

Marijuana and Adolescent Brain Development

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Impact of Marijuana Commercialization on Youth Use in Colorado

The Colorado Experience

- **The 2015 Healthy Kids Colorado Survey (HKCS) Data indicate that regions with marijuana friendly policies, including commercialization, show some of the highest youth use rates in their state.**
- For additional information see an analysis of the [2015 HKCS by Dr. Christian Thurstone](#), an Associate Professor of Addiction Psychiatry and the Director of Medical Training of the Addiction Psychiatry Fellowship program at the University of Colorado.
 - **Dr. Thurstone says:** "I'm interested in this subject because 95 percent of the teenagers treated for substance abuse and addiction in my adolescent substance-abuse treatment clinic at Denver Health are there because of their marijuana use, and because nationwide, 67 percent of teens are referred to substance treatment because of their marijuana use. Marijuana is the No. 1 reason why adolescents seek substance-abuse treatment in the United States."

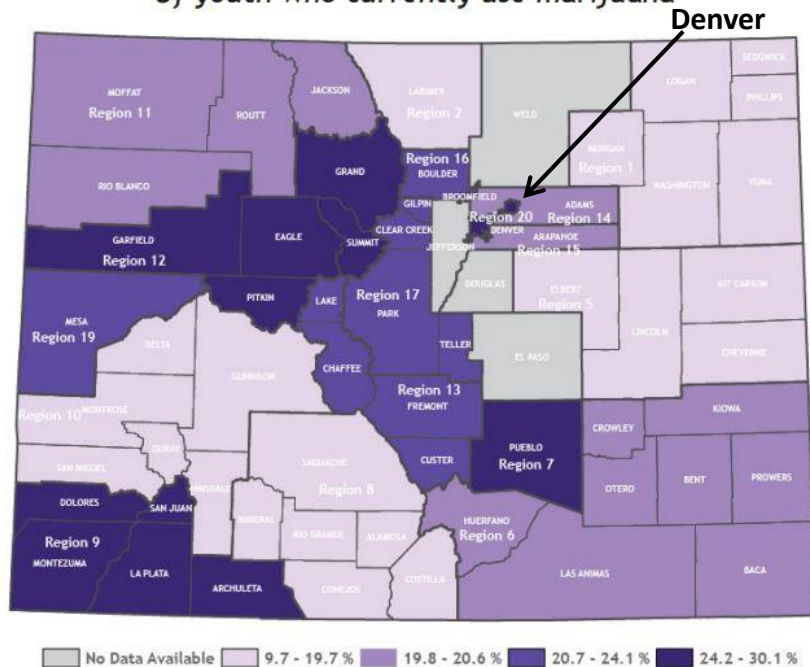
For More information: <http://drthurstone.com/healthy-kids-colorado-survey-2015/>

2015 HKCS Data Compared with Pot Shop Locations

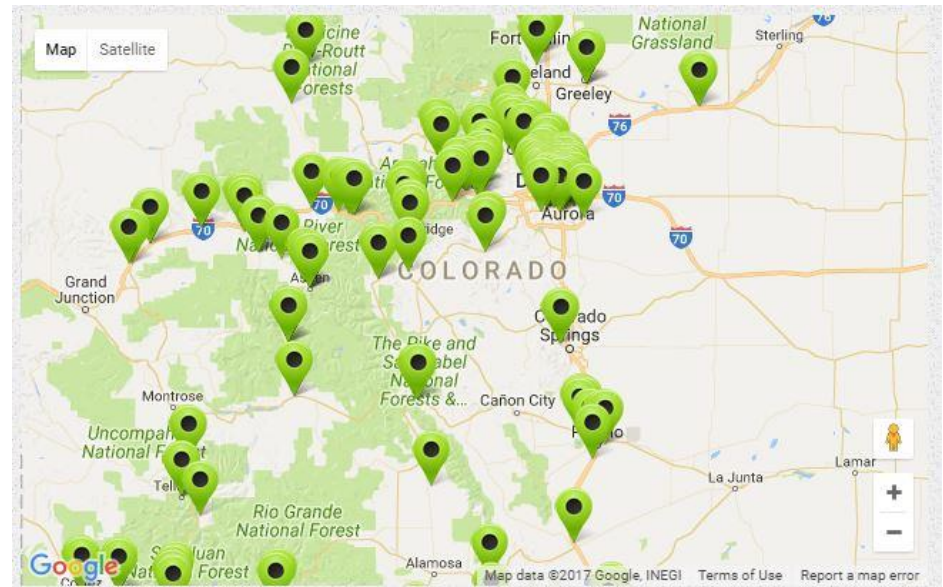
Healthy Kids CO 2015 Survey Data

REGIONAL BREAKDOWN

Of youth who currently use marijuana



NORML Marijuana Retail Shop Locator



2015 CO "Healthy Kids" Youth (Gr. 9-12) Current Marijuana Use (past 30 days) = 21%

2015 NSDUH U.S. = 7.2% of 12-17 year olds
2015 NSDUH CO= 11.1% of 12-17 year olds (state data)

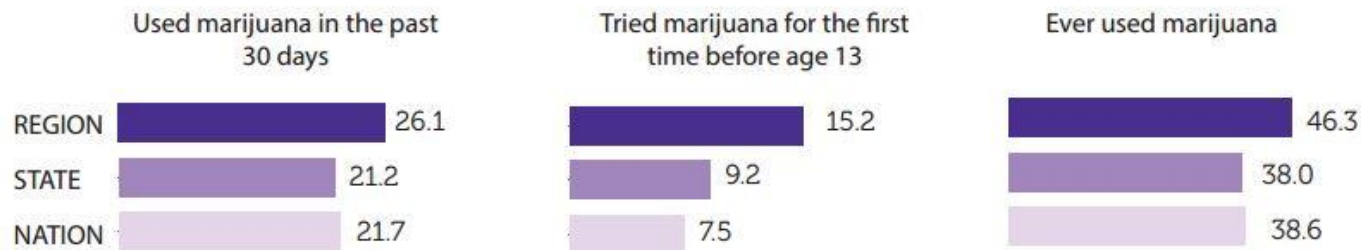
According to data from the 2015 Healthy Kids Colorado Survey (HKCS), there is an association between counties with high densities of recreational pot shops and high rates of current marijuana use by CO youth.

For More information: <http://drthurstone.com/healthy-kids-colorado-survey-2015/>

[2015 Healthy Kids Colorado Survey Data](#) (High School): High School MJ Use in Two Counties that Allow Rec Pot Shops

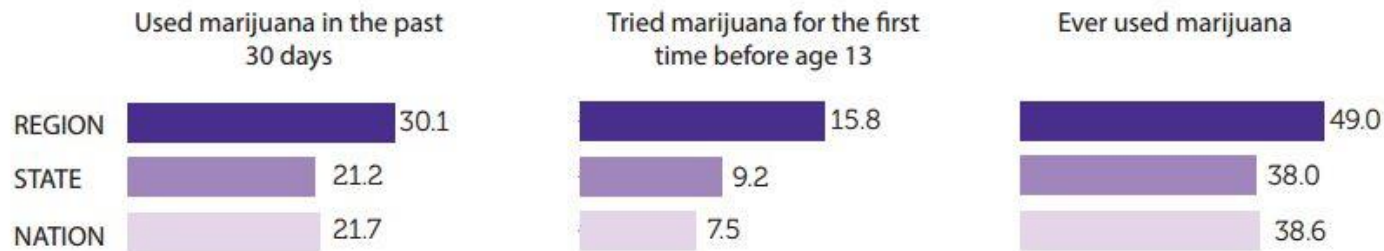
Denver County

YOUTH MARIJUANA USE



Pueblo County

YOUTH MARIJUANA USE



*Denver and Pueblo Counties are known for their pot-friendly policies.

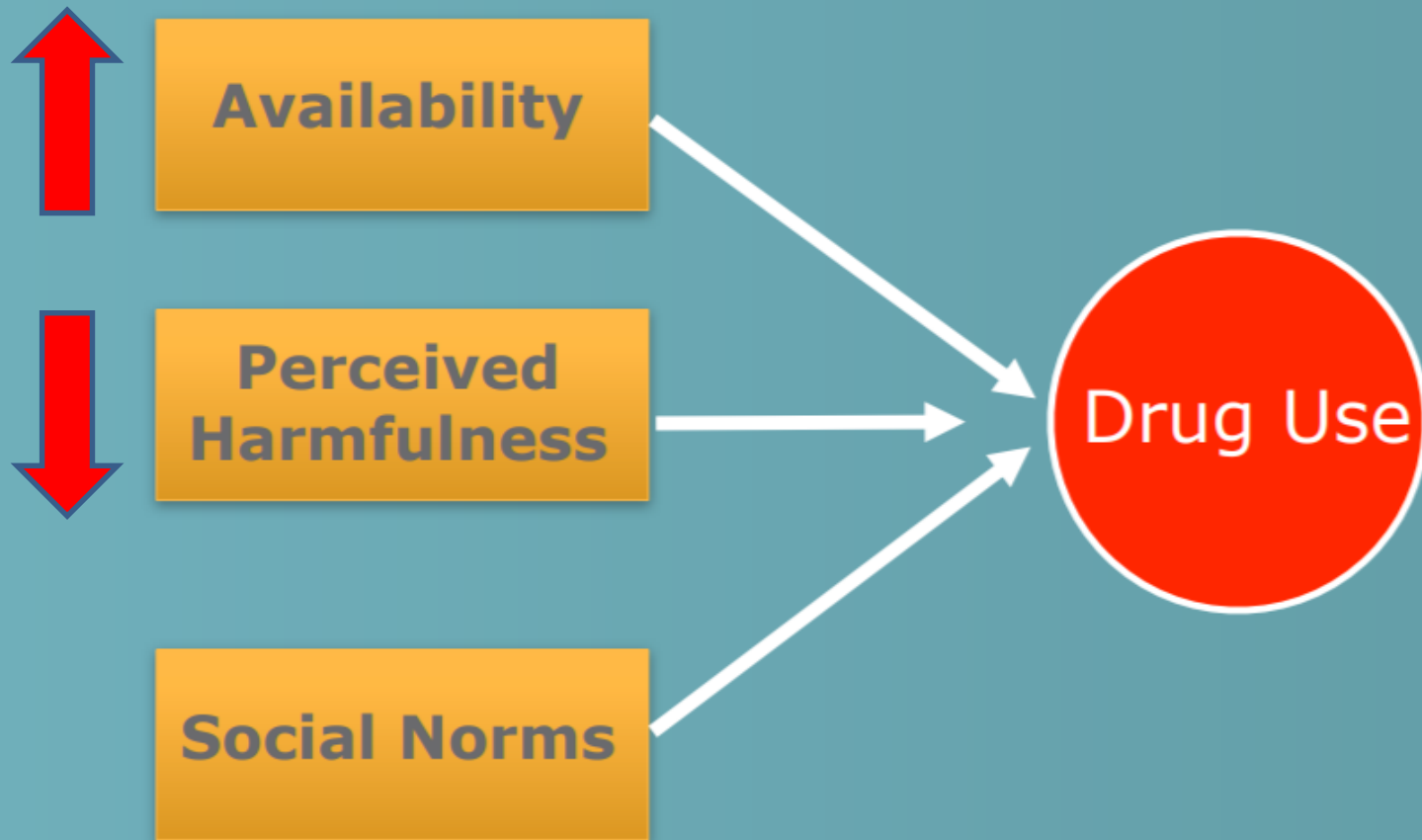
Dr. Christian Thurstone reports:

“A common theme among these regions [with higher youth marijuana use] is a high level of marijuana commercialization in the forms of retail and medical stores.”

Prevention Science: Why is Marijuana Commercialization Associated with Higher Rates of Youth Use?

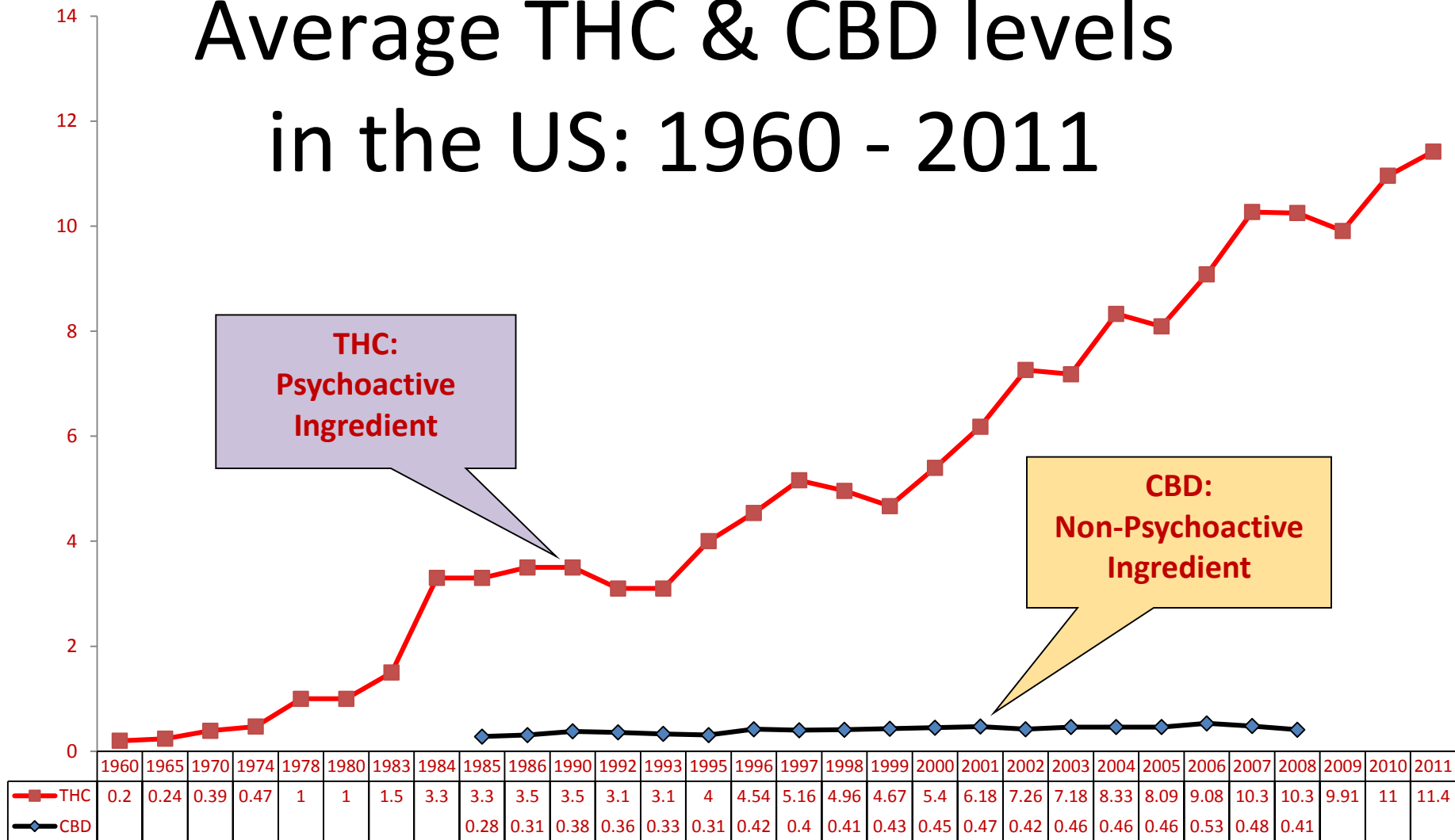
- Increased access and availability
 - Youth will still access via grey and black market
- Decreased perception of harm
- Decreased perception of disapproval
- Cultural normalization of marijuana use

Three big contributors to drug use



Why Does it Matter if Adolescents Use Marijuana?

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.

Average THC to CBD Ratios in the US: 1995 - 2014

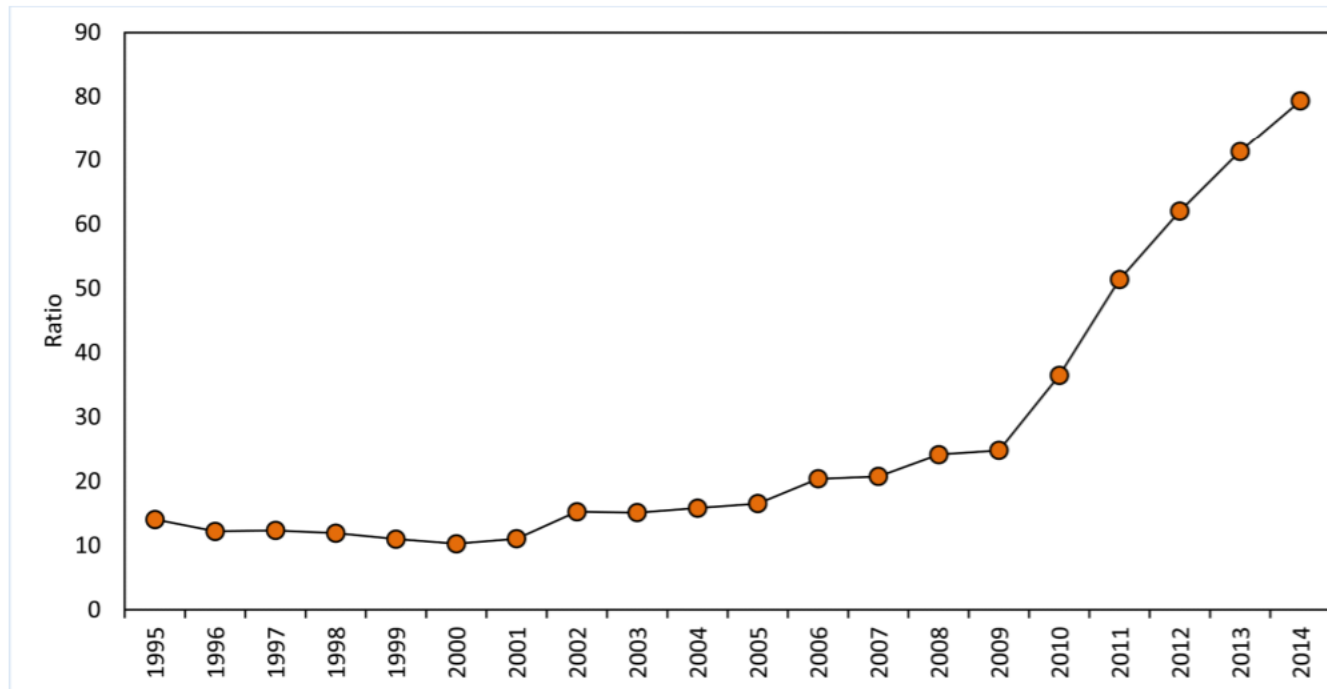
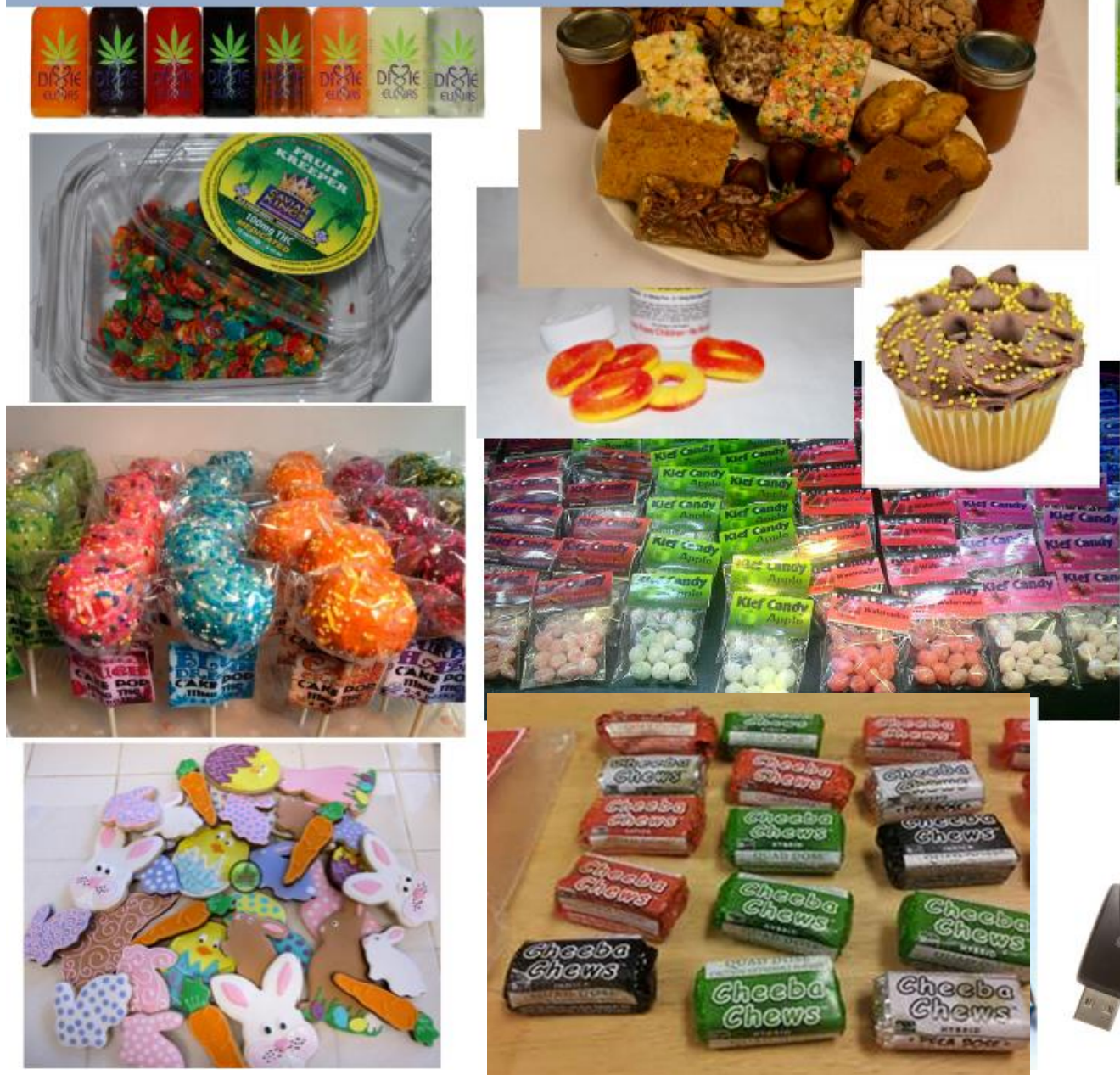


Figure 6.

Ratio of the average concentration of THC to CBD in DEA specimens by year, 1995 – 2014.

ElSohly et al, Biol Psychiatry . 2016 April 1; 79(7): 613–619.

Products and Packaging: Like this?



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

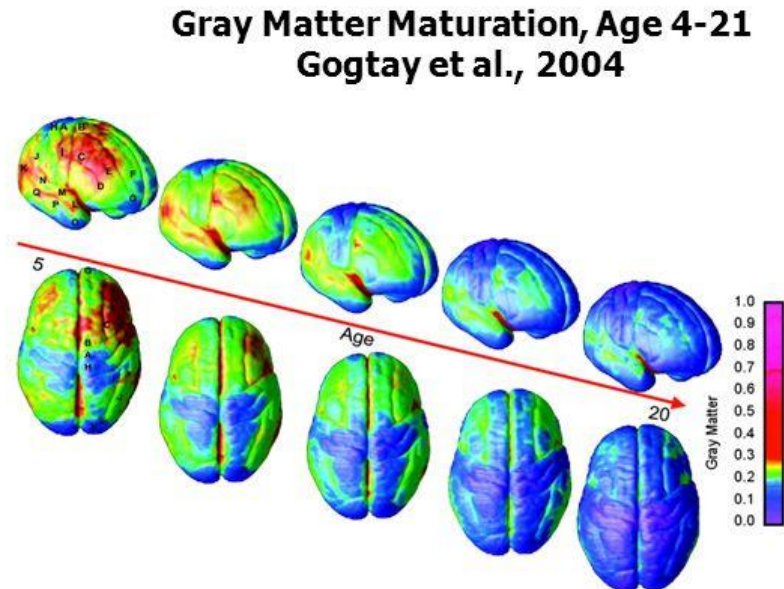


Hash Oil Capsules

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

Summary

- The brain undergoes a considerable amount of development during the teen years.
- The last area to mature is the prefrontal cortex region; involved in planning, decision making and impulse control.



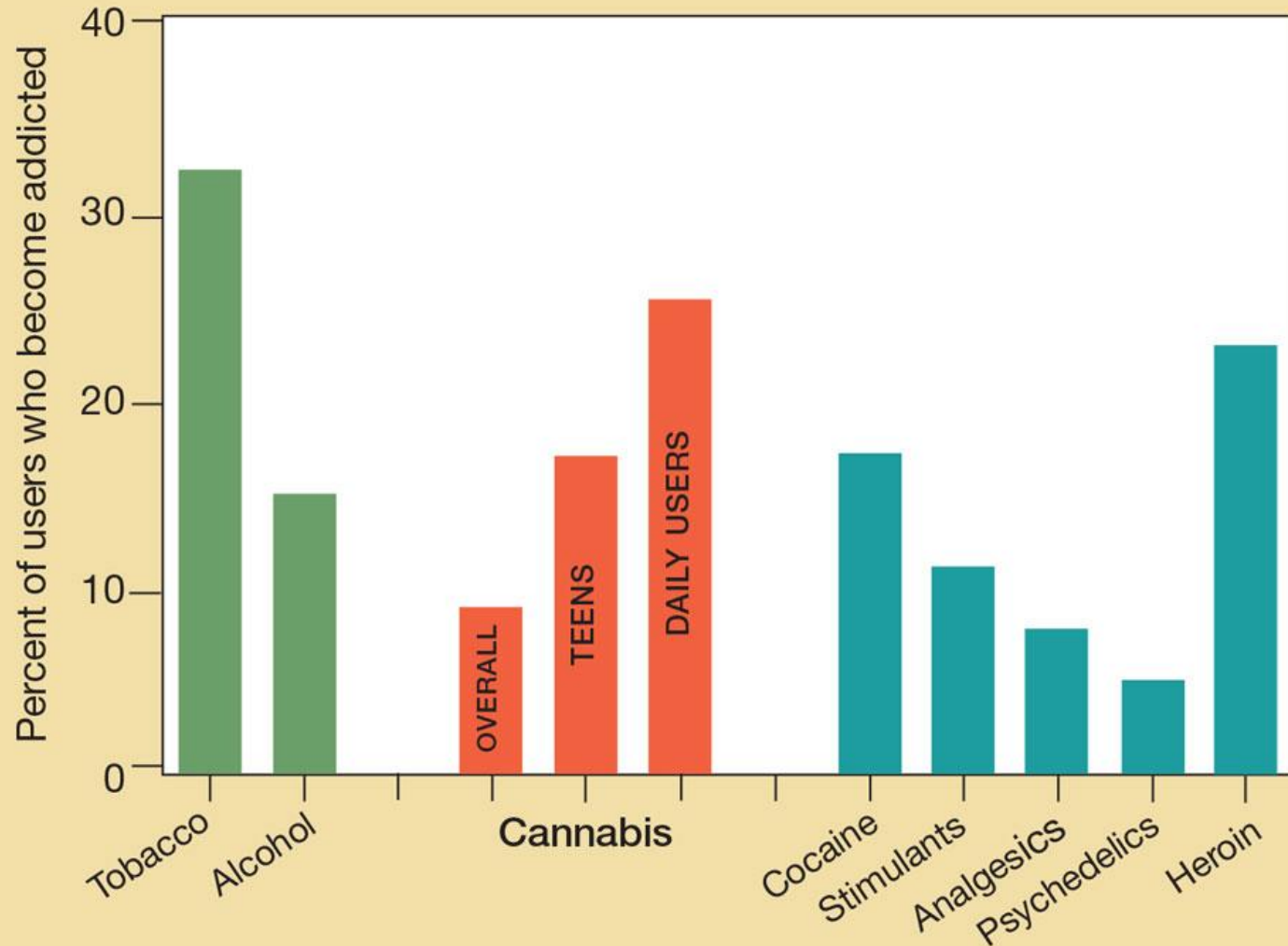
Adolescent brains are building super-highways for the pathways used regularly.

The reward system is particularly active in the teen brain.

The centers for logic and reasoning are still developing.

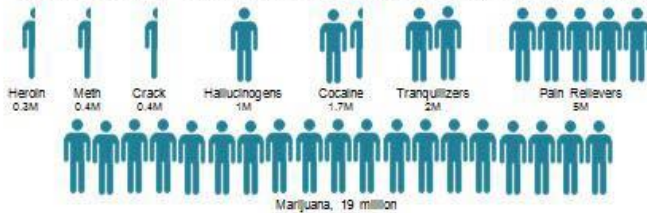


Comparison of addictive potential by drug type¹⁹

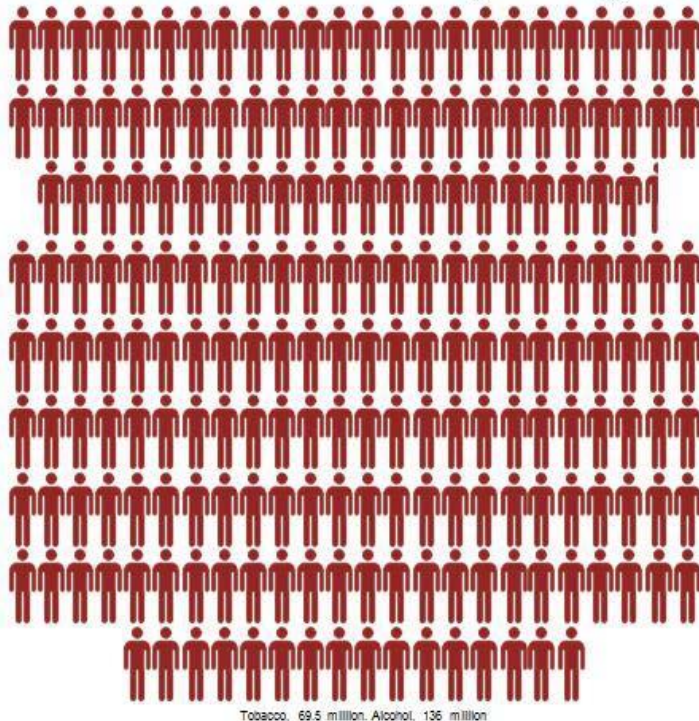


Gilman, 2015--<http://www.psychiatrictimes.com/special-reports/cannabis-use-young-adults-challenges-during-transition-adulthood>

This is America on illegal drugs.



This is America on legal drugs.



Legal drugs are produced by commercial industries that seek to increase consumption in order to increase profits. Nearly 4 times more Americans use tobacco than marijuana; 7 times more use alcohol. Because legalizing marijuana opens the door to commerce, the number of people who use marijuana is likely to equal the number who use tobacco and/or alcohol.

Do we really want to legalize a third addictive drug?

National Families in Action
404-248-9676

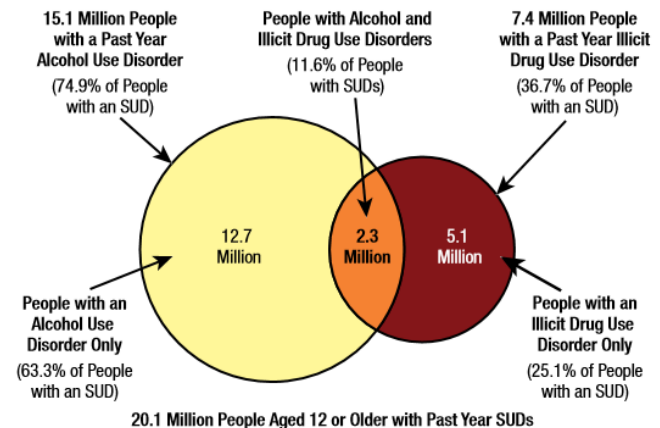
Drug Free America Foundation
727-828-0211

Source: 2012 National Survey on Drug Use and Health. Past-month use ages 12 and older. Numbers are rounded. 1 figure equals 1M Americans.

Substance Use Disorder (2016 NSDUH Data)

- In 2016, approximately 20.1 million people aged 12 or older had an SUD in the past year, including 15.1 million people who had an alcohol use disorder and 7.4 million people who had an illicit drug use disorder (Figure 42). An estimated 2.3 million people aged 12 or older had both an alcohol use disorder and an illicit drug use disorder in the past year (Figure 43). Thus, among people aged 12 or older in 2016 who had an SUD in the past year, nearly 3 out of 4 had an alcohol use disorder, and about 1 out of 3 had an illicit drug use disorder. About 1 in 9 people aged 12 or older who had SUDs in the past year had both an alcohol use disorder and an illicit drug use disorder.
- Of the 7.4 million people aged 12 or older who had a past year SUD related to their use of illicit drugs, 4.0 million had a past year disorder related to their use of marijuana, and 2.4 million people had an opioid use disorder (misuse of prescription opioids and/or heroin) (Figure 42).

Figure 43. Alcohol Use Disorder and Illicit Drug Use Disorder in the Past Year among People Aged 12 or Older with a Past Year Substance Use Disorder (SUD): 2016



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

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

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)

- The following are cannabis-related disorders and associated diagnosis codes, recognized by the DSM-5, because clinicians see these in practice:
 - Cannabis Intoxication
 - **Cannabis Use Disorder**
 - Cannabis Withdrawal
 - **Other Cannabis-induced Disorders**
 - Cannabis intoxication delirium
 - Cannabis-induced psychotic disorder
 - Cannabis-induced anxiety disorder
 - Cannabis-induced sleep disorder
 - Unspecified cannabis-related disorder

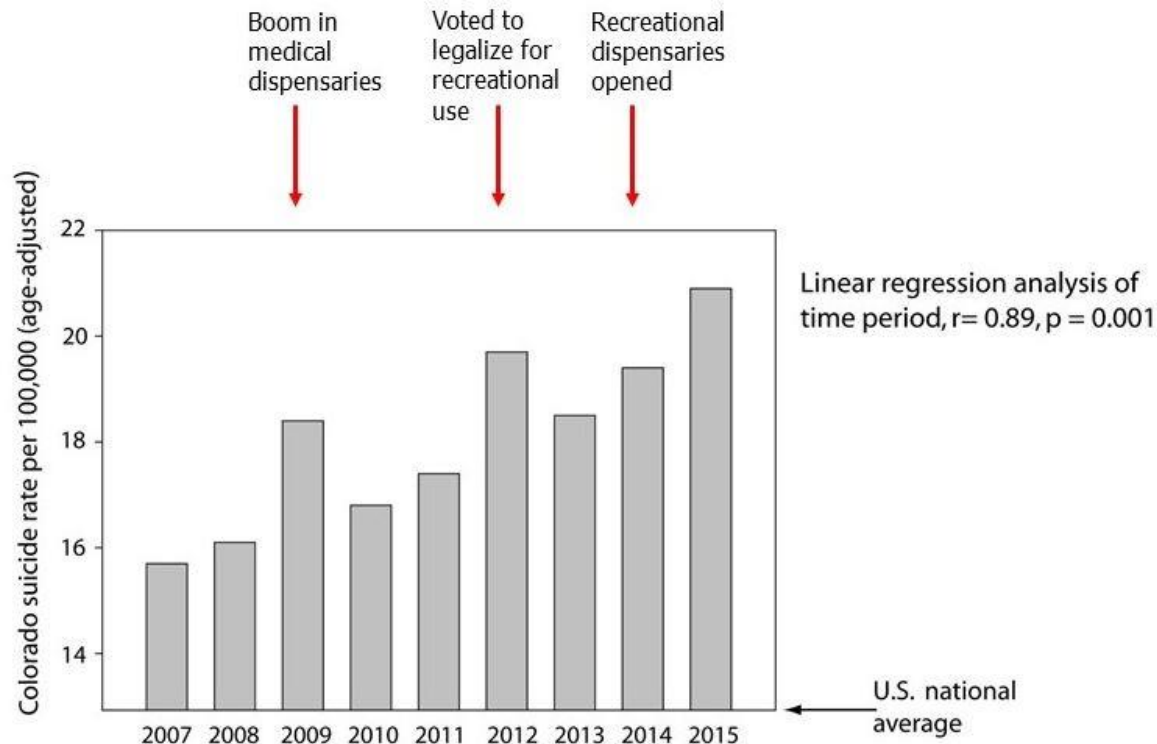
Statement from National Alliance on Mental Illness (NAMI)

- The NAMI Website lists Substance Use (specifically “marijuana use”) as a possible “Cause” of schizophrenia:
 - **“Substance use.** Some studies have suggested that taking mind-altering drugs during teen years and young adulthood can increase the risk of schizophrenia. **A growing body of evidence indicates that smoking [using] marijuana increases the risk of psychotic incidents and the risk of ongoing psychotic experiences. The younger and more frequent the use, the greater the risk.** Another study has found that smoking marijuana led to earlier onset of schizophrenia and often preceded the manifestation of the illness.” - See more at:
<https://www.nami.org/Learn-More/Mental-Health-Conditions/Schizophrenia#sthash.MJZSn0eA.dpuf>

Is Colorado's Rising Suicide Rate Associated with Marijuana Friendly Policies?

SUICIDE RATES IN COLORADO AND THE CONNECTION TO MARIJUANA

Colorado Suicide Rates in Relation to Marijuana Commercialization



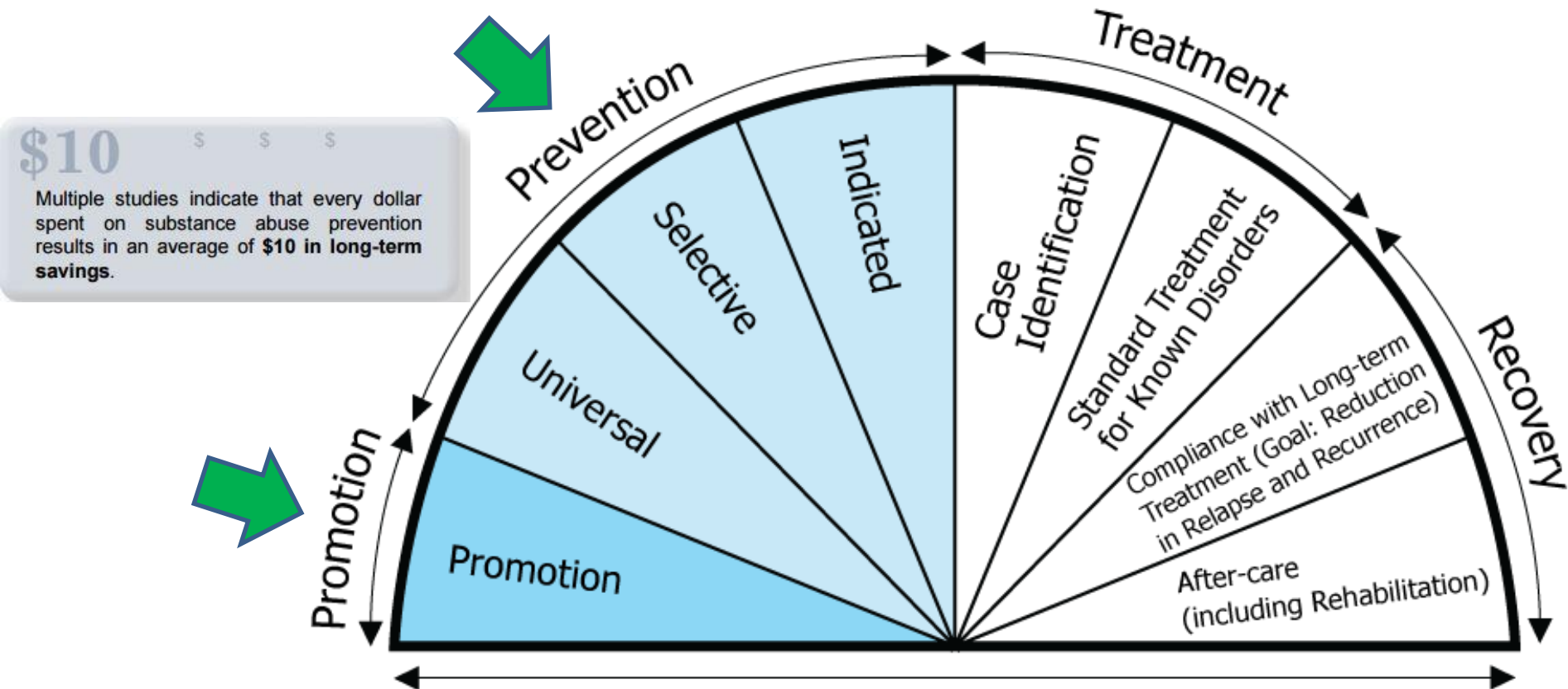
Conclusions

- Marijuana commercialization is associated with higher rates of youth use.
- Use of marijuana, particularly regular use of high potency products, carries significant risks for youth including but not limited to:
 - Issues with attention, memory and learning
 - Poorer educational and life outcomes
 - Reduced IQ for persistent heavy users
 - Potential for addiction to marijuana/THC and increased risk of addiction to other drugs
 - Increased risk of psychosis, and possibly suicide

Massachusetts Must Prioritize Behavioral Health Promotion and Prevention

“We cannot treat our way out of the Opioid Epidemic”

—Sue Thau, Public Policy Consultant with Community Anti-Drug Coalitions of America



The Behavioral Health Continuum Model, SAMHSA

Recommendations for Best Practices in Marijuana Policy—Youth Substance Use Prevention

- **Public health and safety advocates should hold the majority of seats on the advisory committees related to the proposition.** It is imperative state advisory committees not follow Colorado's model, which is dominated by industry representatives. The results have led to weak regulation of potency, edibles, and other important public health measures that continue to harm and erode public health and safety. Ensure that strong voices for the public interest hold a majority of the seats on these bodies, and if not, establish independent oversight panels.
- **Demand a strong *per se* standard for driving while high.** As Colorado and Washington have demonstrated, states with legalization should expect a surge in fatalities related to driving while high. A strong *per se* standard for driving while high is critical to deter as many marijuana users as possible from driving while impaired to keep the roads as safe as possible.
- **Establish an independent oversight office, staffed solely by public health experts, to track data related to marijuana use.** Following the adage of "you can't manage what you can't measure," an independent office staffed solely by public health professionals needs to gather and track data related to the health impacts of marijuana use. The advisory committees referenced above are not enough—their objective is to make recommendations, not to collect data, and they will also be subject to tremendous political pressure by a powerful pot lobby. An independent body is needed, staffed with research experts with deep expertise in addictive substances and social cost measures. Otherwise, while the pot lobby drives for-profit consumption through marketing and sales, there will be no robust data collection to track the industry's impact.
- **Dedicate funds to marijuana prevention education and marijuana-related disease research and education.** Adolescents are particularly vulnerable to serious, negative consequences from marijuana use. 21 years of age should be set as the minimum age of purchase and access to marijuana. Funding must be dedicated to fully educate youth and the general public about the risks associated with marijuana use. Broad based media campaigns aimed at the general public, as well as youth, should be implemented to minimize drug use and addiction.
- **Set up a statewide law enforcement office to measure black market and cartel activity, and coordinate with neighboring states.** Colorado has seen an unprecedented rise in black market activity since legalization. The state had one organized crime filing in 2007, and 40 in 2015. In 2016, reports of Mexican cartel activity began to filter in, indicating that underground networks are taking advantage of the changing laws to hide in plain sight. Gathering data on this black market activity will be critical, and the industry will not shoulder that burden.
- **Pass strong product liability and dram shop laws for marijuana.** The marijuana industry, promoting and selling a psychotropic product that will be associated with negative outcomes and addiction for some users, must be held accountable for product liability and dram shop laws. Shops that sell marijuana to individuals who are clearly impaired should be strictly liable to anyone injured by that person. Manufacturers, distributors, and retailers should be liable to those who have adverse reactions from using their product.

Recommendations for Best Practices in Marijuana Policy—Youth Substance Use Prevention (continued)

- **Restrict edibles and concentrates as much as possible.** The most serious danger to public health with respect to legal marijuana products are edibles and concentrate products. Their high potency, resemblance to non-laced consumer products (candy, topical lotions, etc.), and ease of use create serious, costly problems. They must be heavily regulated to prohibit their advertising, sales, and use.
- **Ban public consumption of marijuana.** Include marijuana in existing smoke-free laws to reduce exposure to secondhand smoke.
- **Mandate strict advertising restrictions.** Advertising should be limited to inside retail stores only, with no visibility to youth. Like alcohol and tobacco, underage users are a very profitable market for the marijuana industry, even if sales to them are illegal. Early-onset users are more likely to become highly profitable heavy users, and brand loyalty is generally developed and solidified when users are younger. Advertising is therefore an important component to targeting and capturing these users, as the U.S. experience with tobacco has demonstrated. To the extent possible, advertising should be heavily regulated and restricted. Moreover, simple prohibitions on ads “targeting minors” have an empirically poor track record—there is too much legal room to debate on what targets minors and what does not. Good restrictions must go farther than that and be general in nature.
- **Heavy penalties for advertising or selling to minors.** Given the importance of keeping marijuana out of the hands of minors, this is a critical component of a strong regulatory policy.
- **Targeting investors with enforcement actions.** Strong enforcement should address those financing non-compliant marijuana operations, as well as the operators.
- **Proactive prosecutions of lawbreakers.** This includes proactively promising, via a formal memorandum, to refer marijuana businesses that do not comply with state law to federal law enforcement, or promising to bring state racketeering prosecutions and/or forfeiture actions against not only the operators but also their investors, no matter where they are located. (Creating potential criminal liability for investors is key to controlling the industry—those solely interested in returns are highly unlikely to risk prosecution in exchange for a slightly higher return on investment.)

Other Recent Relevant Information/Articles

Some Recent Links to Related Information

- Emergency Visits Related to Marijuana Use at Colorado Hospital Quadruple: <http://www.aappublications.org/news/2017/05/04/PASMarijuana050417> (American Academy of Pediatrics News, May 2017)
- American College of Pediatricians (April 2017): <https://www.acpeds.org/marijuana-use-detrimental-to-youth>
- American Academy of Pediatrics (March 2017): <http://pediatrics.aappublications.org/content/pediatrics/early/2017/02/23/peds.2016-4069.full.pdf>
- Smart Approaches to Marijuana Toolkit (February 2017): <https://learnaboutsam.org/wp-content/uploads/2017/02/06Feb2017-SAM-educational-briefs.pdf>

Daily Use, Especially of High-Potency Cannabis, Drives the Earlier Onset of Psychosis in Cannabis Users

Marta Di Forti^{*,1}, Hannah Sallis², Fabio Allegri³, Antonella Trotta¹, Laura Ferraro⁴, Simona A. Stilo⁵, Arianna Marconi¹, Caterina La Cascia⁴, Tiago Reis Marques¹, Carmine Pariante⁶, Paola Dazzan¹, Valeria Mondelli⁶, Alessandra Paparelli¹, Anna Kolliakou¹, Diana Prata¹, Fiona Gaughran¹, Anthony S. David¹, Craig Morgan⁵, Daniel Stahl⁷, Mizanur Khondoker⁷, James H. MacCabe^{1,8}, and Robin M. Murray^{1,8}

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May 4, 2017

Emergency visits related to marijuana use at Colorado hospital quadruple

PAS Meeting Updates

SAN FRANCISCO – Visits by teens to a Colorado children's hospital emergency department and its satellite urgent care centers increased rapidly after legalization of marijuana for commercialized medical and recreational use, according to new research being presented at the 2017 Pediatric Academic Societies Meeting in San Francisco.

Adolescents with symptoms of mental illness accounted for a large proportion (66%) of the 3,443 marijuana-related visits during the study period, said lead author George Sam Wang, M.D., FAAP, with psychiatry consultations increasing from 65 to 442.

Emergency Visits Related to Marijuana Use at Colorado Hospital Quadruple:

<http://www.aappublications.org/news/2017/05/04/PASMarijuana050417> (American Academy of Pediatrics News, May 2017)

Increased Marijuana-Related Acute Health Care Contacts in Colorado

Prev Med. 2017 Mar 30. pii: S0091-7435(17)30120-2. doi: 10.1016/j.ypmed.2017.03.022. [Epub ahead of print]

Marijuana and acute health care contacts in Colorado.

Wang GS¹, Hall K², Vigil D², Banerji S³, Monte A⁴, VanDyke M².

⊕ Author information

Abstract

Over 22 million Americans are current users of marijuana; half of US states allow medical marijuana, and several allow recreational marijuana. The objective of this study was to evaluate the impact marijuana has on hospitalizations, emergency department (ED) visits, and regional poison center (RPC) calls in Colorado, a medical and recreational marijuana state. This is a retrospective review using Colorado Hospital Association hospitalizations and ED visits with marijuana-related billing codes, and RPC marijuana exposure calls. Legalization of marijuana in Colorado has been associated with an increase in hospitalizations, ED visits, and RPC calls linked with marijuana exposure. From 2000 to 2015, hospitalization rates with marijuana-related billing codes increased from 274 to 593 per 100,000 hospitalizations in 2015. Overall, the prevalence of mental illness among ED visits with marijuana-related codes was five-fold higher (5.07, 95% CI: 5.0, 5.1) than the prevalence of mental illness without marijuana-related codes. RPC calls remained constant from 2000 through 2009. However, in 2010, after local medical marijuana policy liberalization, the number of marijuana exposure calls significantly increased from 42 to 93; in 2014, after recreational legalization, calls significantly increased by 79.7%, from 123 to 221 ($p < 0.0001$). The age group <17 years old also had an increase in calls after 2014. As more states legalize marijuana, it is important to address public education and youth prevention, and understand the impact on mental health disorders. Improvements in data collection and surveillance methods are needed to more accurately evaluate the public health impact of marijuana legalization.

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KEYWORDS: Cannabis; Colorado; Emergency department; Emergency room; Hospitalizations; Legalization; Marijuana; Poison center

PMID: 28365373 DOI: [10.1016/j.ypmed.2017.03.022](https://doi.org/10.1016/j.ypmed.2017.03.022)

Very Recent Study Shows Possible Association Between CUD and Suicide Attempts in Veterans



Journal of Psychiatric Research

Volume 89, June 2017, Pages 1–5



Cannabis use disorder and suicide attempts in Iraq/Afghanistan-era veterans

Nathan A. Kimbrel^{a, b, c}, Amie R. Newins^d, Eric A. Dedert^{a, b, c}, Elizabeth E. Van Voorhees^{a, b, c}, Eric B. Elbogen^{a, b, c}, Jennifer C. Naylor^{a, b, c}, H. Ryan Wagner^{a, b, c}, Mira Brancu^{a, b, c}, [Show more](#)

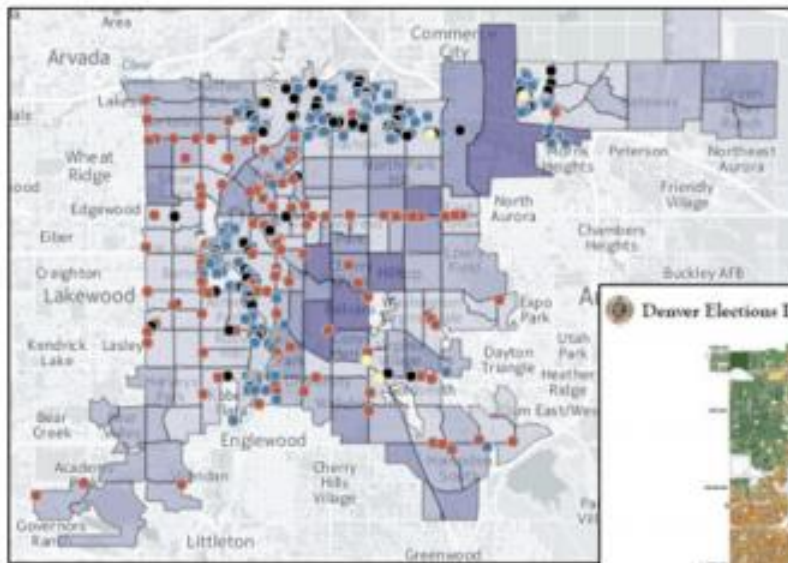
<https://doi.org/10.1016/j.jpsychires.2017.01.002>

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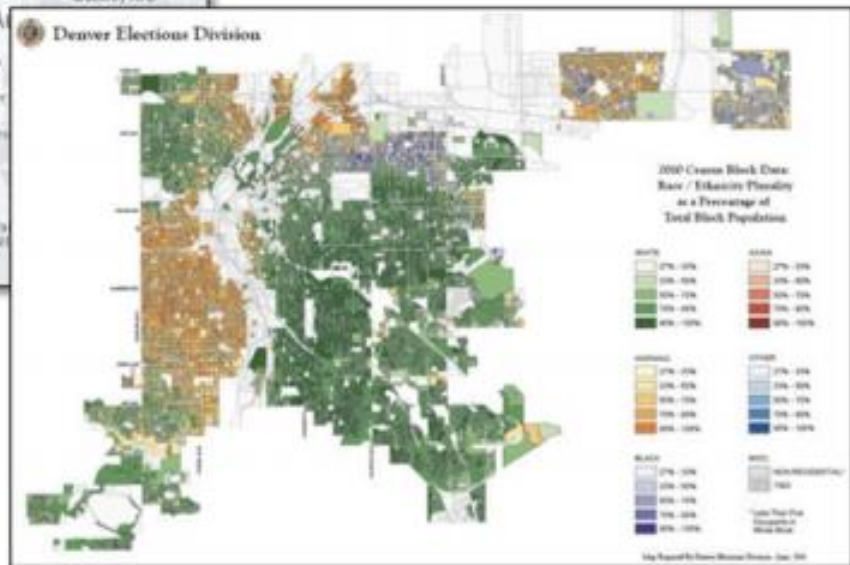
Abstract

The objective of the present research was to examine the association between lifetime cannabis use disorder (CUD), current suicidal ideation, and lifetime history of suicide attempts in a large and diverse sample of Iraq/Afghanistan-era veterans ($N = 3233$) using a battery of well-validated instruments. As expected, CUD was associated with both current suicidal ideation ($OR = 1.683, p = 0.008$) and lifetime suicide attempts ($OR = 2.306, p < 0.0001$), even after accounting for the effects of sex, posttraumatic stress disorder, depression, alcohol use disorder, non-cannabis drug use disorder, history of childhood sexual abuse, and combat exposure. Thus, the findings from the present study suggest that CUD may be a unique predictor of suicide attempts among Iraq/Afghanistan-era veterans; however, a significant limitation of the present study was its cross-sectional design. Prospective research aimed at understanding the complex relationship between CUD, mental health problems, and suicidal behavior among veterans is clearly needed at the present time.

MARIJUANA BUSINESSES IN DENVER ARE CONCENTRATED IN NEIGHBORHOODS OF COLOR



Locations of pot businesses
(dots represent businesses;
neighborhoods shaded
by income; lighter =
lower-income)



Denver neighborhoods colored by race/ethnicity:
green = White; orange = Latino; purple = Black;
red = Asian; blue = Other