

Marijuana and Adolescent Brain Development

Amy Turncliff, PhD

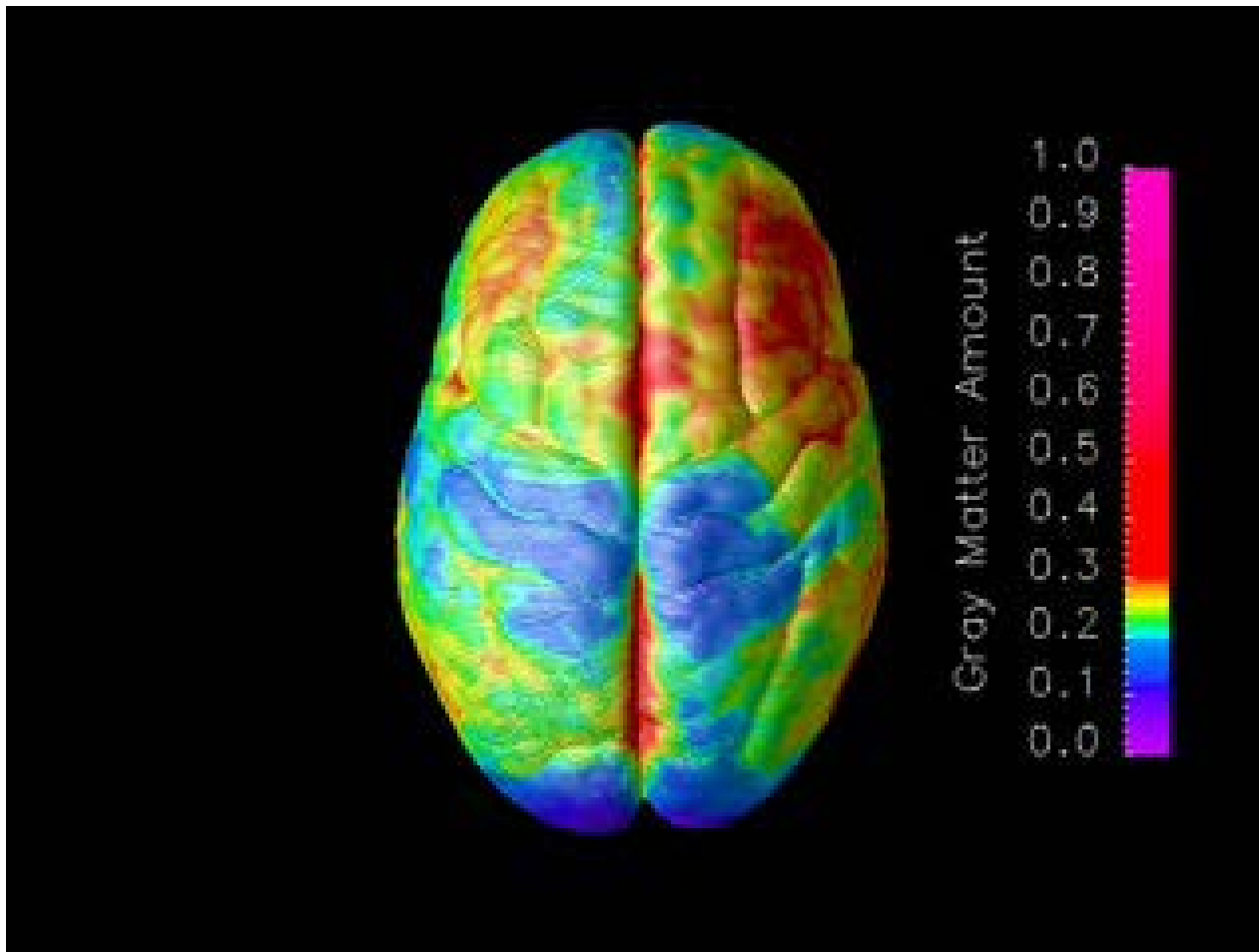
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Acknowledgements: Slides contributed by Ruth Potee MD, Bertha Madras PhD, John Scheft Esq, and Heidi Heilman.





Maturation of the human brain, age 4-21---Brain isn't fully developed until ages 21-25 years.





The “use it or lose it” principle

"If a teen is doing music or sports or academics, those are the cells and connections that will be hardwired. If they're lying on the couch or playing video games..., those are the cells and connections that are going to survive."

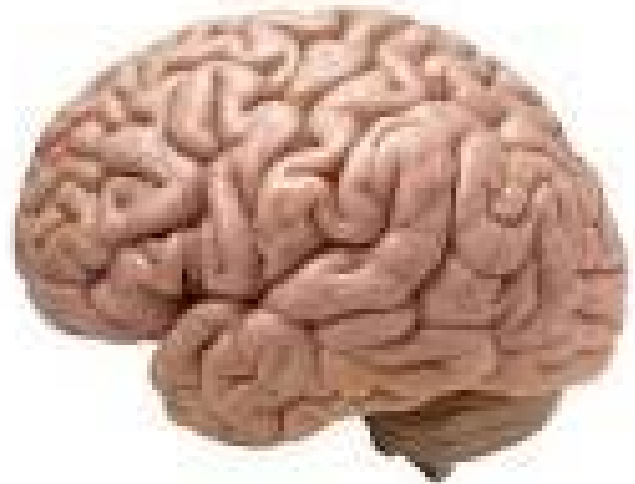
Jay N. Giedd, M.D., Chief of Brain Imaging,
Child Psychiatry Branch, National Institutes of Health



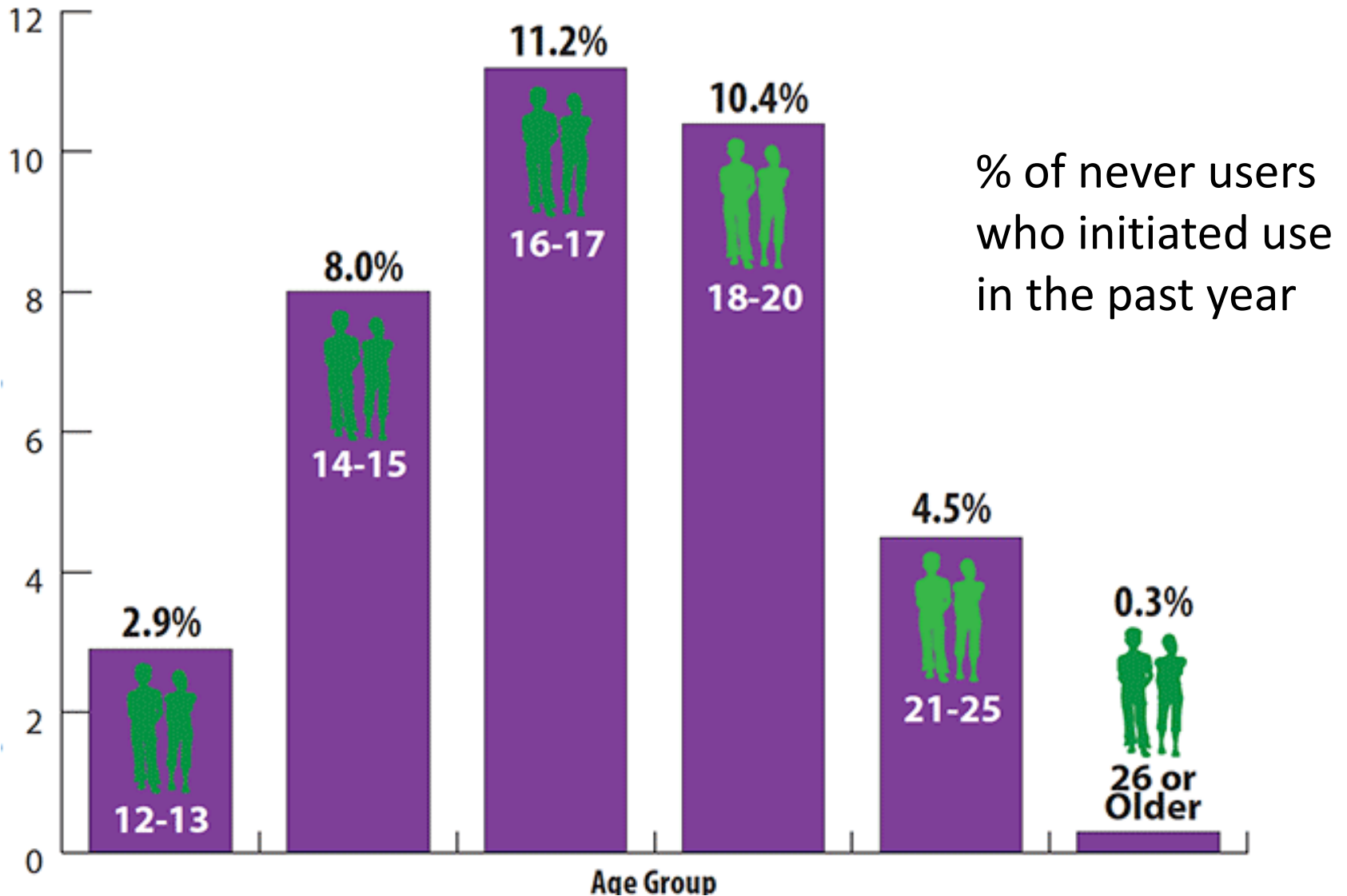
Adolescent brains are building super-highways for the pathways used regularly.

The reward system is particularly active in the teen brain.

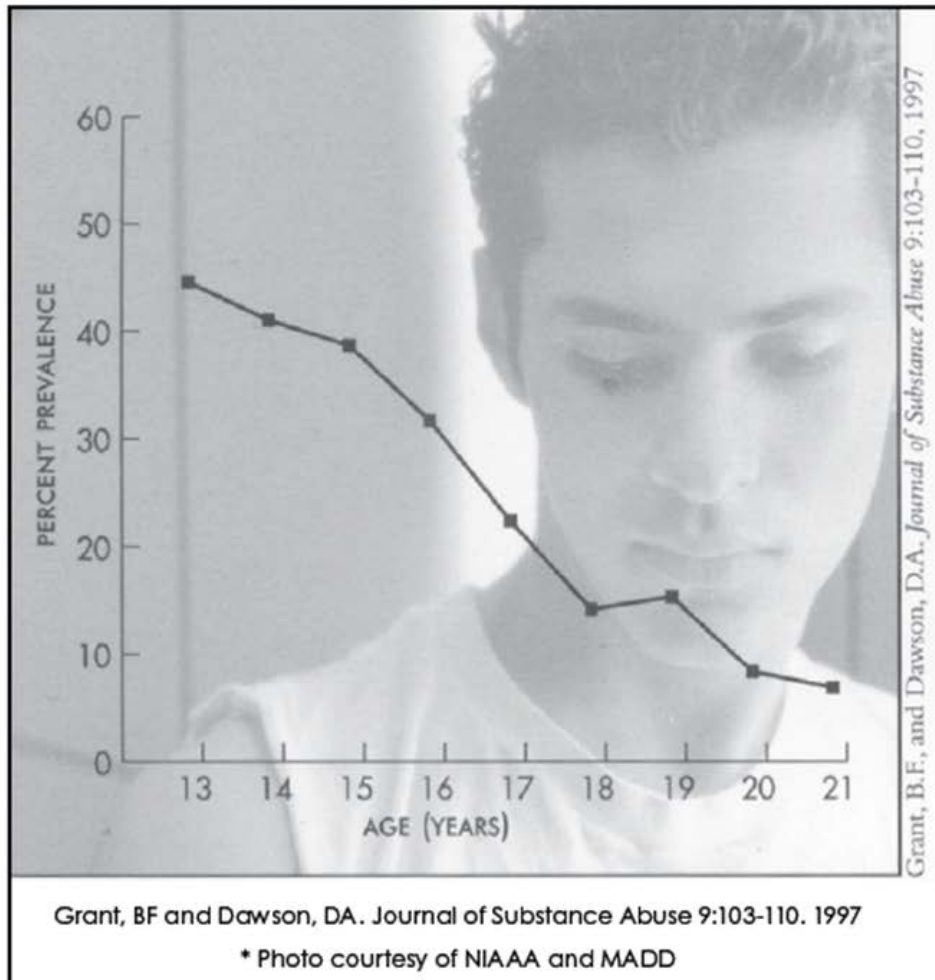
The centers for logic and reasoning are still developing.



Teens are more likely to start using illicit drugs than other age groups



Dependence on substances is highly correlated with early use

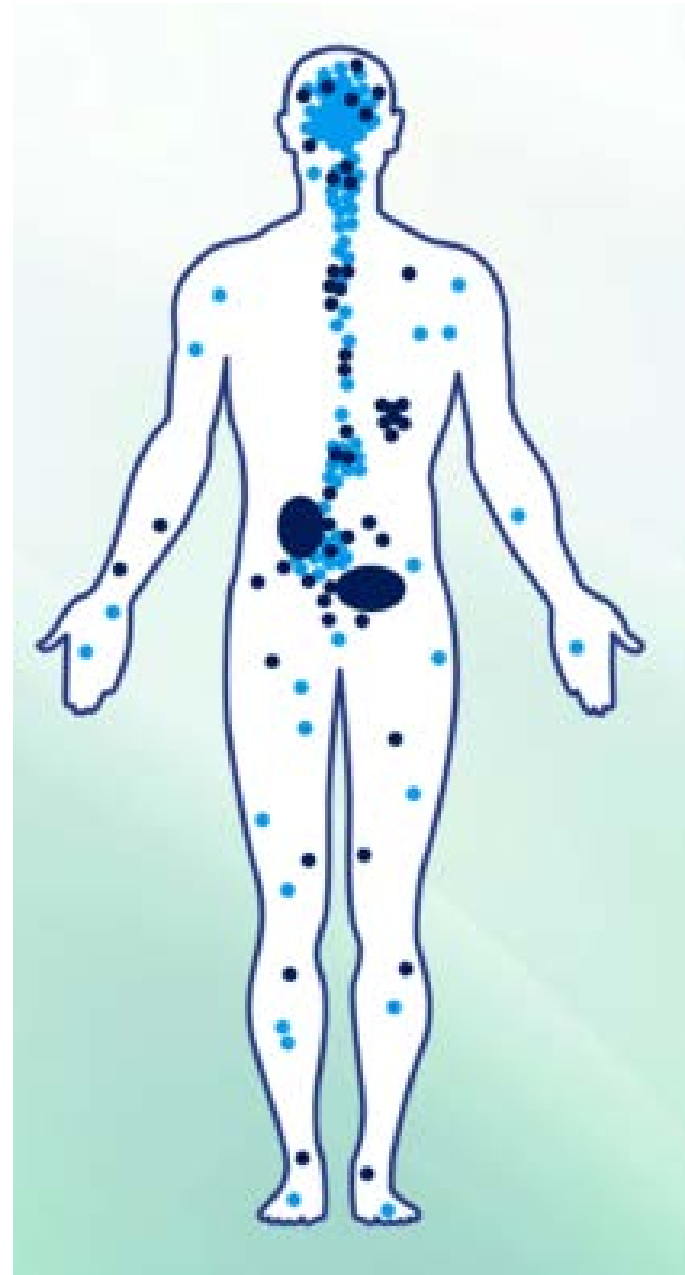


40% of those who begin drinking at age 15 will develop an alcohol use disorder.

7% of those who begin drinking at age 21 will develop an alcohol use disorder.



- There are receptors for endocannabinoids, naturally occurring signals, in the human body.
- These are found throughout the body including the brain.
- THC, CBD and other cannabinoids from marijuana mimic the body's own chemistry and can bind to those receptors and alter natural signals.



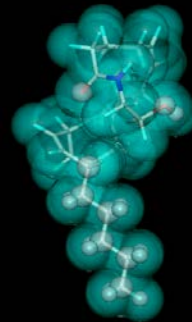
The marijuana plant (*Cannabis sativa*)



- 480 chemical compounds
- 80 cannabinoids, including THC and CBD

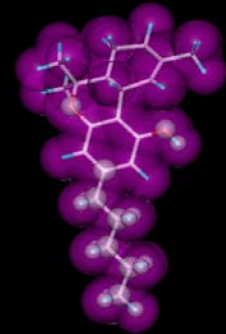
Like most drugs,
cannabinoids
mimic natural
brain messengers.

Brain's Chemical



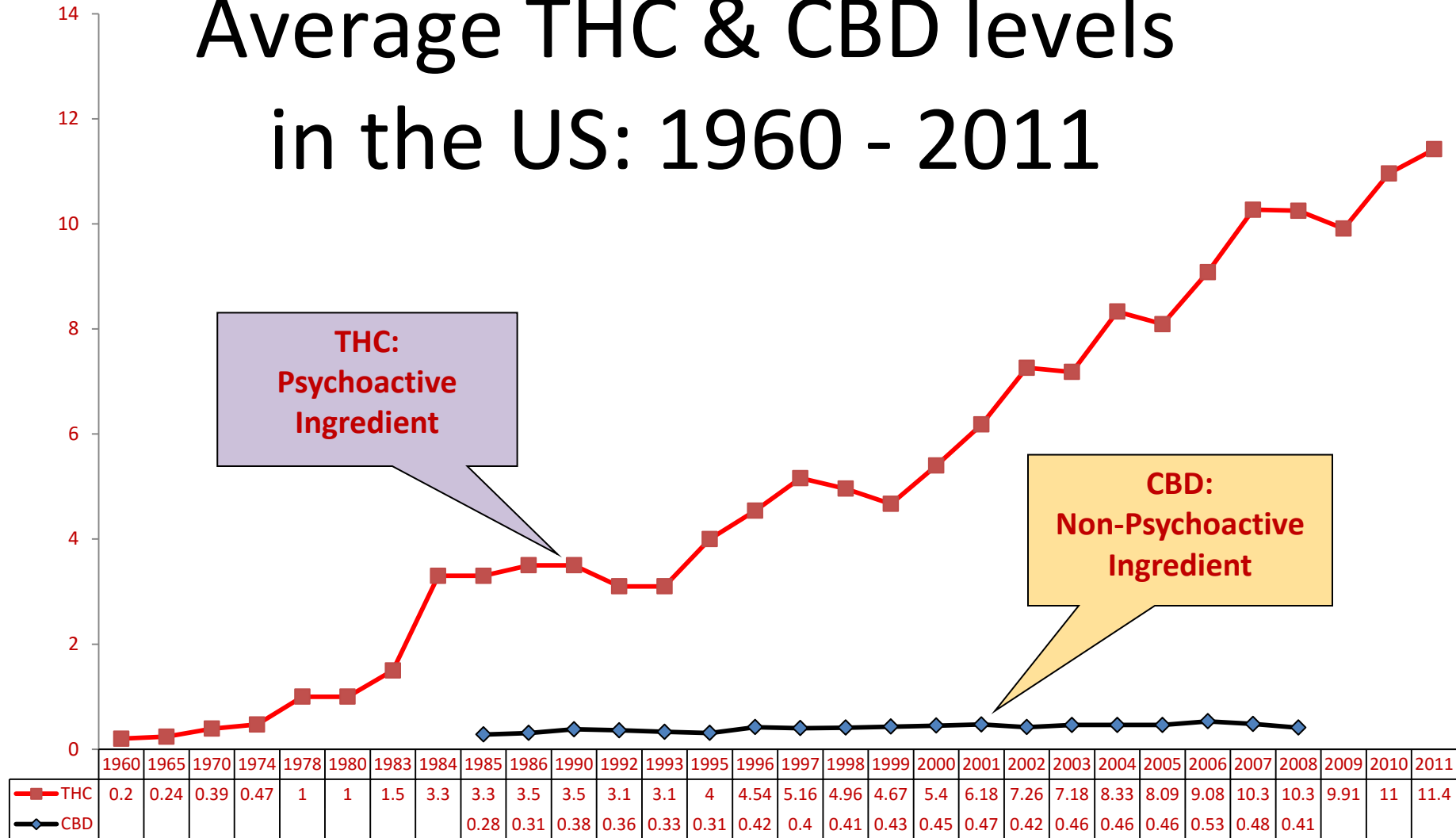
Anandamide

Drug



THC

Average THC & CBD levels in the US: 1960 - 2011



Data from the NIDA-sponsored Potency Monitoring program at the University of Mississippi, showing average THC and CBD levels in samples of marijuana seized by federal, state and local governments in each year shown.

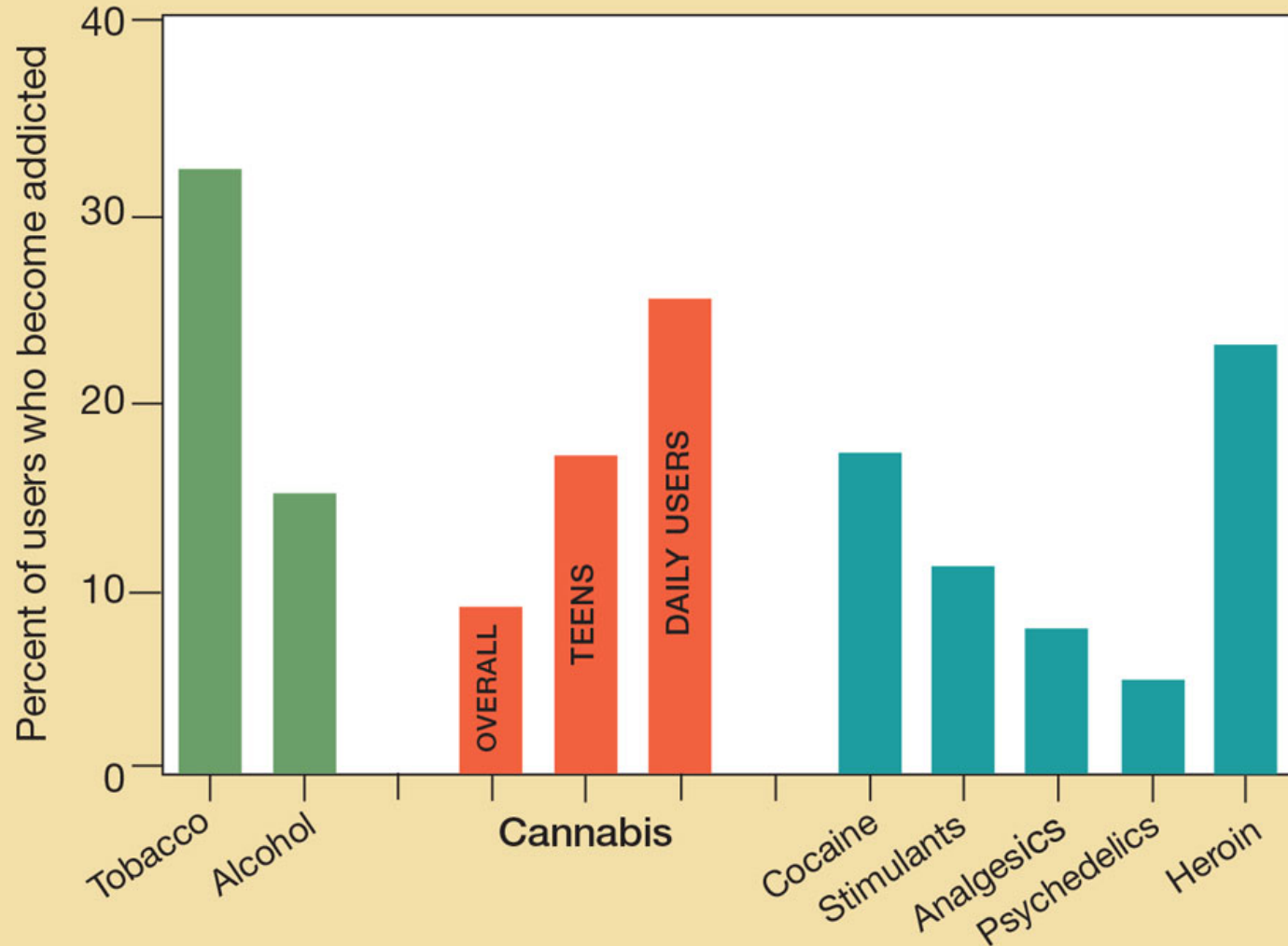


TABLE. Myth vs fact about marijuana use

Myth	Fact	What we don't know
Marijuana is not addictive	1 in 6 teenagers becomes addicted, and this addiction—like addiction to alcohol or cigarettes—affects neural mechanisms underlying tolerance, changes the reward system of the brain, and is associated with a withdrawal syndrome	Why some people become addicted while others do not
There are no long-term effects of marijuana use	Marijuana use before age 18 may affect IQ, learning and memory, and brain structure and function years later	How long-lasting these effects are, and whether they resolve after abstinence
Marijuana is a treatment for mental health disorders	The current state of science does not show the benefit of smoked marijuana for psychological conditions; in fact, marijuana use likely worsens symptoms	Whether scientists will someday discover therapeutic components of cannabis that can be extracted and purified
Marijuana is a safe drug for teenagers	Nearly all negative effects of marijuana (eg, brain changes, neurocognitive deficits, addictive potential) are worse in teenage than in adult users	How differences in mental health, level of exposure to marijuana, and use of other substances affect marijuana-related harms

Gilman, 2015--<http://www.psychiatrictimes.com/special-reports/cannabis-use-young-adults-challenges-during-transition-adulthood>

Comparison of addictive potential by drug type¹⁹



Gilman, 2015--<http://www.psychiatrictimes.com/special-reports/cannabis-use-young-adults-challenges-during-transition-adulthood>



Potential longer-term effects of regular marijuana use on youth development

- Issues with attention, memory and learning
- Poorer educational and life outcomes
- Loss of IQ for persistent heavy users
- Potential for addiction to marijuana and increased risk of addiction to other drugs
- Increased risk of psychosis

Adverse Effects of Marijuana on Health and Well-Being

Level of Confidence in the Evidence for Adverse Effects of Marijuana on Health and Well-Being

Effect	Overall Level of Confidence*
Addiction to marijuana and other substances -----	High
Abnormal brain development -----	Medium
Progression to use of other drugs -----	Medium
Schizophrenia -----	Medium
Depression or anxiety -----	Medium
Diminished lifetime achievement -----	High
Motor vehicle accidents -----	High
Symptoms of chronic bronchitis -----	High
Lung cancer -----	Low

Volkow ND et al. N Engl J Med 2014;370:2219-2227.



What Does Commercialized
Marijuana (“Medical” and/or
Recreational) Look Like?

SMOKING



PIPE



BONG



BUBBLER



DAB



JOINT



BLUNT

BEVERAGES



TEA



SODA



ALCOHOL



MILK

Ways to
consume
marijuana

EDIBLES



CANDY



ICE CREAM



BAKED GOODS

VAPORIZING



DESKTOP VAPORIZER



PORTABLE VAPORIZER

OTHER



CAPSULES



SPRAY



TINCTURE

Products & packaging:
Like this?



Commercialization Has Begun



The “Crack” of Marijuana - Engineered to Addict

Engineered to be 80-90% THC



“Green Crack” wax



Butane Hash Oil
(BHO)



“Ear Wax”

Wax



“Budder”



“Shatter”



A Dab



Hash Oil Capsules

Sales outlets/dispensaries



A dispensary in Colorado ...
now painted gray after community complaints that the mural enticed children



Advertising/promotions

OPEN M-F: 11A-7P & SAT: 12P-5P

MAHATMA
CONCENTRATES EST 2010

2 for \$45
While supplies last.

\$125 Oz
Select Strains
While supplies last.

\$20 1/8th
Select Strains

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FREE GRAM

First Time Patients
Buy 1 Gram
Get One FREE

New Patient Special \$140 OZ Any Strain

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MILAGRO • 1181 County Rd 308
(Exit 234 off I-70)
Dumont, CO
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**STOP BY ON YOUR WAY UP
THE MOUNTAIN FOR ALL YOUR
RECREATIONAL NEEDS!**

SHOW YOUR SKI PASS AND RECEIVE
A \$1.00 JOINT
WITH PURCHASE!



MARIJUANA: *KNOW THE FACTS*



MARIJUANA: KNOW THE FACTS

How do changes in marijuana policy impact the health and safety of our communities and our children?

What does the science say?

- **Marijuana can be addictive.** The earlier someone begins using marijuana, the higher their risk of addiction -- one in six users who start under age 18 become dependent; 25-50% of teen heavy users become addicted.
- **Marijuana today is not the marijuana of the 1970s.** Highly concentrated marijuana products available today range from 5 to 85% THC (the psychoactive part of marijuana). High potency marijuana, often in the form of candies, cookies, sodas, and hashish concentrates (e.g., budder, wax, honey oil, shatter), are more likely to be associated with addiction and the negative health consequences in young people seen in recent years.²
- **Marijuana use has long-term negative consequences for kids.** According to studies by the National Academy of Sciences and other organizations, marijuana use by adolescents can impair brain development, reduce academic success, impact long-term career growth, and even lower IQ. Marijuana is associated with long-term health risks, including increased susceptibility to mental health issues (e.g., paranoia, depression, suicidal thoughts, and schizophrenia) and heart attacks.^{3,4,5,6,7,8,9,10}
- **Marijuana use/dependency is associated with addiction to other drugs.** In a prospective study, marijuana use was associated with a 6.2 times (620%) higher risk of developing any substance use disorder. The younger marijuana is used, the higher the rates of addiction to marijuana and to other drugs, including opioids.^{11,12}



MARIJUANA: KNOW THE FACTS

How do changes in marijuana policy impact the health and safety of our communities and our children?

What do the experiences of other states tell us?

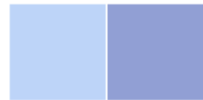
- **Where marijuana is legal, young people are more likely to use it.** Since becoming the first state to legalize, Colorado has also become the #1 state in the nation for teen marijuana use. Teen use jumped 20% in Colorado in the two years since legalization, even as that rate has declined nationally.^{13,14}
- **Colorado saw a 29% increase in marijuana-related emergency room visits the year marijuana was legalized.** High potency edible products have also been associated with negative consequences for adults who may fail to pay attention to serving sizes, leading to overexposure to marijuana.^{14, 15, 16}
- **Colorado has seen an increase in traffic deaths caused by operators testing positive for marijuana.** In 2014, when retail marijuana stores began operating, there was a 32% increase in traffic deaths caused by operators who tested positive for the presence of marijuana. 25-40% of OUIs in Colorado involved marijuana alone.^{14,16}
- **Increase in accidental marijuana use by young children.** According to data from the National Poison Data System, accidental exposure to marijuana among children under 6 years old has been on the rise. Marijuana infused products such as gummy bears, candy bars and “cannabis cola” are often indistinguishable from traditional products and attractive to children, placing them at significant risk of accidental use.^{14,16}

“We will use [medical marijuana] as a red-herring to give marijuana a good name.”

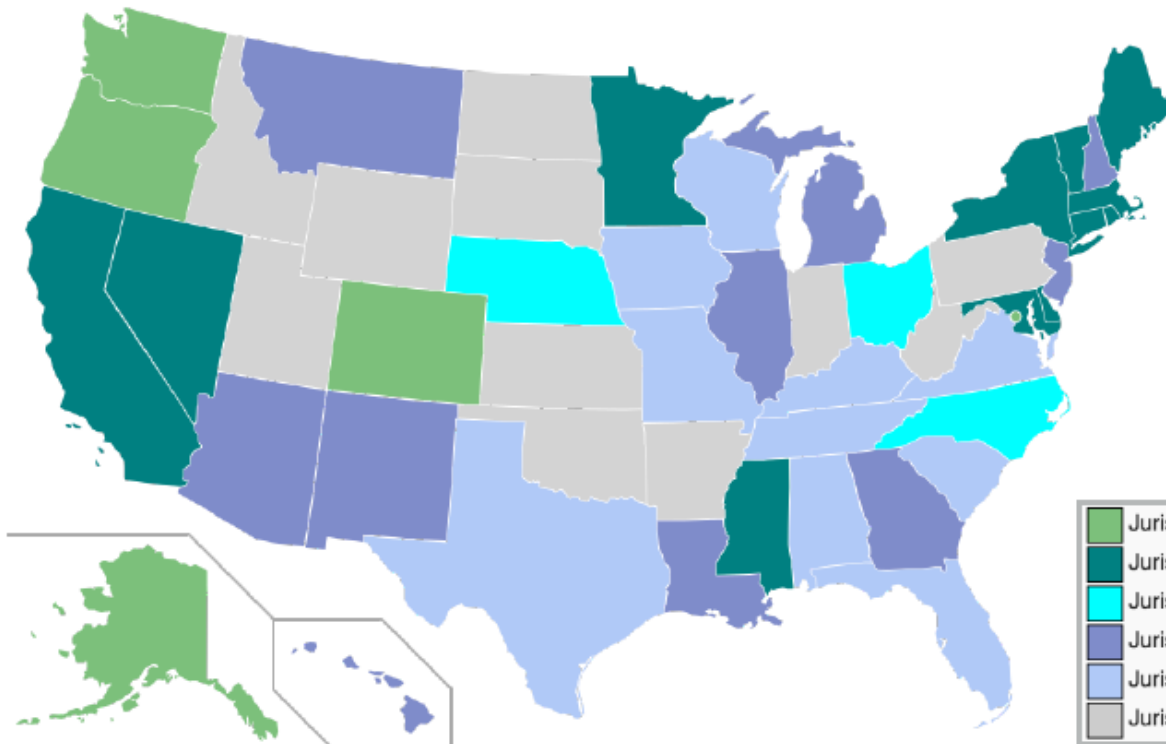
Keith Stroup, head of NORML to the Emory Wheel, 1979

Big Marijuana Strategy

Decriminalize > “Medical” > Legalize > **COMMERCIALIZE**



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- Jurisdiction with legalized cannabis.
- Jurisdiction with both medical and decriminalization laws.²
- Jurisdiction with decriminalized cannabis possession laws.
- Jurisdiction with legal psychoactive medical cannabis.
- Jurisdiction with legal non-psychoactive medical cannabis.
- Jurisdiction with cannabis prohibition.

Summary of Concerns About Marijuana Policy

- *“I am a family physician who is board certified in addiction medicine. I have been running trainings all over the state talking with parents and students about the impact of marijuana on the developing teenage brain. I have never seen a larger chasm between the 30 year olds and younger generation and those older than that on the perception of marijuana risks and benefits. The average adolescent and twenty-something considers marijuana to be an herbal supplement, beneficial for all health conditions. I think we are going to reflect on what happened in 2014 twenty years from now and think, “What were we thinking? We have created a generation of individuals with lower cognitive skills, higher rates of addiction, and a greater sense of lost purpose than we could have imagined”. This is a drug grown intentionally to be more potent and addictive and then processed for the strongest high possible. We are allowing Big Tobacco to become Big Marijuana and the health consequences will be enormous.” --- Dr. Ruth Potee*

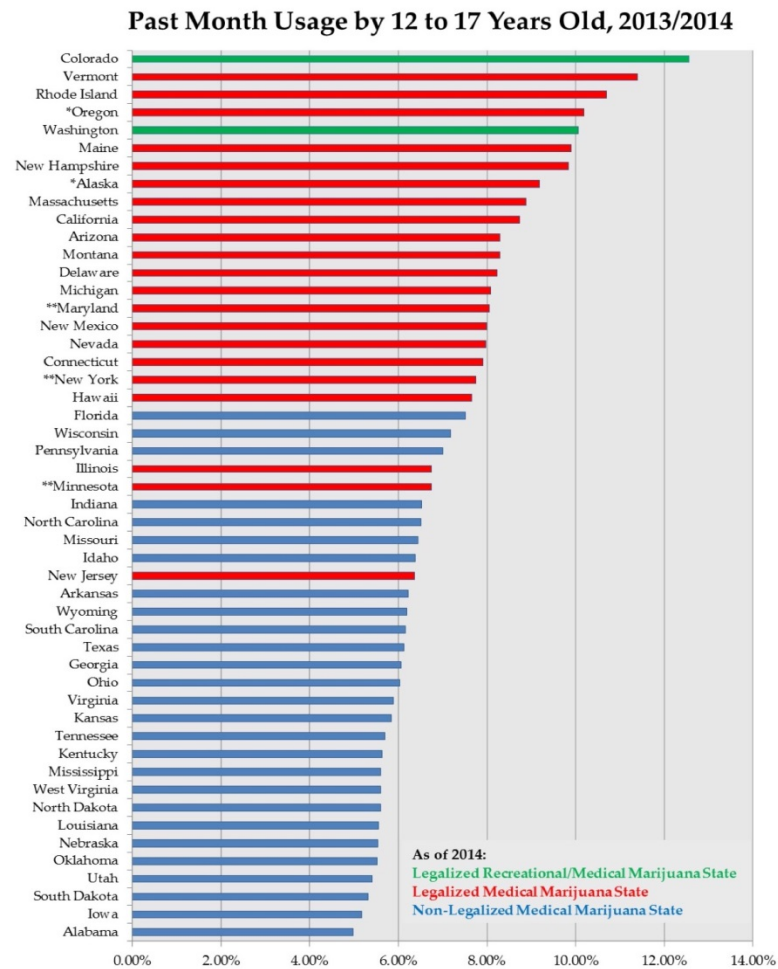


Some considerations affecting youth—"medical" marijuana and if recreational use is legalized

- ❖ Marijuana-related health harms
- ❖ Establishment and enforcement of regulations
- ❖ Minimum legal sales age
- ❖ Use in public
- ❖ Driving under the influence
- ❖ Types of products allowed
- ❖ Packaging and labeling
- ❖ Advertising and marketing
- ❖ Appearance of store fronts
- ❖ Location and density of vendors
- ❖ If recreational legalization passes, "medical" dispensaries will be able to "convert" to recreational "Pot shops"—Colorado is #1 in U.S. for youth use.
- ❖ Use of revenue for prevention

Youth Use of Marijuana is Highest in States with Legalization of “Medical” and/or “Recreational” Marijuana

- If legalization of recreational marijuana passes in MA, “medical” dispensaries will be able to convert to recreational “Pot shops”.
- Colorado is #1 in U.S. for youth use.



SOURCE: SAMHSA.gov, National Survey on Drug Use and Health 2013 and 2014

NOTE:

*Oregon and Alaska voted to legalize recreational marijuana in November 2014

**States that had legislation for medical marijuana signed into effect during 2014

Resource list

Adolescent brain

- David Dobbs, “Beautiful Brains,” *National Geographic*, October 2011, <http://ngm.nationalgeographic.com/2011/10/teenage-brains/dobbs-text>
- Laurence Steinberg, *Age of Opportunity: Lessons from the New Science of Adolescence*, 2014.
- Frances E. Jensen with Amy Ellis Nutt, *The Teenage Brain. A Neuroscientist’s Survival Guide to Raising Adolescents and Young Adults*, 2015.

Prevention

- US Surgeon General, National Prevention Strategy, *Preventing Drug Abuse and Excessive Alcohol Use*, <http://www.surgeongeneral.gov/priorities/prevention/strategy/preventing-drug-abuse-excessive-alcohol-use.html>
- Trust for America’s Health’s *Reducing Teen Substance Misuse: What Really Works*, 2015, <http://healthyamericans.org/assets/files/TFAH-2015-TeenSubstAbuse-FnlRv.pdf>
- Community Anti-Drug Coalitions of America. *The Coalition Impact: Environmental Prevention Strategies* <http://www.cadca.org/sites/default/files/resource/files/environmentalstrategies.pdf>
- *Community Action Plan*, May 2016, available on the Communities That Care Coalition website CommunitiesThatCareCoalition.org

Addiction

- Dr. Ruth Potee, *Physiology of Addiction* (video), <https://www.youtube.com/watch?v=eySb0etE1PA>
- National Institute on Drug Abuse, *Drugs, Brains, and Behavior: The Science of Addiction*, <https://www.drugabuse.gov/publications/drugs-brains-behavior-science-addiction/drug-abuse-addiction>

Marijuana

- Commonwealth of Massachusetts, *Report of the Special Senate Committee on Marijuana*, March 8, 2016, <https://malegislature.gov/Document/Bill/189/Senate/SD2479/DocumentAttachment/sd2479.pdf>
- MA Department of Health, *Medical Use of Marijuana Program* (including Guidance for Municipalities), <http://www.mass.gov/eohhs/gov/departments/dph/programs/hcq/medical-marijuana/>
- Colorado Department of Public Safety, *Marijuana Legalization in Colorado: Early Findings*, March 2016, <http://cdpsdocs.state.co.us/ors/docs/reports/2016-SB13-283-Rpt.pdf>
- National Institute on Drug Abuse, *Drug Facts: Marijuana*, March 2016, <https://www.drugabuse.gov/publications/drugfacts/marijuana>
- National Organization for the Reform of Marijuana Laws (NORML), <http://norml.org/>

Report of the Special Senate Committee on Marijuana



March 8, 2016

The Legalization of Marijuana in Colorado *The Impact*

Volume 4
September 2016



Rocky Mountain High Intensity
Drug Trafficking Area
www.rmhidta.org

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