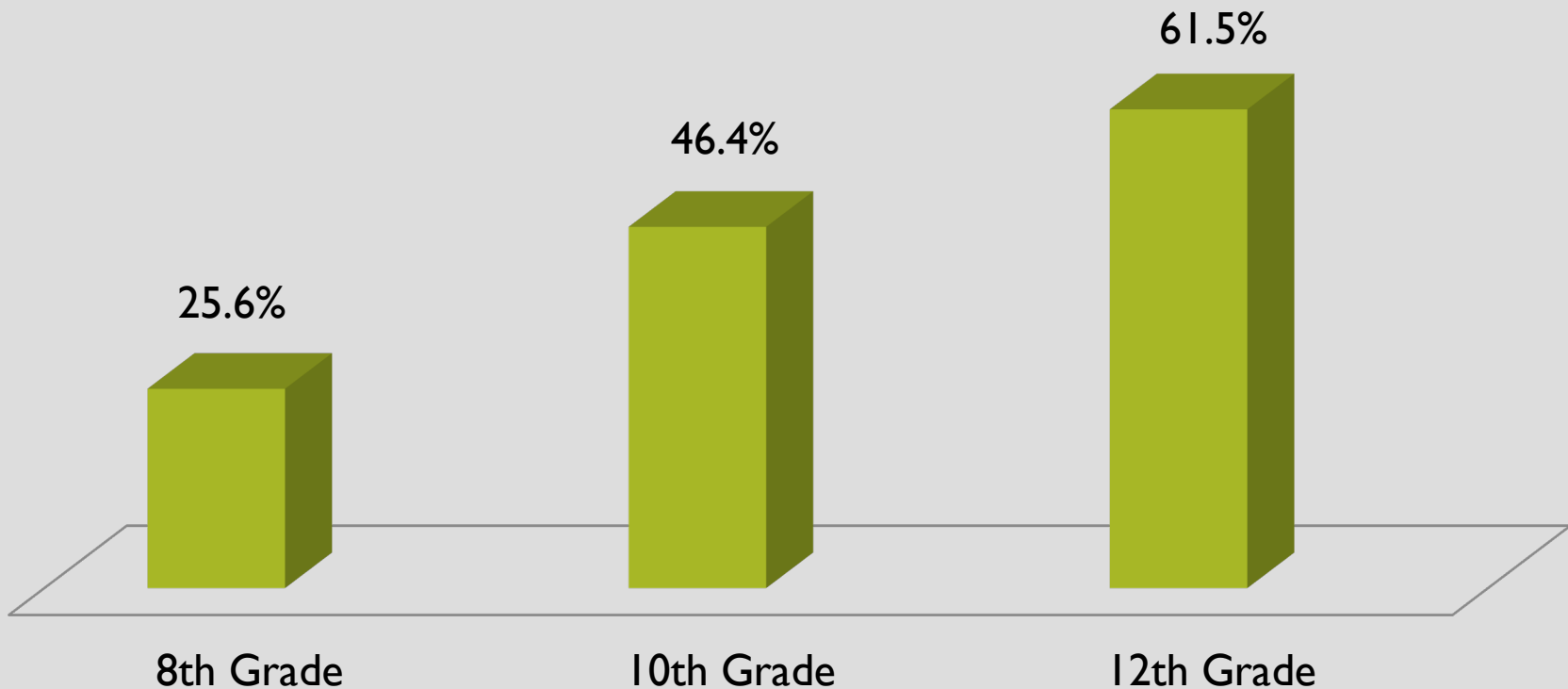
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Source: Monitoring The Future (2021)

# LIFETIME ALCOHOL USE RATES INCREASE 2.5X FROM 8<sup>TH</sup> TO 12<sup>TH</sup> GRADE AMONG US STUDENTS

Rates for 2020: Ever Drank Alcohol



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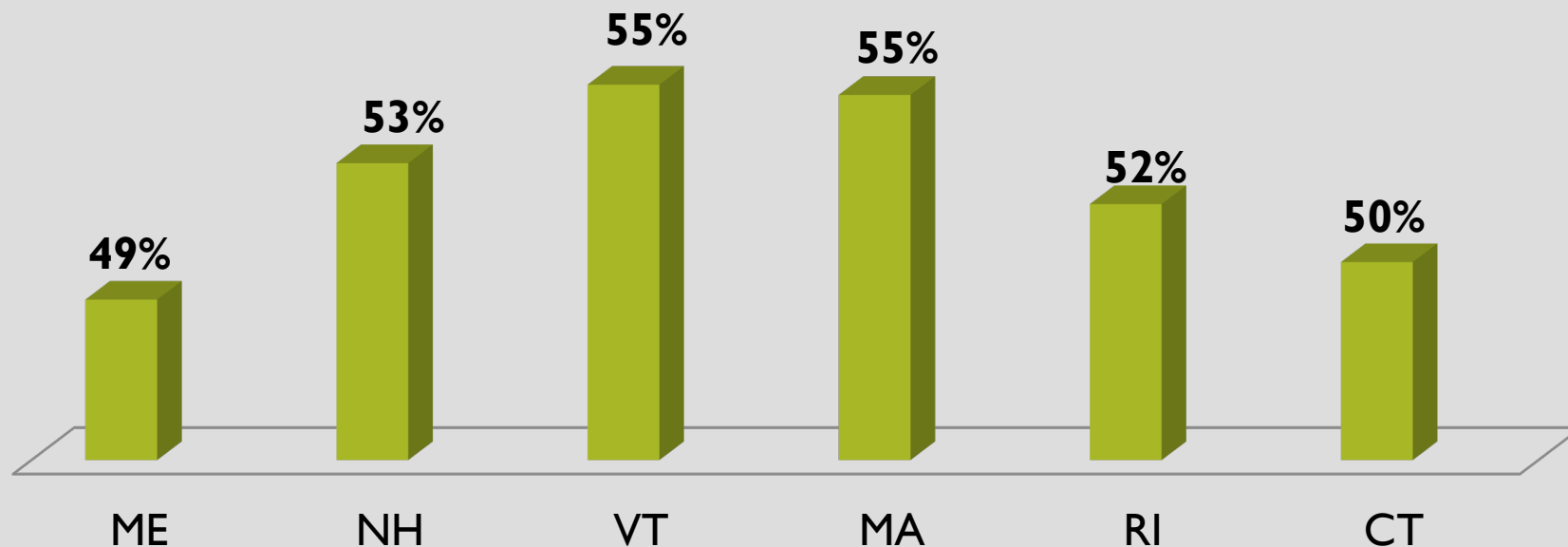
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Source: Monitoring The Future (2021)

# LIFETIME ALCOHOL USE RATES OF HIGH SCHOOL STUDENTS ARE RELATIVELY STABLE ACROSS THE SIX NEW ENGLAND STATES

Rates for 2019: Ever Drank



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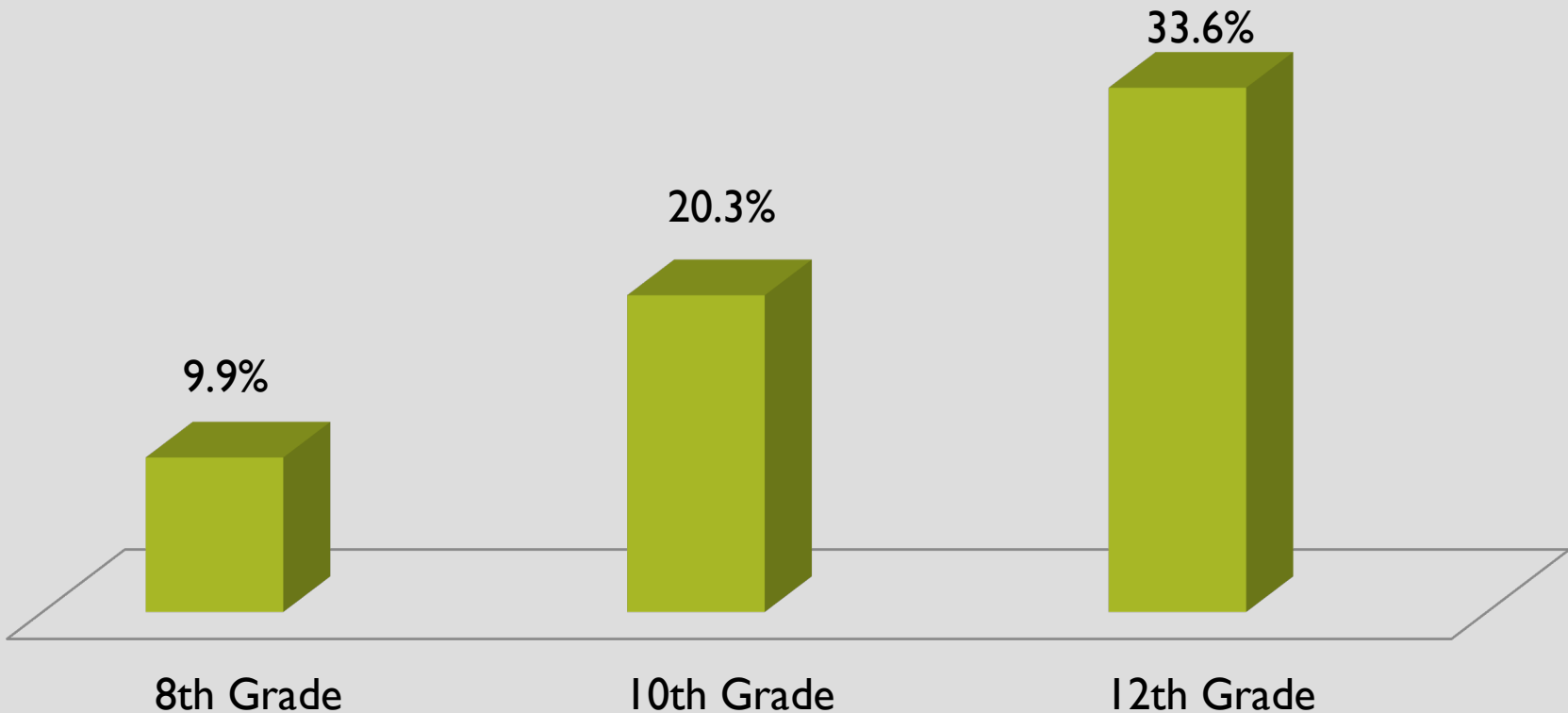
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Sources: 2019 Youth Risk Behavior Survey (2020).  
Rates reflect weighted averages of 9<sup>th</sup> – 12<sup>th</sup> graders in each state.

# PAST MONTH ALCOHOL USE QUADRUPLES FROM 8<sup>TH</sup> TO 12<sup>TH</sup> GRADE AMONG US STUDENTS

Rates for 2020: Past 30 Days Alcohol Use



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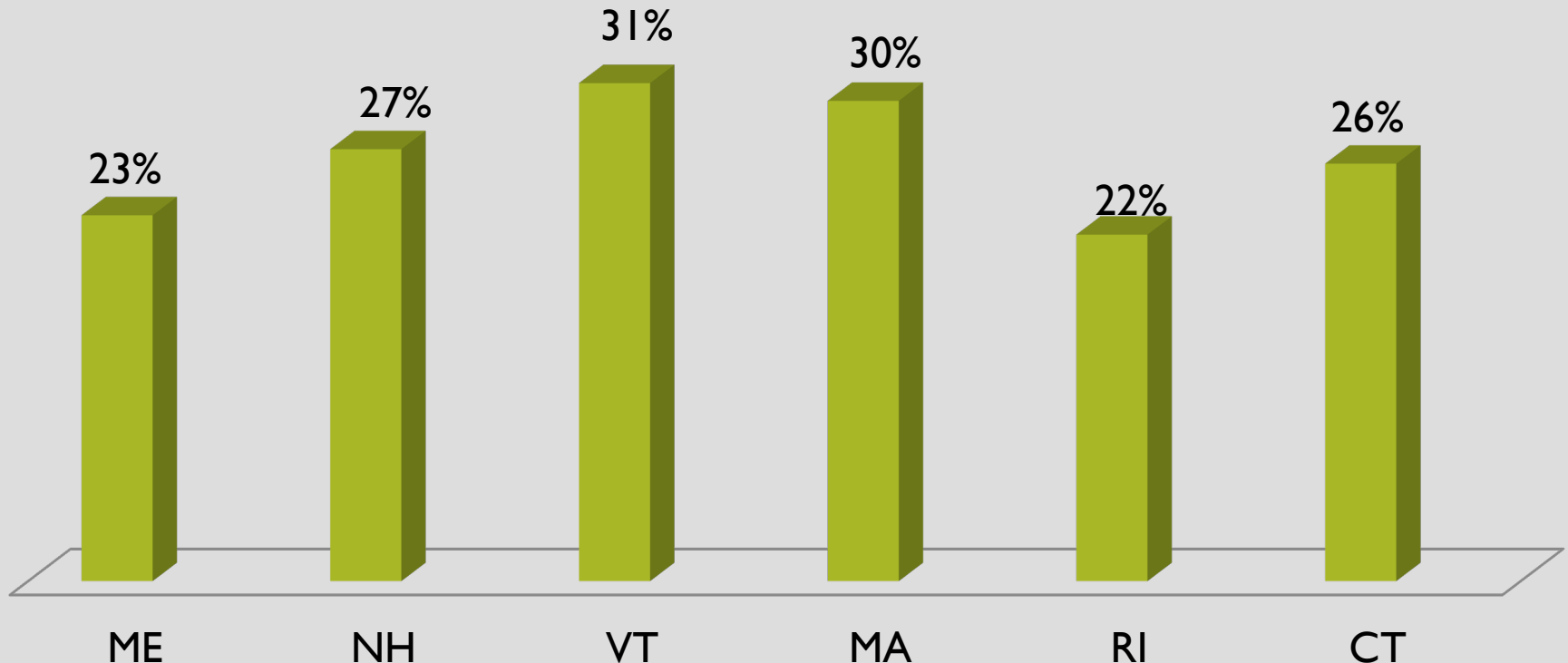
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Source: Monitoring The Future (2021)

# PAST MONTH ALCOHOL USE OF HIGH SCHOOL STUDENTS VARIES SOMEWHAT ACROSS THE SIX NEW ENGLAND STATES

Rates for 2019: Past 30 Days Alcohol Use



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Sources: 2019 Youth Risk Behavior Survey (2020).  
Rates reflect weighted averages of 9<sup>th</sup> – 12<sup>th</sup> graders in each state.



# ASSOCIATED RISKS TO ASSESS

- Binge drinking – 13.7% of teens, in past month
  - Criteria:  $\geq 4$  drinks in a row for females;  $\geq 5$  for males
- DUI – In past month, 5.4% drove, 16.7% rode with a driver who had been drinking
- Risky sex – 21.2% of teens' most recent sexual experiences occurred while under the influence

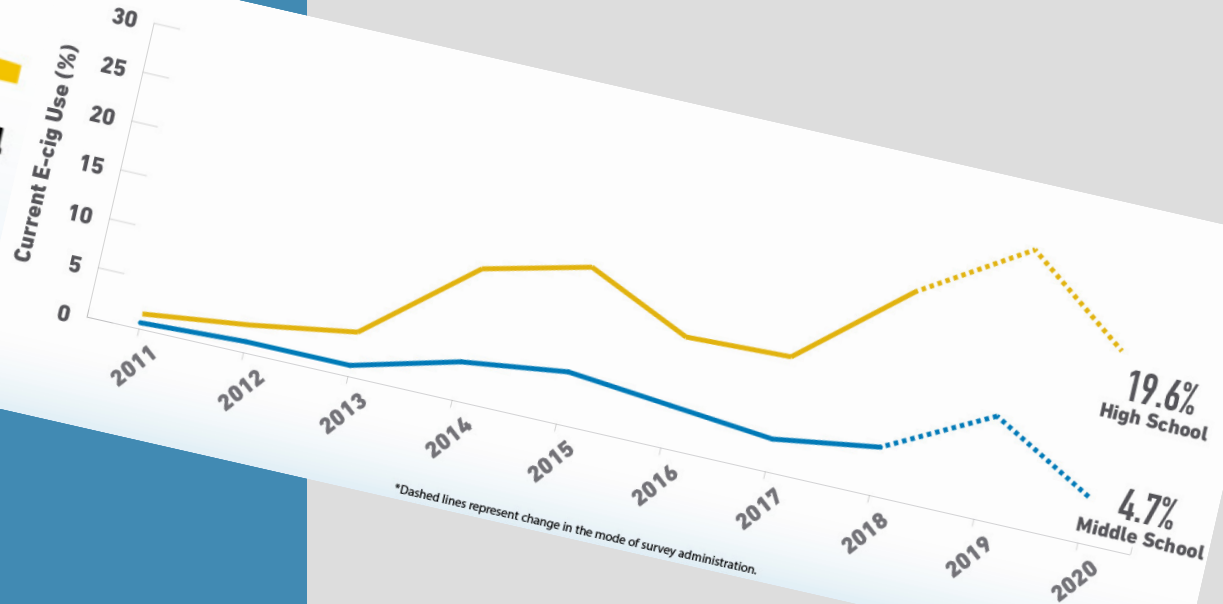


# WHICH IS 2<sup>ND</sup> MOST USED BY HIGH SCHOOL STUDENTS?

- ~~A. Alcohol~~
- B. Cannabis (weed, pot, marijuana)
- C. Cigarettes (tobacco)
- D. Prescription opioids
- E. Club drugs (Ecstasy, Molly, LSD)
- F. E-Cigarettes (nicotine)



# 2020 National Youth Tobacco Survey



VAPERS BE LIKE

SELFIE

## #2: E-CIGARETTES (NICOTINE)

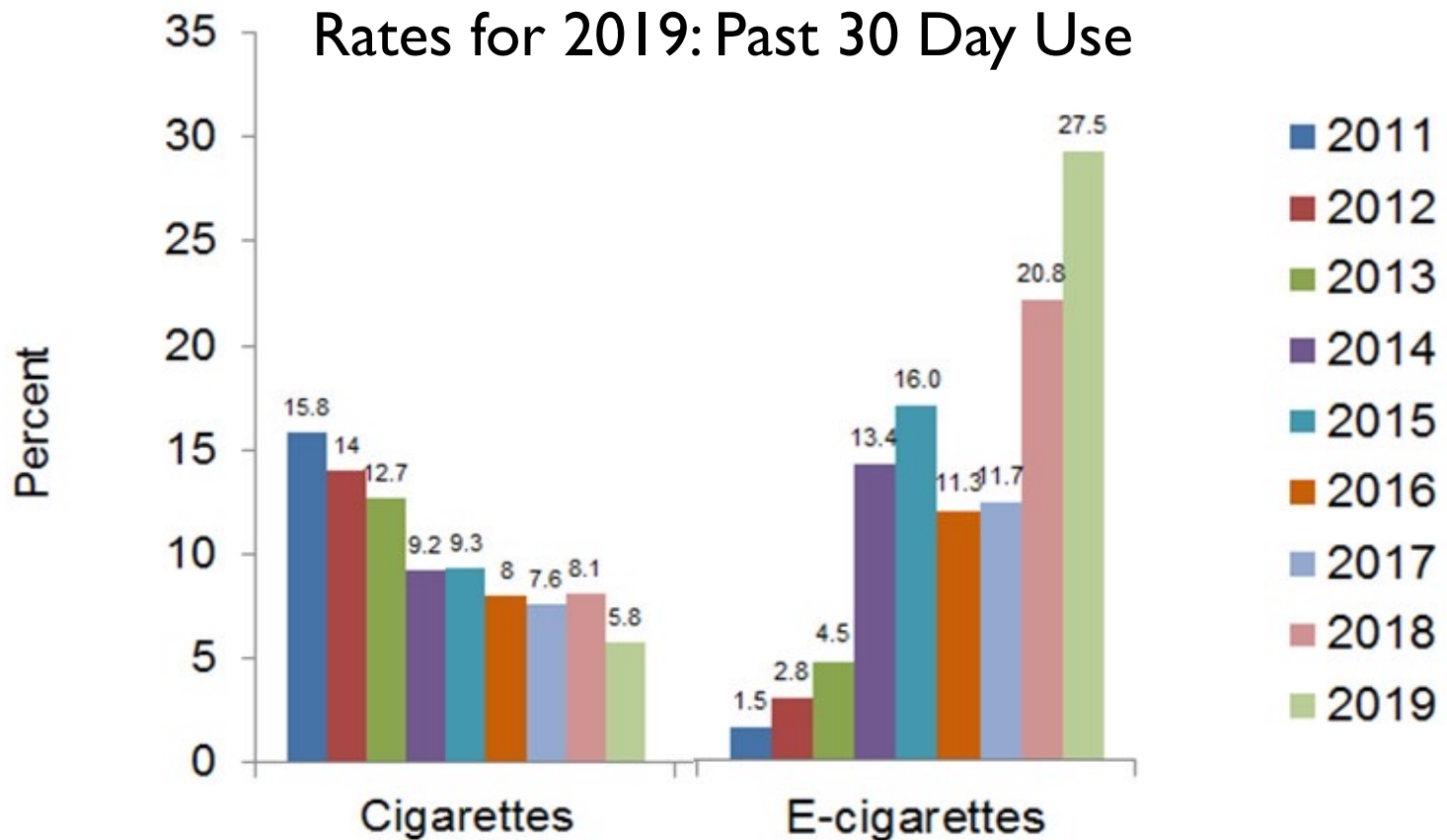
(Prior to 2017, cannabis was the 2<sup>nd</sup> most-used among teens)

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# NICOTINE USE HAS SKYROCKETED IN RECENT YEARS, DUE TO POPULARITY OF E-CIGARETTES



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Source: National Youth Tobacco Survey (2019)

\*All nicotine vaporizers can be called e-cigarettes

More than **8 out of 10** current youth e-cig users use flavored e-cigs



**E-cigarettes come in lots of shapes and sizes.**

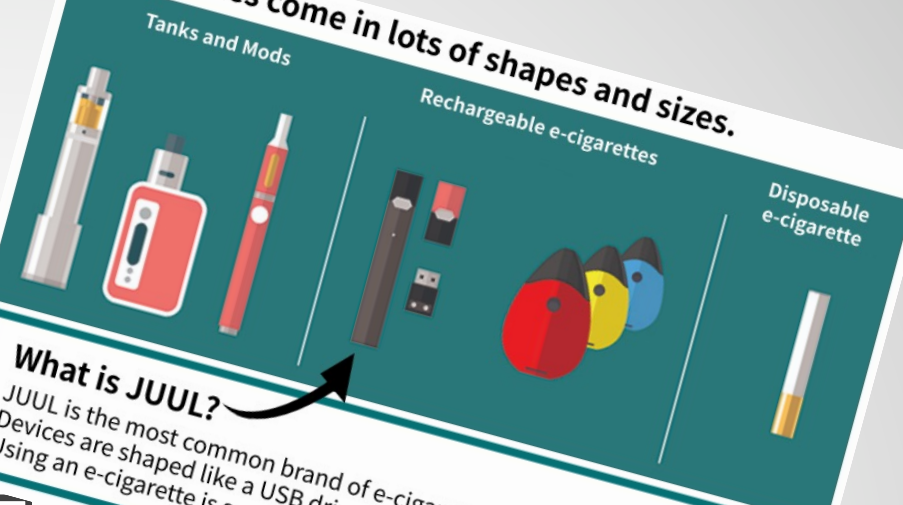
Tanks and Mods

Rechargeable e-cigarettes

Disposable e-cigarette

**What is JUUL?**

JUUL is the most common brand of e-cigarette. Devices are shaped like a USB drive and pods always contain nicotine. Using an e-cigarette is sometimes called "JUULing."



## WHAT IS VAPING?

- Vaping devices, also known as e-cigarettes, heat a liquid into an aerosol that the user inhales.
- Virtually all vaping liquids (e.g., Juul pods) contain nicotine. Users can also vape cannabis or "just" flavor pods, though the latter is less common.
- Vapes include many other chemicals (e.g., formaldehyde, acrolein) that can harm humans and have been linked to cancer.
- There are no current federal regulations about what chemicals can be in vape pods or "e-juice", so there is no way to know exactly what you're inhaling.



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# HOW OLD DO YOU HAVE TO BE TO VAPE?

★ UNITED STATES OF AMERICA ★



Retailers are prohibited from selling vapes or tobacco products to customers under 21. Until recently, the country had a patchwork of age laws. But in December 2019 Congress passed and president Trump signed a federal Tobacco 21 law, which includes e-cigarettes.

21 YEARS OLD



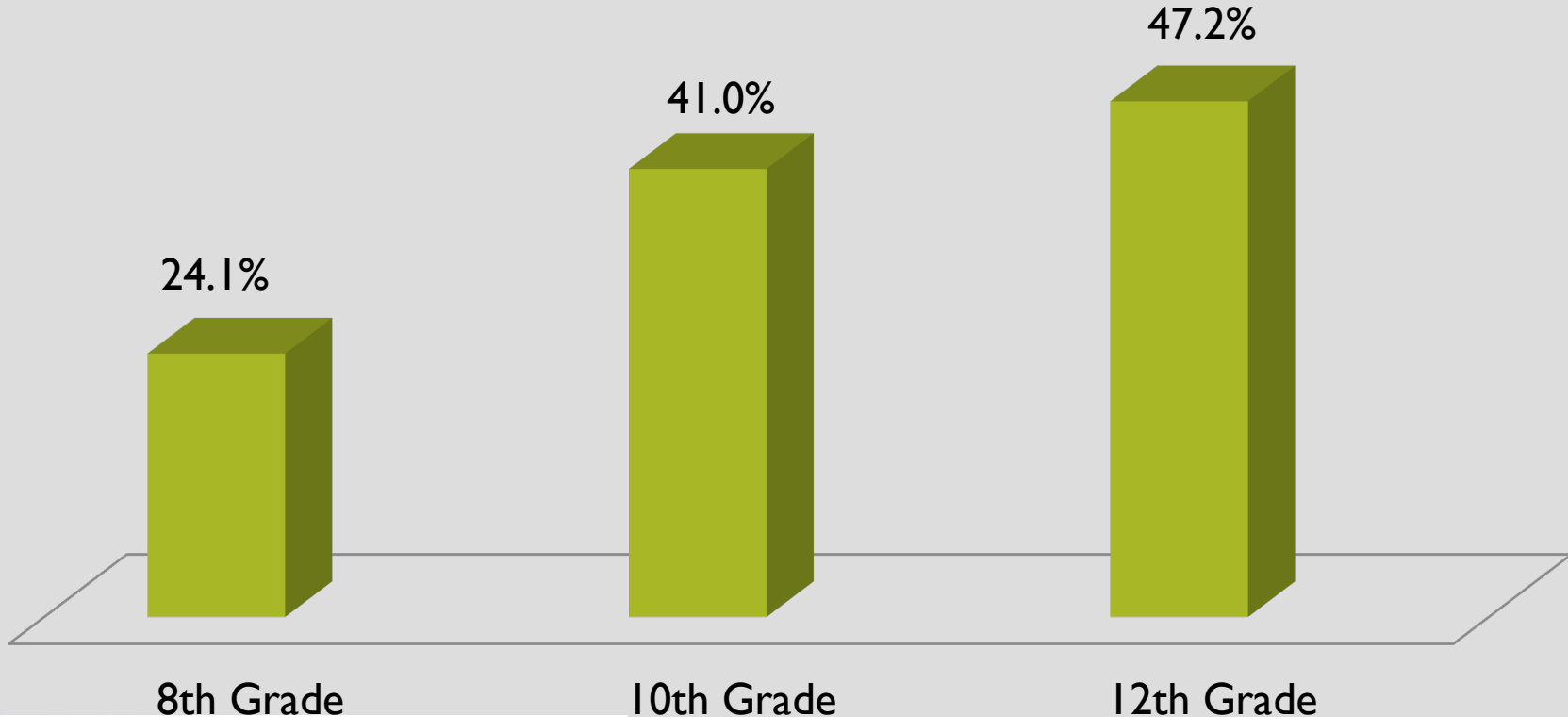
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# LIFETIME VAPING ABOUT DOUBLES FROM 8<sup>TH</sup> TO 12<sup>TH</sup> GRADE AMONG US STUDENTS

Rates for 2020: Ever Vaped



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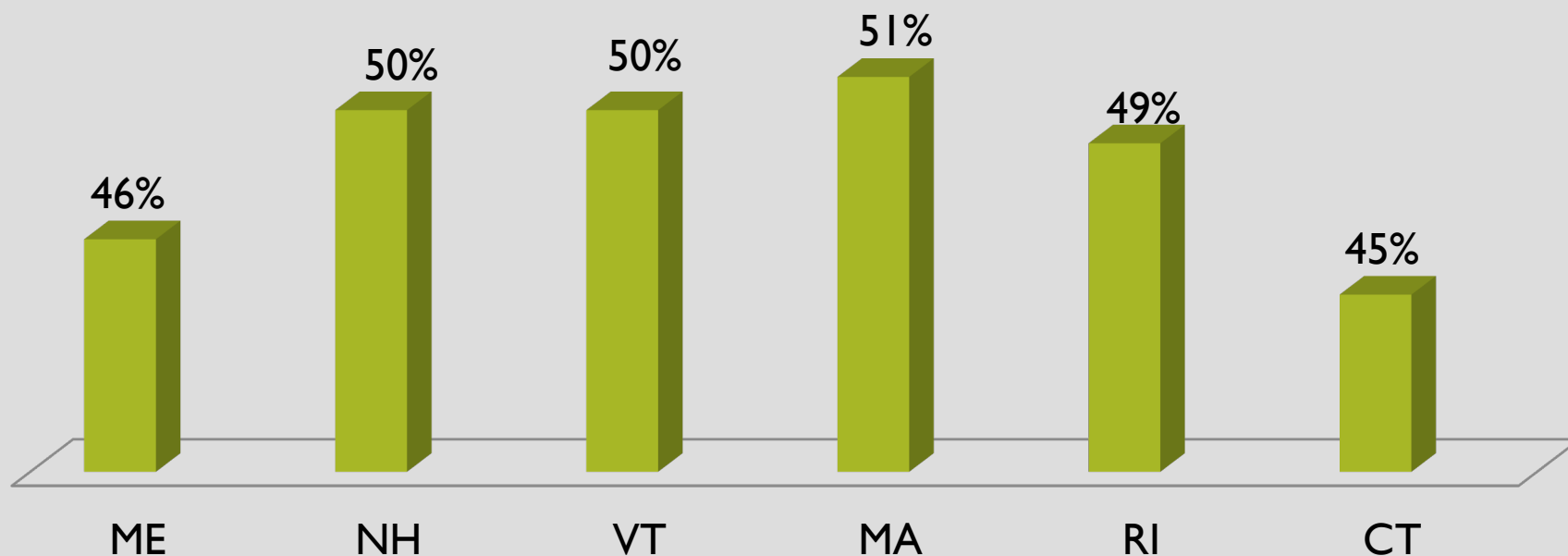
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Sources: Monitoring The Future (2021)

# LIFETIME VAPING RATES OF HIGH SCHOOL STUDENTS ARE RELATIVELY STABLE ACROSS SIX NEW ENGLAND STATES

Rates for 2019: Ever Vaped



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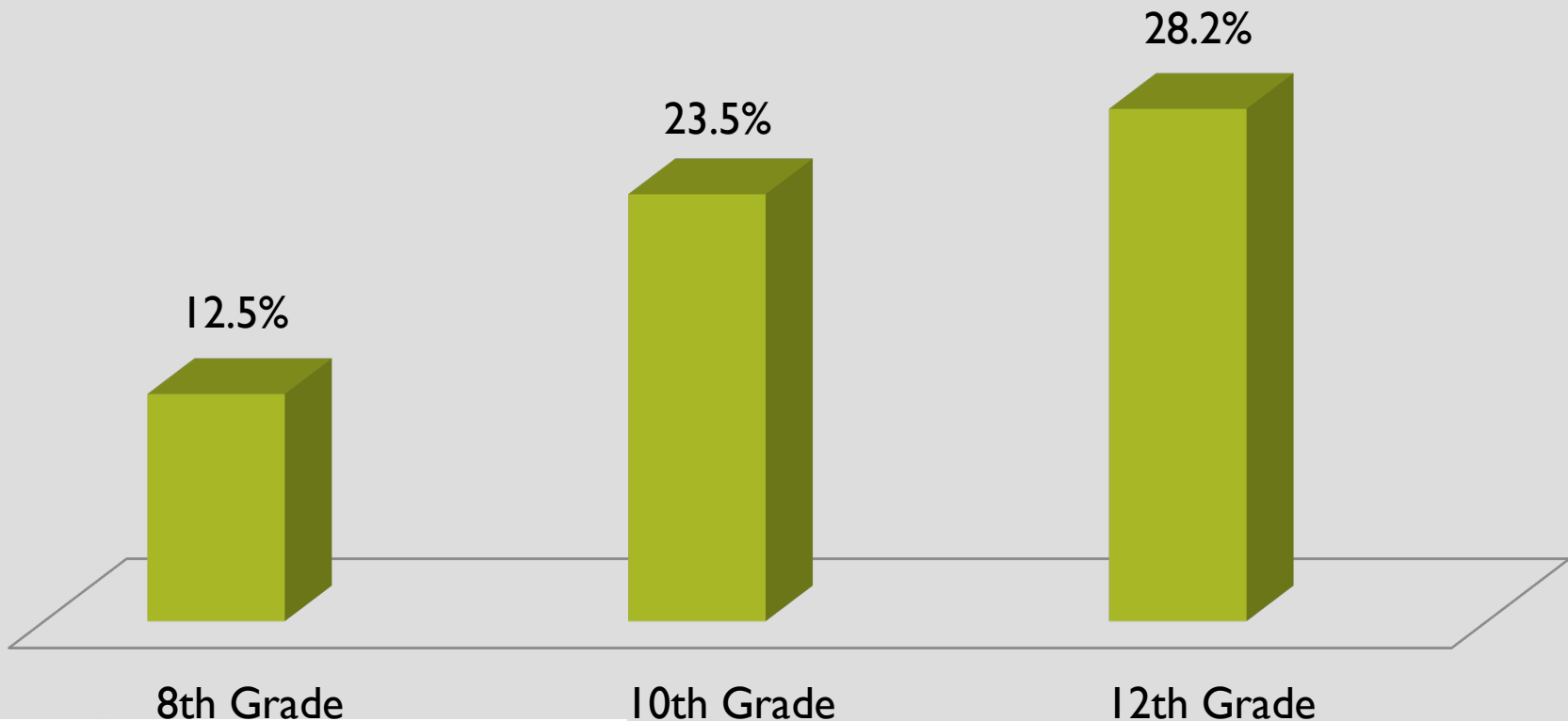
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Sources: 2019 Youth Risk Behavior Survey (2020)  
Rates reflect weighted averages of 9<sup>th</sup> – 12<sup>th</sup> graders in each state.



# PAST MONTH VAPING MORE THAN DOUBLES FROM 8<sup>TH</sup> TO 12<sup>TH</sup> GRADE AMONG US STUDENTS

Rates for 2020: Vaping in Past 30 Days



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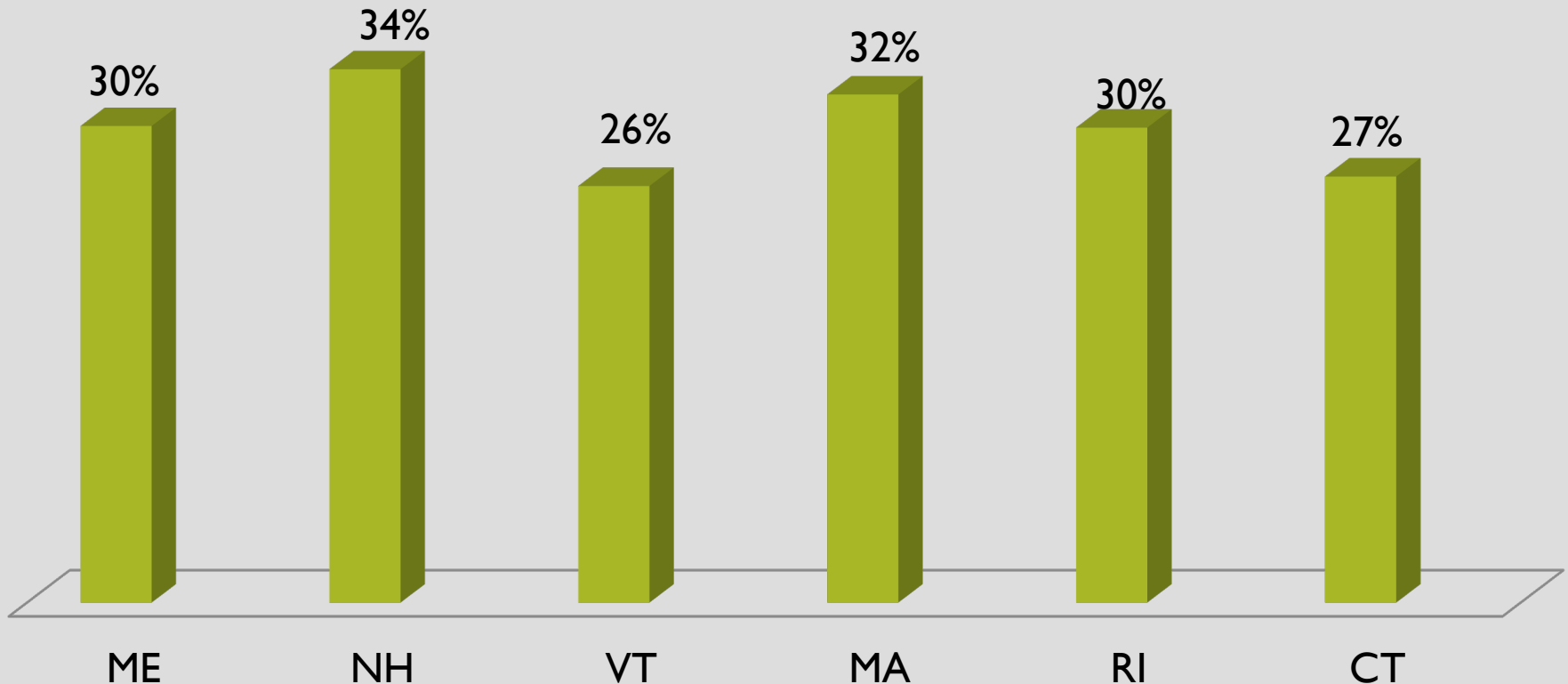
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Sources: Monitoring The Future (2021)

# PAST MONTH VAPING OF HIGH SCHOOL STUDENTS VARIED SOMEWHAT ACROSS SIX NEW ENGLAND STATES

Rates for 2019: Vaped in Past Month



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Sources: 2019 Youth Risk Behavior Survey (2020)

# FACT OR MYTH?

#1: Vaping devices help cigarette smokers quit



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# IT'S COMPLICATED!

#1: Vaping devices help <sup>some adult</sup> cigarette smokers quit but have been shown to increase the risk of regular cigarette use in teens.

On its own, vaping can lead to nicotine addiction.



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Sources: National Academy of Sciences (2019); Rigotti et al. (2015); Chaffee et al. (2018)

## **FACT OR MYTH?**

**#2: Vaping is safer than smoking traditional cigarettes**

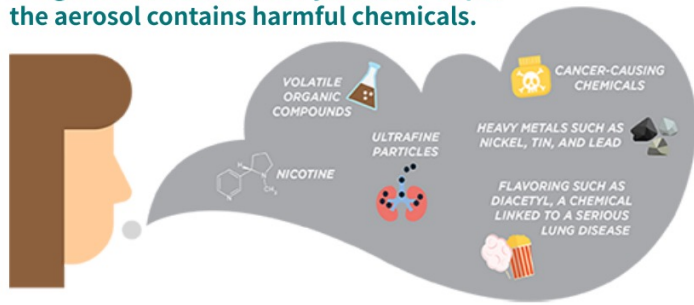
# IT'S COMPLICATED!

less harmful to cigarette smokers

#2: Vaping is safer than smoking traditional cigarettes,  
but that doesn't mean vaping is "safe".



E-cigarette aerosol is NOT just water vapor--  
the aerosol contains harmful chemicals.



More research is needed to  
clarify the long-term health  
effects of vaping

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# WHO VAPES WHAT?

	Just Flavoring*	Nicotine	Cannabis
US 8 <sup>th</sup> Graders	6.8%	10.5%	4.2%
US 10 <sup>th</sup> Graders	10.4%	23.5%	11.3%
US 12 <sup>th</sup> Graders	8.4%	28.2%	12.2%

Many popular vaping devices (e.g., Juul) *do not offer* nicotine-free products.

Teens who vape are exposed to known carcinogenic compounds

# WHICH IS 3<sup>RD</sup> MOST USED BY HIGH SCHOOL STUDENTS?

- ~~A.~~ Alcohol
- B. Cannabis (weed, pot, marijuana)
- C. Cigarettes (tobacco)
- D. Prescription opioids
- E. Club drugs (Ecstasy, Molly, LSD)
- ~~F.~~ E-Cigarettes (nicotine)





**CORRECT  
ANSWER:**



**Cannabis**

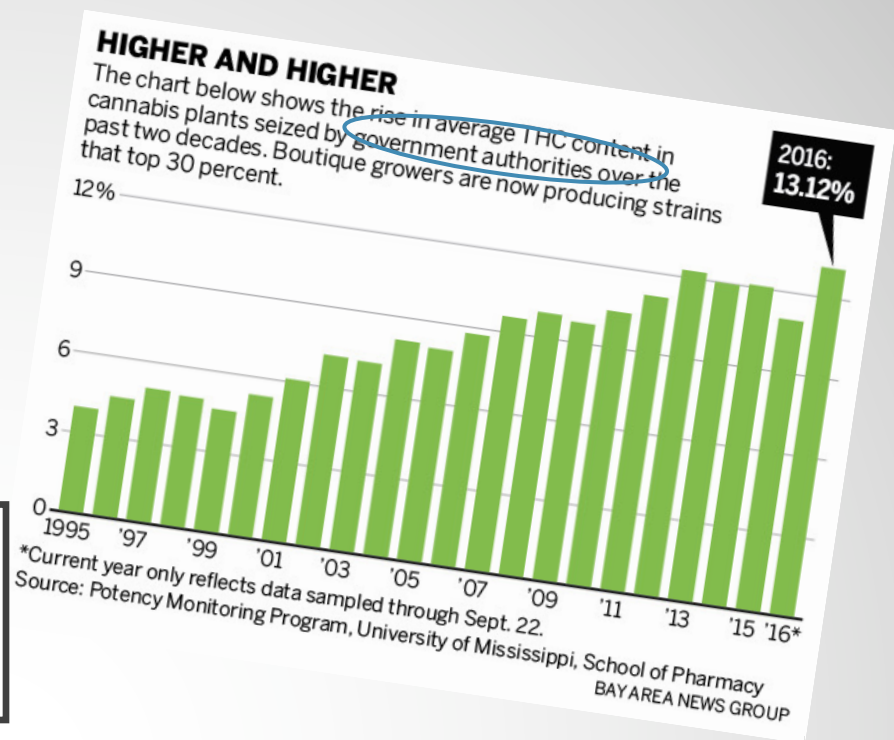


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# WHAT IS CANNABIS?

- Cannabis, also called marijuana, is a green, brown, or gray mixture of dried, shredded leaves, stems, seeds, and flowers of the hemp plant.
- All forms of cannabis are mind-altering (psychoactive). In other words, they change how the brain works.
- They all contain THC (delta-9-tetrahydrocannabinol), the main active chemical in cannabis.
- THC content of cannabis has been increasing since the 1970's.
- Contain more than 400 other chemicals.



# HOW MANY US TEENS USE CANNABIS REGULARLY?

- A. None
- B. A few
- C. About Half
- D. Most



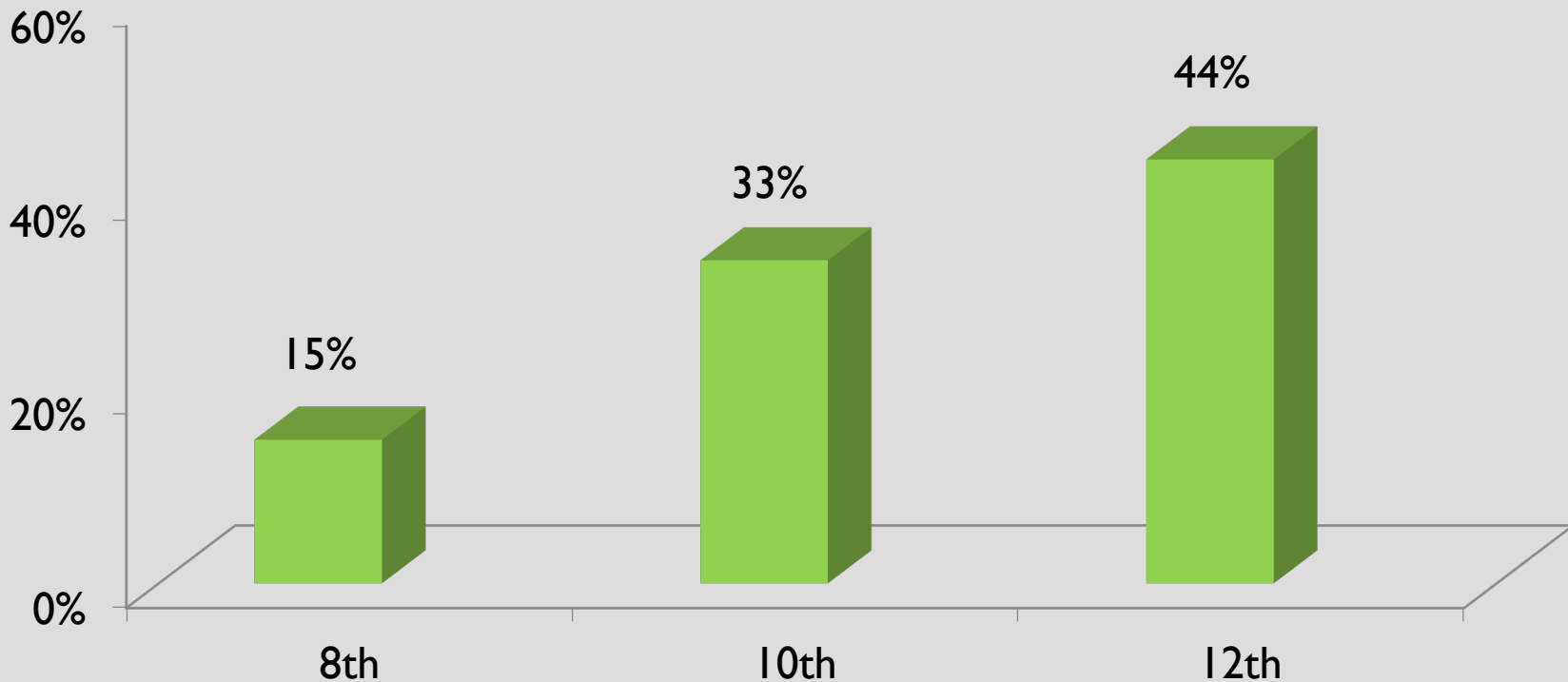
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# LIFETIME CANNABIS USE TRIPLES FROM 8<sup>TH</sup> TO 12<sup>TH</sup> GRADE AMONG US STUDENTS

Rates for 2020: Ever Used Cannabis



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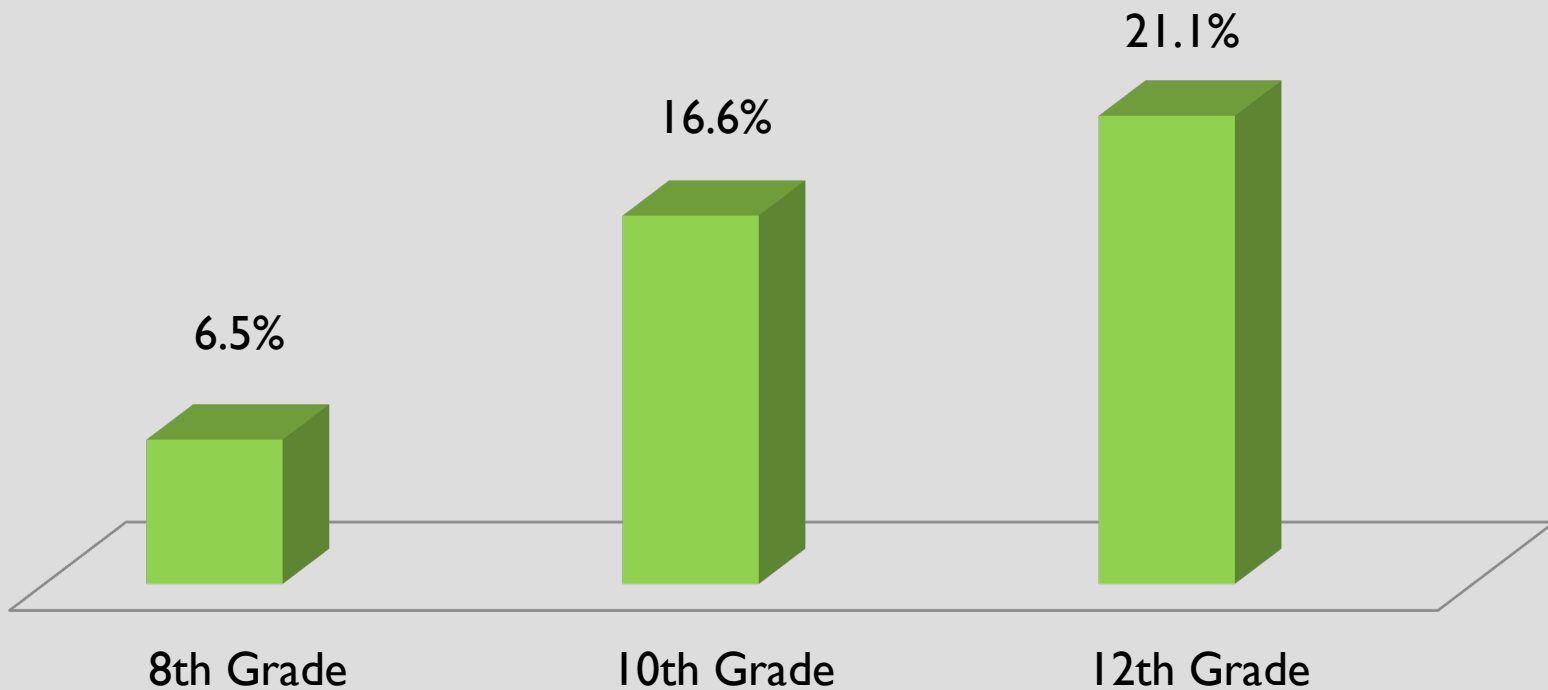
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Sources: Monitoring The Future (2021)

# PAST MONTH CANNABIS USE TRIPLES FROM 8<sup>TH</sup> TO 12<sup>TH</sup> GRADE AMONG US STUDENTS

Rates for 2020: Used in Past Month



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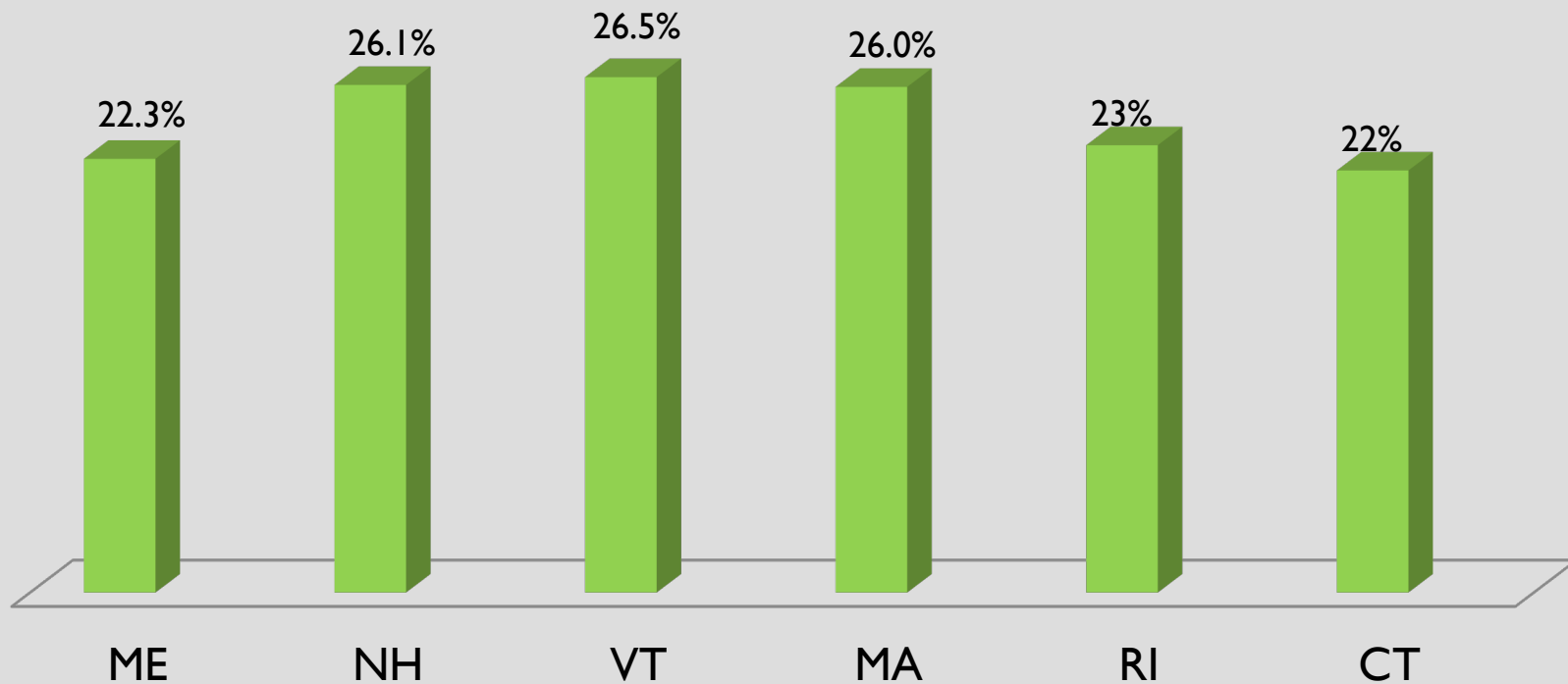
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Sources: Monitoring The Future (2021)

# PAST MONTH CANNABIS USE OF HIGH SCHOOL STUDENTS IS RELATIVELY STABLE ACROSS NEW ENGLAND STATES

Rates for 2019: Used in Past Month





Compared to other drugs,  
cannabis is not addictive.



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# CORRECT ANSWER: MYTH

- DSM-V criteria for addiction includes abuse, tolerance, withdrawal and cravings
- Research shows...
  - ✓ **Continued use:** Teens who use cannabis regularly continue to use it **despite experience problems at school, work, and with their families.**
  - ✓ **Tolerance:** Teens who begin experimenting with cannabis find that they **need to increase their use in order to get the same effects.**
  - ✓ **Withdrawal:** **People who regularly smoke cannabis have withdrawal symptoms—** drug cravings, decreased appetite, nervousness, irritability, stomach pain, aggression and anxiety, among others.

Research shows that about 1 in 11, of those who use cannabis at least once will become addicted—or 1 in 6 if you start smoking in your teens.



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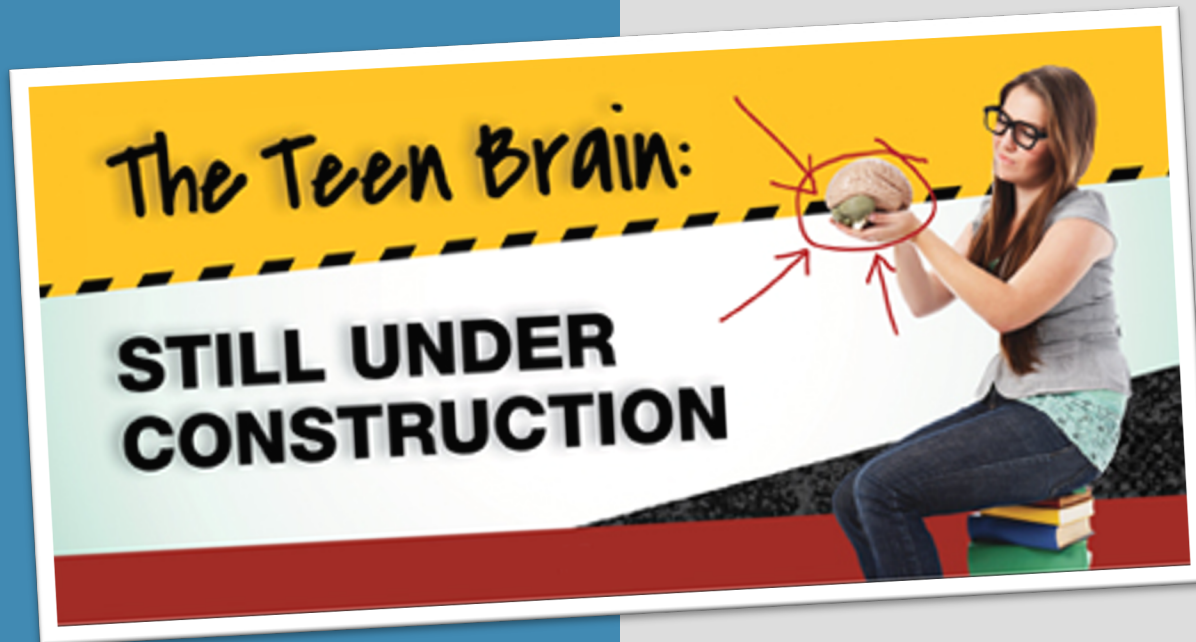
**There is no  
difference in  
smoking cannabis  
now, or in waiting  
until adulthood**



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**CORRECT ANSWER: MYTH**  
USING SUBSTANCES CAN LEAD TO  
CHANGES IN AN ADOLESCENT'S  
DEVELOPING BRAIN.

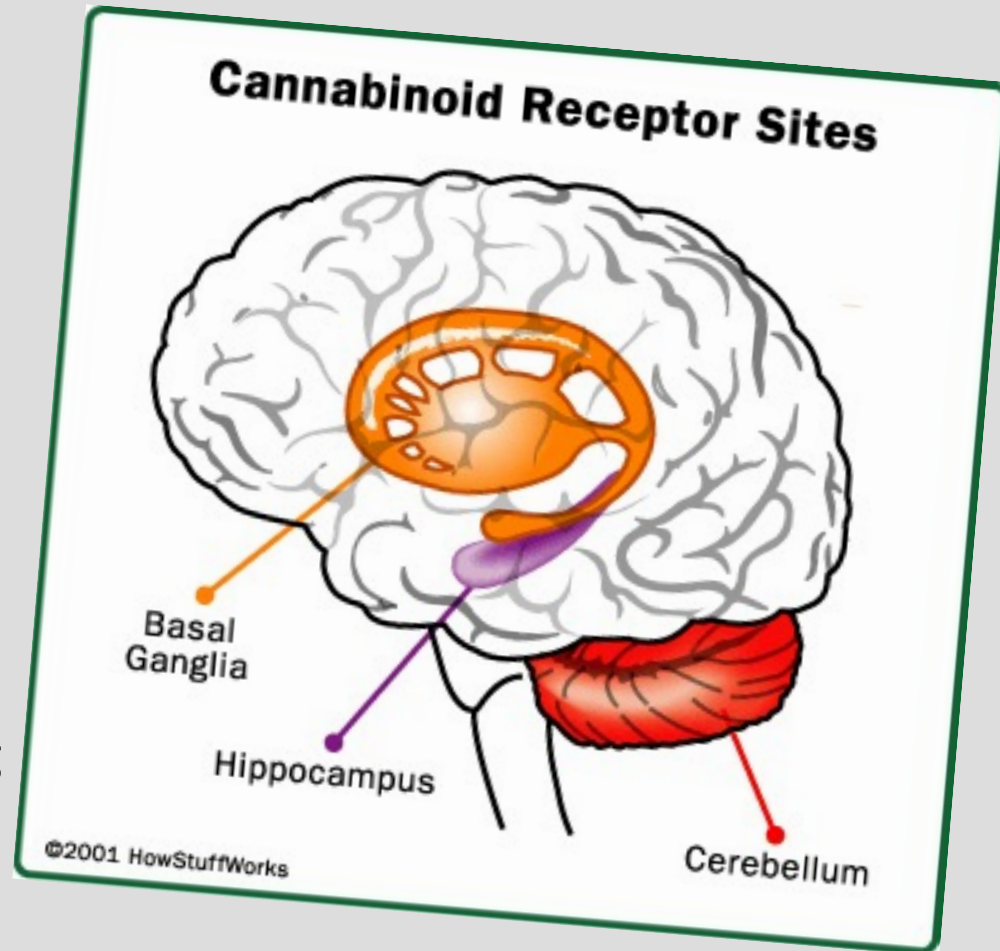
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# HOW DOES CANNABIS AFFECT THE BRAIN?

- When smoked, THC quickly passes through the lungs, into the bloodstream, and into various organs, including the brain.
- High concentrations of cannabinoid receptors exist in the parts of the brain that influence **pleasure, memory, thought, concentration, sensory and time perception, and coordinated movement.**
- Research shows that **these parts of the brain are not fully developed until our early 20's.**
- Changes caused by drugs on a developing brain are more likely to 'stick' and become hardwired by adulthood.



# MYTH OR FACT?

Cannabis does not affect learning, it just makes you really lazy and sleepy.

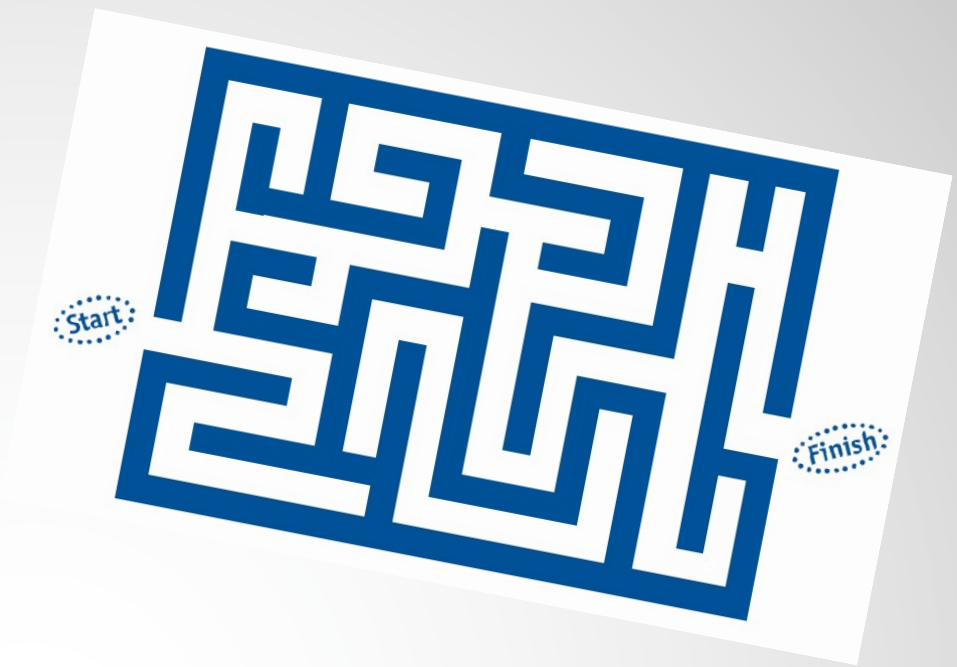


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**CORRECT  
ANSWER:  
MYTH**



- Recent studies suggest that adolescents who regularly smoke cannabis **perform poorer on performance tests of learning, cognitive flexibility, visual scanning, error commission, and working memory.**
- The number of lifetime cannabis use episodes is related to **overall poorer cognitive functioning.**



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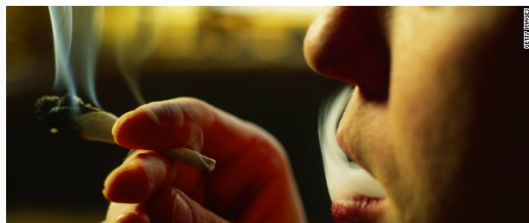
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**Breaking news** President Obama beat Mitt Romney in their second presidential debate, according to a new CNN/ORC poll.

## Pot smoking may leave mark on teen brains

Health.com By Amanda Gardner, Health.com  
 updated 3:24 PM EDT, Mon August 27, 2012



Aug 27, 2012 5:38pm

## Teenage Marijuana Use May Hurt Future IQ

Like 769 Tweet 222 +1 16

Reported by Drs. Tiffany Chao and Shari Barnett:

Teenagers lighting joints may end up less bright, according to new research released Monday.

In a study of more than 1,000 adolescents in New Zealand, those who began habitually smoking marijuana before age 18 showed an eight-point drop in IQ between the ages of 13 and 38, a considerable decline.

The average IQ is 100 points. A drop of eight points represents a fall from the 50th percentile to the 29th percentile in terms of intelligence.

The research, published in the Proceedings of the National Academy of Sciences, charted the IQ changes in participants over two decades.

## Persistent cannabis users show neuropsychological decline from childhood to midlife

Madeline H. Meier<sup>a,b,1</sup>, Avshalom Caspi<sup>a,b,c,d,e</sup>, Antony Ambler<sup>b,f</sup>, HonaLee Harrington<sup>b,c,d</sup>, Renate Houts<sup>b,c,d</sup>, Richard S. E. Keefe<sup>g</sup>, Kay McDonald<sup>h</sup>, Aimee Ward<sup>i</sup>, Richie Poulton<sup>j</sup>, and Terrie E. Moffitt<sup>a,b,c,d,e</sup>

<sup>a</sup>Duke Transdisciplinary Prevention Research Center, Center for Child and Family Policy, <sup>b</sup>Department of Psychology and Neuroscience, and <sup>c</sup>Institute for Genome Sciences and Policy, Duke University, Durham, NC 27708; <sup>d</sup>Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, <sup>e</sup>10; <sup>f</sup>Social, Genetic, and Developmental Psychiatry Centre, Institute of Psychiatry, King's College London, London SE5 8AF, United Kingdom; <sup>g</sup>Interdisciplinary Health and Development Research Unit, Department of Preventive and Social Medicine, School of Medicine, University of <sup>h</sup>9054, New Zealand

el I. Posner, University of Oregon, Eugene, OR, and approved July 30, 2012 (received for review April 23, 2012)

s show that fewer adolescents believe that regular s harmful to health. Concomitantly, adolescents are abis use at younger ages, and more adolescents are s on a daily basis. The purpose of the present study ie association between persistent cannabis use and s decline and determine whether decline is among adolescent-onset cannabis users. Participants rs of the Dunedin Study, a prospective study of 1,037 individuals followed from birth (1972/1973) cannabis use was ascertained in interviews at ages and 38 y. Neuropsychological testing was conducted before initiation of cannabis use, and again at age pattern of persistent cannabis use had developed. nabis use was associated with neuropsychological y across domains of functioning, even after control-f education. Informants also reported noticing more

neuropsychological test performance after a period of abstinence from cannabis. There are two commonly cited potential limitations of this approach. One is the absence of data on initial, precannabis-use neuropsychological functioning. It is possible that differences in test performance between cannabis users and controls are attributable to premonitory rather than cannabis-induced deficits (17–20). A second limitation is reliance on retrospectively reported quantity, frequency, duration, and age-of-onset of cannabis use, often inquired about years after initiation of heavy use.

A prospective, longitudinal investigation of the association between cannabis use and neuropsychological impairment could redress these limitations and strengthen the existing evidence base by assessing neuropsychological functioning in a sample of youngsters before the onset of cannabis use, obtaining prospective data on cannabis use as the sample is followed over

- Followed a group of 1,037 individuals from birth (1972/1973) to age 38
- Neuropsychological testing was conducted at age 13, before starting cannabis use, and again at age 38, after a pattern of persistent cannabis use had developed.
- Persistent cannabis use was associated with an 8-point drop in IQ, even after controlling for years of education
- Impairment was greatest among those who started using as adolescents, with more use associated with greater decline in IQ



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Sources: CNN, ABC News, Meier et al. (2012) PNAS



Cannabis is a natural plant, so it must be less harmful than cigarettes



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# CORRECT ANSWER: MYTH

- Cannabis is more harmful than cigarettes given that the technique for smoking cannabis generally involves **unfiltered smoking, larger puffs, deeper inhalation and longer breath holding.**
- **5 joints a day can be as harmful as 20 cigarettes a day.**
- **Cannabis smoke deposits four times more tar in the lungs** and contains 50% - 70% more cancer-causing substances than tobacco smoke does.



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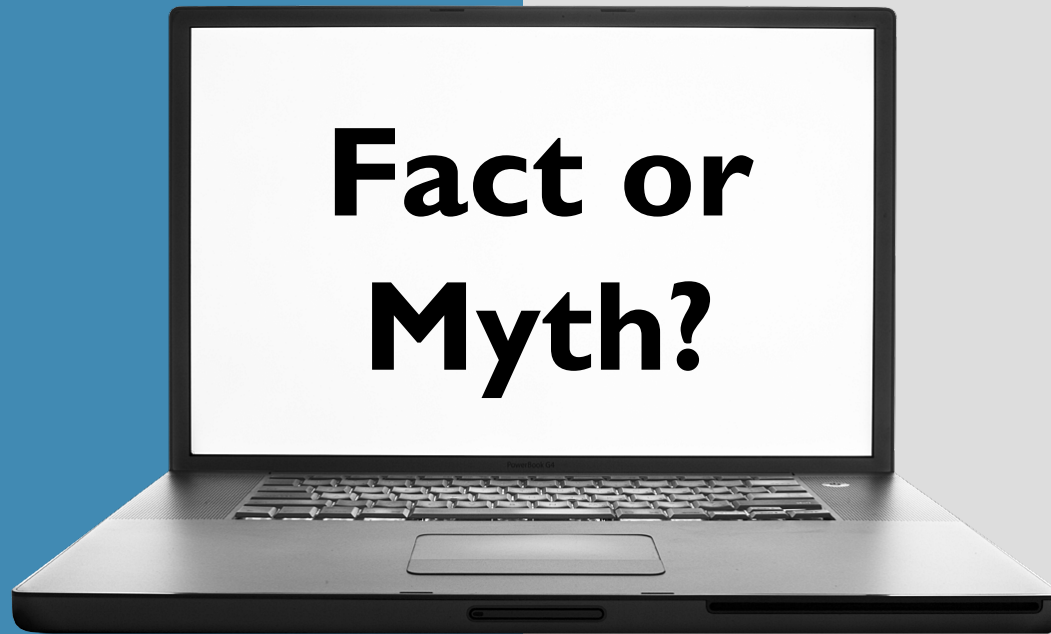
- Currently, **cannabis products are not subject to any federal health and safety standards** and therefore, may be contaminated with other drugs, pesticides or toxic fungi completely unknown to the user.
- Cannabis contains over 400 chemicals, many of them carcinogenic.



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**CANNABIS CAN BE USED  
AS MEDICINE**



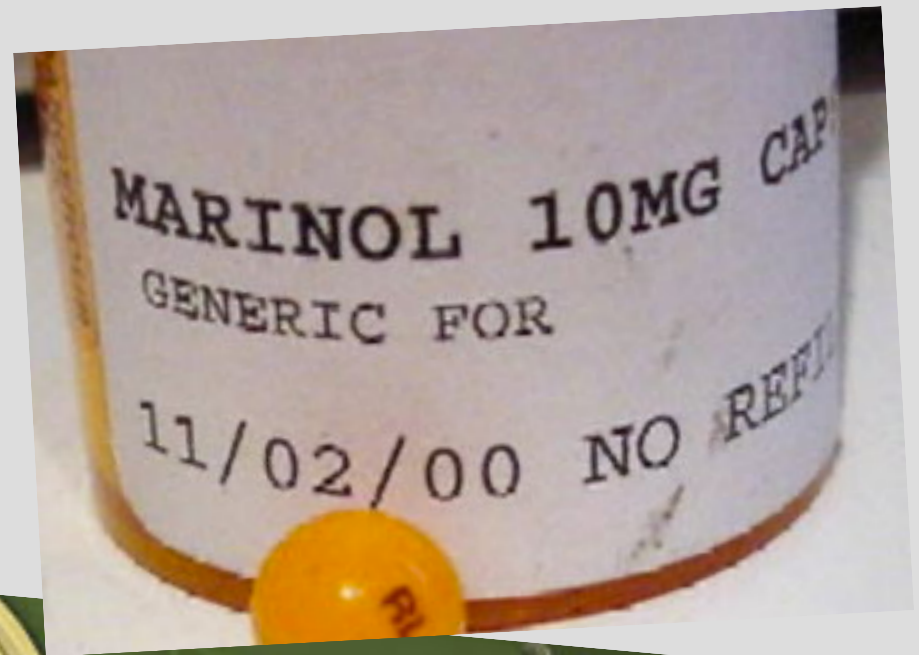
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# CORRECT ANSWER: IT'S COMPLICATED

- THC, the primary active chemical in cannabis, can be useful for treating *some* medical problems.
- THC can be used to *treat the nausea and vomiting* that occur with certain cancer treatments and to help AIDS patients *eat more* to keep up their weight.
- Cannabis as a smoked product *has never proven to be medically beneficial*.
- Cannabis is only used to *decrease discomfort; not to cure an illness*.



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# WHY ISN'T CANNABIS AN FDA APPROVED MEDICINE?

- THC is an FDA-approved medication, the cannabis plant is **NOT**.
- Reasons why the FDA has not approved cannabis include:
  1. There haven't been enough studies to show that its benefits outweigh its harms—that is, that it doesn't cause more problems than it treats.
  2. Also, because it is a plant, there is no way to know how much or exactly what chemicals a person is getting each time they use it (unlike with a pill or shot).





A



B



C



D



E

**WHICH OF THESE WEBS WAS CONSTRUCTED BY A SPIDER NOT ON DRUGS?**



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**Sober**



**Cannabis**



**Stimulants  
(Benzedrine)**



**Caffeine**



**Sedatives (Chloral hydrate)**

**CORRECT ANSWER: A**



THANK YOU FOR YOUR  
TIME!

**Contact Information:**



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Subject Matter Expert, New England ATTC

Center for Alcohol and Addiction Studies  
Brown University School of Public Health  
[sarah\\_helseth@brown.edu](mailto:sarah_helseth@brown.edu)

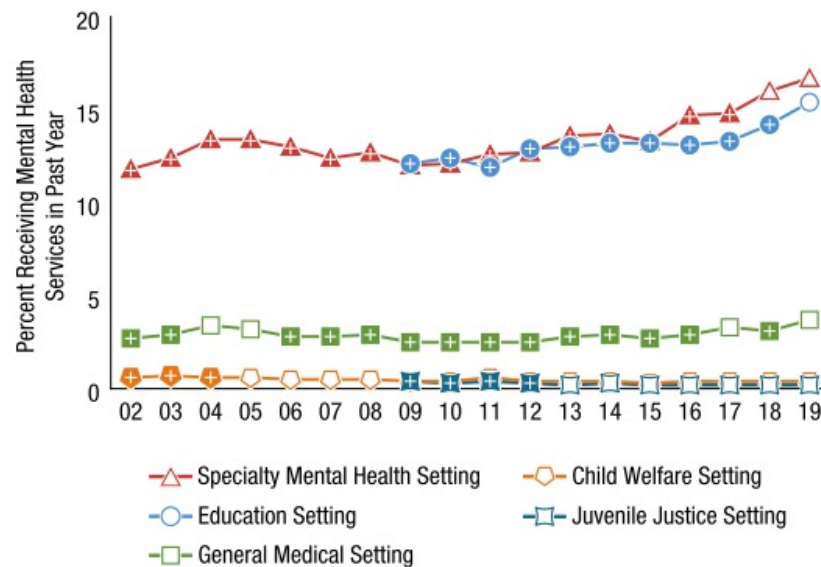


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**Figure 73. Sources of Mental Health Services in the Past Year among Youths Aged 12 to 17: 2002-2019**



+ Difference between this estimate and the 2019 estimate is statistically significant at the .05 level.

**Figure 73 Table. Sources of Mental Health Services in the Past Year among Youths Aged 12 to 17: 2002-2019**

Source	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Specialty Mental Health Setting	11.8 <sup>+</sup>	12.4 <sup>+</sup>	13.4 <sup>+</sup>	13.4 <sup>+</sup>	13.0 <sup>+</sup>	12.4 <sup>+</sup>	12.7 <sup>+</sup>	12.0 <sup>+</sup>	12.1 <sup>+</sup>	12.6 <sup>+</sup>	12.7 <sup>+</sup>	13.6 <sup>+</sup>	13.7 <sup>+</sup>	13.3 <sup>+</sup>	14.7 <sup>+</sup>	14.8 <sup>+</sup>	16.0	16.7
Education Setting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.1 <sup>+</sup>	12.4 <sup>+</sup>	11.9 <sup>+</sup>	12.9 <sup>+</sup>	13.0 <sup>+</sup>	13.2 <sup>+</sup>	13.2 <sup>+</sup>	13.1 <sup>+</sup>	13.3 <sup>+</sup>	14.2 <sup>+</sup>	15.4
General Medical Setting	2.7 <sup>+</sup>	2.9 <sup>+</sup>	3.4	3.2	2.8 <sup>+</sup>	2.8 <sup>+</sup>	2.9 <sup>+</sup>	2.5 <sup>+</sup>	2.5 <sup>+</sup>	2.5 <sup>+</sup>	2.5 <sup>+</sup>	2.8 <sup>+</sup>	2.9 <sup>+</sup>	2.7 <sup>+</sup>	2.9 <sup>+</sup>	3.3	3.1 <sup>+</sup>	3.7
Child Welfare Setting	0.6 <sup>+</sup>	0.7 <sup>+</sup>	0.6 <sup>+</sup>	0.6	0.5	0.5	0.5	0.4	0.4	0.6	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4
Juvenile Justice Setting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.4 <sup>+</sup>	0.3 <sup>+</sup>	0.4 <sup>+</sup>	0.3 <sup>+</sup>	0.2	0.3	0.2	0.2	0.2	0.2	0.2

N/A = not available.

+ Difference between this estimate and the 2019 estimate is statistically significant at the .05 level.



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**Figure 34 Table. Perceived Great Risk from Substance Use among Youths Aged 12 to 17: 2015-2019**

Substance Use	2015	2016	2017	2018	2019
Smoking Marijuana Once or Twice a Week	40.6 <sup>+</sup>	40.0 <sup>+</sup>	37.7 <sup>+</sup>	34.9	34.6
Using Cocaine Once or Twice a Week	80.2 <sup>+</sup>	80.6 <sup>+</sup>	80.1 <sup>+</sup>	79.6	78.7
Using Heroin Once or Twice a Week	82.9	83.4 <sup>+</sup>	84.0 <sup>+</sup>	83.0	82.1
Having 4 or 5 Drinks of Alcohol Nearly Every Day	64.1	65.5 <sup>+</sup>	65.2 <sup>+</sup>	64.4	63.5
Smoking One or More Packs of Cigarettes per Day	68.2 <sup>+</sup>	69.3 <sup>+</sup>	67.2 <sup>+</sup>	65.3	65.0

<sup>+</sup> Difference between this estimate and the 2019 estimate is statistically significant at the .05 level.



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Source: 2019 National Survey on Drug Use and Health (SAMHSA, 2020)