Marijuana and Adolescent Brain Development

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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
The reward system is particularly active in the teen brain.

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

The centers for logic and reasoning are still developing.
Teens are more likely to start using illicit drugs than other age groups.

% of never users who initiated use in the past year:
- 14-15: 8.0%
- 16-17: 11.2%
- 18-20: 10.4%
- 21-25: 4.5%
- 26 or Older: 0.3%
Dependence on substances is highly correlated with early use of substances.

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.
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>
<thead>
<tr>
<th>Myth</th>
<th>Fact</th>
<th>What we don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marijuana is not addictive</td>
<td>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</td>
<td>Why some people become addicted while others do not</td>
</tr>
<tr>
<td>There are no long-term effects of marijuana use</td>
<td>Marijuana use before age 18 may affect IQ, learning and memory, and brain structure and function years later</td>
<td>How long-lasting these effects are, and whether they resolve after abstinence</td>
</tr>
<tr>
<td>Marijuana is a treatment for mental health disorders</td>
<td>The current state of science does not show the benefit of smoked marijuana for psychological conditions; in fact, marijuana use likely worsens symptoms</td>
<td>Whether scientists will someday discover therapeutic components of cannabis that can be extracted and purified</td>
</tr>
<tr>
<td>Marijuana is a safe drug for teenagers</td>
<td>Nearly all negative effects of marijuana (e.g., brain changes, neurocognitive deficits, addictive potential) are worse in teenagers than in adult users</td>
<td>How differences in mental health, level of exposure to marijuana, and use of other substances affect marijuana-related harms</td>
</tr>
</tbody>
</table>

Comparison of addictive potential by drug type\textsuperscript{19}

<table>
<thead>
<tr>
<th>Drug Type</th>
<th>Overall</th>
<th>Teens</th>
<th>Daily Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannabis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stimulants</td>
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<td></td>
<td></td>
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<tr>
<td>Analgesics</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Psychedelics</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Heroin</td>
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</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Effect</th>
<th>Overall Level of Confidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addiction to marijuana and other substances</td>
<td>High</td>
</tr>
<tr>
<td>Abnormal brain development</td>
<td>Medium</td>
</tr>
<tr>
<td>Progression to use of other drugs</td>
<td>Medium</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>Medium</td>
</tr>
<tr>
<td>Depression or anxiety</td>
<td>Medium</td>
</tr>
<tr>
<td>Diminished lifetime achievement</td>
<td>High</td>
</tr>
<tr>
<td>Motor vehicle accidents</td>
<td>High</td>
</tr>
<tr>
<td>Symptoms of chronic bronchitis</td>
<td>High</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>Low</td>
</tr>
</tbody>
</table>

What Does Commercialized Marijuana (“Medical” and/or Recreational) Look Like?
Ways to consume marijuana
Products & packaging: Like this?
Commercialization Has Begun
The “Crack” of Marijuana - Engineered to Addict

Engineered to be 80-90% THC

“A Dab”

“Green Crack” wax

Butane Hash Oil (BHO)

“Ear Wax”

“Budder”

“Shatter”

Hash Oil Capsules

Wax
A dispensary in Colorado ... 
now painted gray after community complaints that the mural enticed children
2 for $45
While supplies last.

$20 1/8th
Select Strains

$125 OZ
Select Strains
While supplies last.

Download our app for great deals and a FREE GRAM

First Time Patients Buy 1 Gram Get One FREE

New Patient Special $140 OZ Any Strain

GREENFIELDS
1798 West Mississippi Ave. Denver, CO 80223

MIND-BODY SPIRIT WELNESS CLINIC
6745 West Mississippi
(Est of Pierce)
Lakewood, Colorado
303.934.9750 • MEDICAL ONLY

MILAGRO • 1181 County Rd 308
(Exit 234 off I-70)
Dumont, CO
720.319.3672

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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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

Source: Emory Wheel Entertainment Staff, 6 February 1979
Big Marijuana Strategy

Decriminalize > “Medical” > Legalize > COMMERCIALIZE

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**


**Prevention**

- Community Action Plan, May 2016, available on the Communities That Care Coalition website [CommunitiesThatCareCoalition.org](http://CommunitiesThatCareCoalition.org)

**Addiction**

- Dr. Ruth Potee, *Physiology of Addiction* (video), [https://www.youtube.com/watch?v=eySb0etE1PA](https://www.youtube.com/watch?v=eySb0etE1PA)

**Marijuana**

Report of the Special Senate Committee on Marijuana

March 8, 2016

Acknowledgements

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