MARIJUANA AND THE DEVELOPING BRAIN
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
- Capacity to learn
Maturation of the human brain, age 4-21
The heightened importance of rewards
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 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.
Healthy subject  |  Person w/ substance use disorder
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.
• 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.
Acute effects of using marijuana (during intoxication)

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

- "Budder"
- "Shatter"
- "Ear Wax"
- "Green Crack" wax
- Hash Oil Capsules
- Butane Hash Oil (BHO)
Marijuana and Driving

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

• 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.

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

Andréasson, 1987
Marijuana, psychosis and schizophrenia

Regular marijuana use increases schizophrenia risk in those with gene for 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.
What can we do to help prevent or delay youth use?
Prevention in schools

Botvin LifeSkills® Training
Community
Advertising & Marketing
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 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
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
Parenting Style
- Warm and Responsive
- Clear Rules
- High Expectation
- Supportive
- Value Independence

Associated Outcome
- Higher Academic Performance
- More Self-Esteem
- Better Social Skills
- Less Mental Illness
- Lower Delinquency
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

Addiction

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

Marijuana

• 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/
• National Organization for the Reform of Marijuana Laws (NORML), http://norml.org/
How to talk with kids about making healthy decisions in a way that they can hear you.
Be Aware and Prepare
• Compared to adults, adolescents have lower baseline levels of dopamine activity and greater sensitivity to dopamine-triggering activities, such as novelty.

• Thus, adolescents may seek novelty more and may experience a greater reward from novelty as a result of this ‘robust’ dopamine system.
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

Arnsten, 2009
Nature Reviews | Neuroscience
Humans experience approximately 50 stress responses per day.
Stress Shrinks Brain Networks

Normal  Stressed
Early Exposure to Stress and Illness Prevalence

Tomasdottir, et al. 2015
RULER tool builds vocabulary of emotion

The mood meter is one of RULER’s four main tools to help students figure out what they’re feeling in terms of their energy level (the Y axis) and pleasantness (the X axis).
Being present takes practice
MIND WANDERING

DISTRACTION AWARENESS

SUSTAINING FOCUS

REORIENTING OF AWARENESS

Ricard, Lutz and Davidson. (2014) Scientific American
RISK vs BENEFIT

Building resiliency as prevention for maladaptive behaviors and addiction
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
PATHWAYS TO RESILIENCE

Resilience is the ability to bounce back from setbacks in our lives. It is the way we can prevent stress from causing serious physical, mental and emotional issues. Practicing positive and often simple activities can actually **retrain our brain to be more resilient!**

### FOR CHILDREN
- Positive Role Models
- Supportive Adults
- Parental Involvement
- Caring Community
- Increased Parent-Infant Contact
- Increased Knowledge of Child Development

### FOR EVERYONE
- Supportive Relationships
- Healthy Food
- Exercise
- Smile
- Talk About Feelings
- Music

### FOR ADULTS
- Walk in the Woods
- Gratitude
- Positive Thoughts
- Laugh
- Hope
- Volunteer
- Acknowledge Trauma
- Seek Support
- Identify Emotional Triggers
- Mental Health and Substance Abuse Treatment
- Create Safe and Stable Nurturing Relationships
Genetics

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

epi·ge·net·ic
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
Thank you