MARIJUANA AND THE DEVELOPING BRAIN:
RAISING YOUTH IN THE AGE OF LEGAL MARIJUANA

Baystate Franklin Medical Center
January 29, 2019
MARIJUANA AND THE DEVELOPING BRAIN

Communities that Care
COALITION
A coalition of schools, human service agencies, local government, law enforcement, businesses, faith-based organizations, parents and youth working to improve the health and well-being of young people in Franklin County and the North Quabbin.
Outline

- How is the developing brain more susceptible to harm?
- How does marijuana affect the developing brain?
- How common is youth marijuana use?
- What can we do to help prevent youth use?
How is the developing brain more susceptible to harm?
Compared to childhood and adulthood, adolescence is a time of heightened:

- Sensation- and reward-seeking
- Risk-taking and impulsivity
- Peer influence
- Mood swings
- Capacity to learn
- Exuberance
Maturation of the human brain, age 4-21
Creating neural super-highways

through pruning & myelination
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 heightened importance of rewards

TEEN-AGE MOUSE

I CAN TOTALLY GET AWAY WITH THIS!
The brain’s reward system
From the neuron’s point of view
When the brain’s reward system is repeatedly overstimulated, it adjusts to reduce dopamine levels.
The reward system is particularly active in the teen brain.

The centers for logic and reasoning are still developing.

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

* Photo courtesy of NIAAA and MADD
• How does marijuana affect the developing brain?
The marijuana plant (Cannabis)

- 480 natural chemical compounds, including THC and CBD

Like most drugs, THC and CBD mimic natural brain messengers.
Cannabinoid receptors are found all over the body...
and throughout the brain.

THC, CBD and other cannabinoids from marijuana can bind with them and alter natural signals.
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.
THC Concentrates

“Green Crack” wax

“Ear Wax”

Butane Hash Oil (BHO)

Hash Oil Capsules

“Budder”

“Shatter”
Ways to consume marijuana
Acute effects of using marijuana (during intoxication)

- Altered judgment
- Slowed reaction time
- Euphoria
- Increased appetite
- Anti-nausea effects
- Impaired coordination
- Altered pain sensitivity
- Impaired memory
- Panic/paranoia/psychosis
Marijuana and Driving

- Lab and simulator studies show that marijuana impairs driving skills, and the more THC, the greater the impairment.
Marijuana and Driving

• Marijuana used with alcohol causes greater impairment than either alone.

• In Colorado in 2014, of drivers testing positive for THC, 2/3 had alcohol and/or other drugs in their systems as well as marijuana.
• How does marijuana affect the developing brain?

What are the longer-term effects of regular marijuana use on youth development?
One thing researchers agree on...

Frequent marijuana use during adolescence has more serious consequences than use by adults.
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 risk of psychosis
Deficits in cognitive functioning among active users

Many studies show that adolescents who use marijuana heavily tend to score worse than non-users on tests of:

- attention
- verbal learning
- memory
- processing speed

... even when they are not high.

Messinis, et al 2006
Deficits in cognitive functioning among active users

- Deficits are larger for those who use more, and for those who begin using younger.
- With sustained abstinence, functioning is largely restored.
Adult life outcomes affected by marijuana use in adolescence

Increasing use of marijuana from age 15-21 was also associated with lower relationship quality and lower life satisfaction at age 25.

Fergusson DM & Boden JM, Cannabis use and later life outcomes. Addiction. 2008 Jun; 103(6):969-76
Loss of adult IQ associated with marijuana dependence in adolescence

The most comprehensive study of marijuana and cognitive function to date:

• Dunedin study followed 1037 individuals from birth to age 38
• assessed IQ at 13 and at 38
• assessed marijuana use and dependence at five points in time from age 18-38
• controlled for use of alcohol and other substances, socio-economic status and years of education
Loss of adult IQ with marijuana dependence in adolescence

Findings:
• Those who developed marijuana dependence before age 18 showed IQ decline in adulthood.
• The longer their dependence persisted, the greater the decline, with a decline of 8 IQ points for the most persistent users.
• Those who began using in adulthood did not show IQ decline.
• Quitting in adulthood did not restore functioning in those who began in adolescence.
Other studies show no association between marijuana use and IQ loss

Mokrysz, et al, 2016:

• Prospective cohort study of 2235 young people in Bristol, UK, considered impact of marijuana use on IQ between age 8 and age 15.
• No association found between teen marijuana use and IQ, after adjusting for various confounders, most notably cigarette smoking.


• Study of 789 pairs of twins followed from preadolescence (age 9-12) to late adolescence (age 17-20).
• Marijuana users experienced declines – as did their non-using twins.
• The authors conclude the decline was related to factors other than marijuana.
Marijuana, psychosis and schizophrenia

Marijuana use at age 18 and later risk of schizophrenia (n=45,570)

Cases of schizophrenia per 1,000

Number of times marijuana used

Andréasson, 1987
Marijuana, psychosis and schizophrenia

DiForti, 2012
How common is youth marijuana use?
Percentage of U.S. 12th grade students reporting past month use of cigarettes, marijuana and alcohol

Percentage of **local** middle & high school students reporting past month use of cigarettes, marijuana and alcohol

SOURCE: Franklin County/North Quabbin Prevention Needs Assessment.
Percentage of **local** youth reporting past month use of marijuana, by grade

- **8th grade**: 40% in 2003, 32% in 2006, 32% in 2009, 32% in 2012, 34% in 2015, 34% in 2018
- **10th grade**: 19% in 2003, 19% in 2006, 20% in 2009, 22% in 2012, 23% in 2015, 23% in 2018
- **12th grade**: 12% in 2003, 12% in 2006, 12% in 2009, 12% in 2012, 12% in 2015, 6% in 2018
Percentage of local youth reporting past month use of marijuana, by gender
Percentage of local youth reporting past month use of marijuana, by demographic group

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latinx (n=163)</td>
<td>28%</td>
</tr>
<tr>
<td>&gt; one race (n=362)</td>
<td>25%</td>
</tr>
<tr>
<td>AA/Black (n=78)</td>
<td>24%</td>
</tr>
<tr>
<td>White (n=4070)</td>
<td>22%</td>
</tr>
<tr>
<td>Amer. Indian (n=52)</td>
<td>19%</td>
</tr>
<tr>
<td>Asian (n=82)</td>
<td>9%</td>
</tr>
<tr>
<td>Lesbian, gay, bisexual, not sure (n=268)</td>
<td>26%</td>
</tr>
<tr>
<td>Straight/heterosexual (n=1094)</td>
<td>20%</td>
</tr>
<tr>
<td>Lower income (n=340)</td>
<td>26%</td>
</tr>
<tr>
<td>Higher income (n=557)</td>
<td>19%</td>
</tr>
</tbody>
</table>
7 in 10 students do NOT use alcohol, cigarettes or marijuana.

- **Alcohol**: 61% also report marijuana use
- **Marijuana**: 71% also report alcohol use
- **Cigarettes**: 93% also report use of marijuana and/or alcohol
What can we do to help prevent youth use?
Community
Advertising & Marketing

FREE DAB!

BOGO PIPES
12X MASTERCASE 280

Go Blow's Glass
1600 W. Colfax Ave. Lakewood
Advertising & Marketing

MAHATMA

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
WELLNESS CLINIC

6745 West Mississippi
(East of Pierce)
Lakewood, Colorado
303.934.9750 • MEDICAL ONLY

MILAGRO • 1181 County Rd 308
(Exit 234 off I-70)
Dumont, CO
720.379.3672

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!
Sales outlets/dispensaries

A dispensary in Colorado ... now painted gray after community complaints that the mural enticed children
The Northampton dispensary
Products & packaging: Like this?
Or this? (Products at the Northampton dispensary)
Prevention in schools
Randomized trials show LifeSkills reduces tobacco, alcohol and marijuana use among participants relative to controls:

- up to 87% for tobacco use,
- up to 60% for alcohol use, and
- up to 75% for marijuana use.

SOURCE: Various studies cited at http://www.lifeskillstraining.com/
Screening, Brief Intervention & Referral to Treatment
Prevention in the family

Students’ report on their parents’ attitudes

How wrong do your parents think it is for you to use marijuana?

SOURCE: Franklin County/North Quabbin Prevention Needs Assessment.
MARIJUANA TALK KIT
What you need to know to talk with your teen about marijuana

Partnership™
for Drug-Free Kids
Where families find answers

#MJTalkKit
In this 10-15 minute experience, you will talk to a child about underage drinking.

Watch Get the Story to learn more about your characters. Then select Start Talking to start the conversation.

Tap to Change Characters

Get the Story

Start Talking
Communities that Care

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Resource list

**Adolescent brain**
- Frances E. Jensen with Amy Ellis Nutt, The Teenage Brain. A Neuroscientist’s Survival Guide to Raising Adolescents and Young Adults, 2015.

**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**
- Commonwealth of Massachusetts Cannibis Control Commission. [https://mass-cannabis-control.com/](https://mass-cannabis-control.com/)
How to talk with kids about making healthy decisions in a way that they can hear you.
RISK vs BENEFIT

Building resiliency as prevention for maladaptive behaviors and addiction
Be Aware and Prepare

Jeremy, have you been listening to me?
Yes, well...
...No...
...But I am now.
If you’ve said anything important over the past few years, this would be a good time to repeat it.

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Prefrontal regulation during alert, non-stress conditions

- Dorsal Medial Pre Frontal Cortex (DMPFC)
  - Reality testing
  - Error monitoring
- Dorsal Lateral PFC (DLPFC)
  - Top-down guidance of attention and thought
- Right Inferior PFC (RIPFC)
  - Inhibits inappropriate motor actions
- Ventral Medial PFC (VMPFC)
  - Regulates emotion

Amygdala control during stress conditions

“Houston we have a problem.”

- 95% or our thoughts, beliefs and behaviors are bottom up; automatic reactions to which we have been programmed through exposure to our environment

- 60 – 90% of all visits to Primary Care are for stress related conditions
Genetics

4 proteins line up in a particular way to make up every human cell:
Epigenetic

epi-gen-etic

adjective

Definition of EPIGENETIC

a: of, relating to, or produced by the chain of developmental processes in epigenesis that lead from genotype to phenotype after the initial action of the genes
b: relating to, being, or involving changes in gene function that do not involve changes in DNA sequence
Decision Making Exercise
Being present takes practice

Without being Mindful:
- **Stimulus** → **Reaction**

Being Mindful:
- **Stimulus** → **Mindful Pause** → **Response**
Four Parenting Styles

- Authoritarian
- Authoritative
- Neglectful
- Permissive
Bonding
Get in the right frame of mind and set the stage for a conversation

• Keep an open mind
• Put yourself in their shoes
• Be clear about your goals
• Be calm and relaxed
• Be positive
• Don’t lecture
• Find a comfortable setting and good timing
• Be aware of body language
Human Nature/Cultivating Resiliency

• Healthful eating
• Restful sleep
• Physical activity
• Stress management strategies
• Manage screen time and social media
• Tend to relationships
• Avoid exposure to tobacco, alcohol, and other drugs