

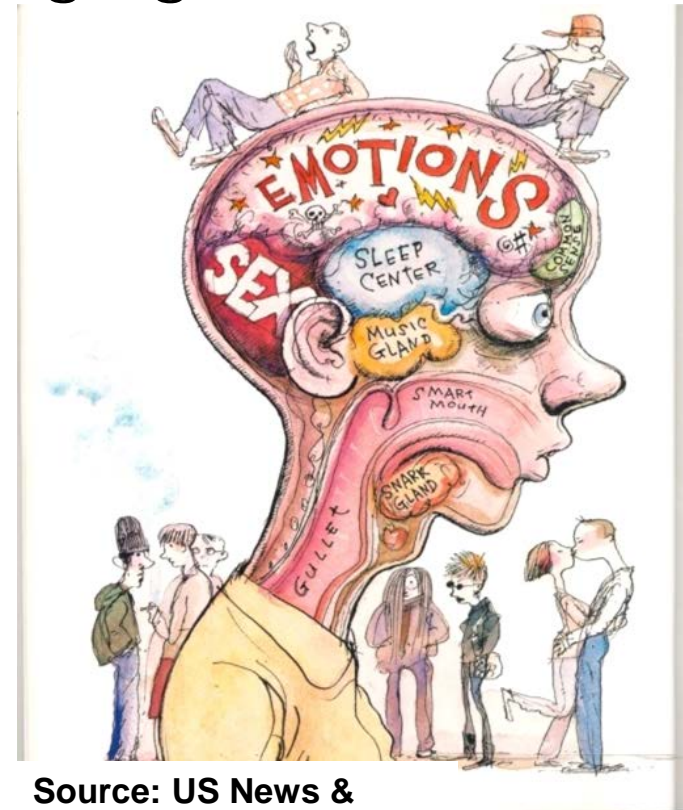
Adolescents and the Changing Brain

Ken Winters, Ph.D.

Senior Scientist, Oregon Research Institute
(MN location)

Retired Professor, Dept. of Psychiatry
University of Minnesota
winte001@umn.edu

July 8, 2020
Webinar Series
National American Indian and Alaska Native
Mental Health Technology Transfer Center



Source: US News &
World Report, 2005

Professional Disclosures

None to report

Personal Disclosure

I hope to avoid a reaction from you that was voiced to a lecturer by the famous Italian-American physicist, Enrico Fermi, after he attended that person's lecture:

"Before I came here, I was confused about this subject. Having listened to your lecture, I am still confused -- but on a higher level."

*The National
Academies of*

SCIENCES
ENGINEERING
MEDICINE

THE NATIONAL ACADEMIES PRESS

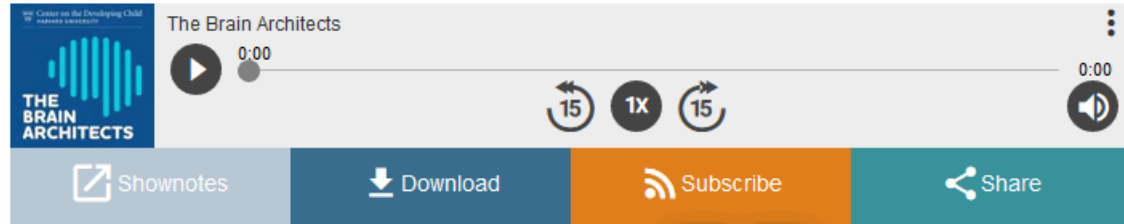
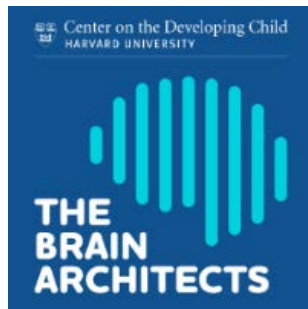
This PDF is available at <http://nap.edu/25388>

SHARE



Podcast Series

- Harvard's Center on the Developing Child new podcast series, *The Brain Architects*



- “Learn the science behind how brains are built and what it means how to build a strong brain.”
- <https://developingchild.harvard.edu/science/key-concepts/brain-architecture/>

YouTube Video

<https://youtu.be/6zVS8HIPUng>
Sarah-Jayne Blakemore's Ted Talk:
The mysterious workings of the
adolescent brain



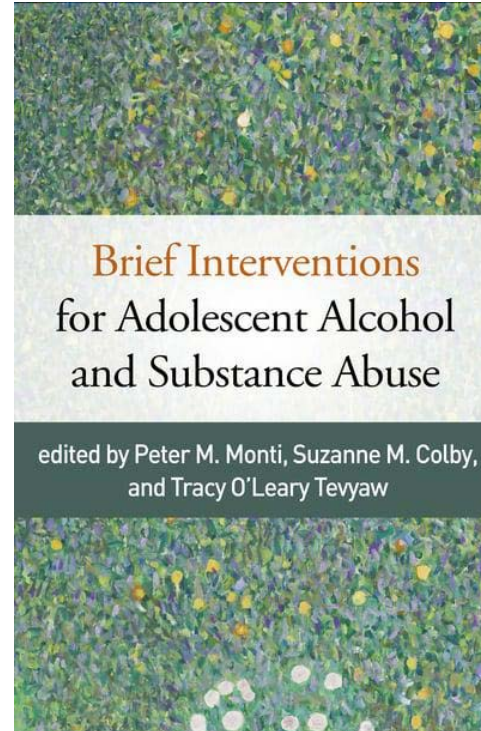
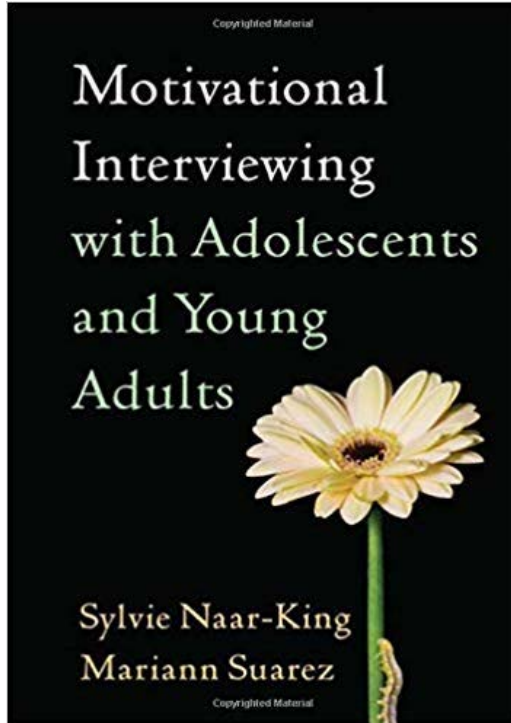
Publication on the Intersection of Brain Development and Treatment

Wetherill, R., & Tapert, S. F. (2013). Adolescent brain development, substance use, and psychotherapeutic change. *Psychology of Addictive Behaviors*, 27(2), 393–402.

<https://doi.org/10.1037/a0029111>

Recent "Treatment" Publications

(that integrate teen brain development)



Teen Brain Development Quiz



1. There are several health indices suggesting that teenagers take less risk than in years past. T or F ?
2. What lifestyle choices during adolescence promote good brain development?
3. Which is more harmful to the developing brain?
 - a. Chronic, heavy use of marijuana?
 - b. Chronic, heavy drinking?

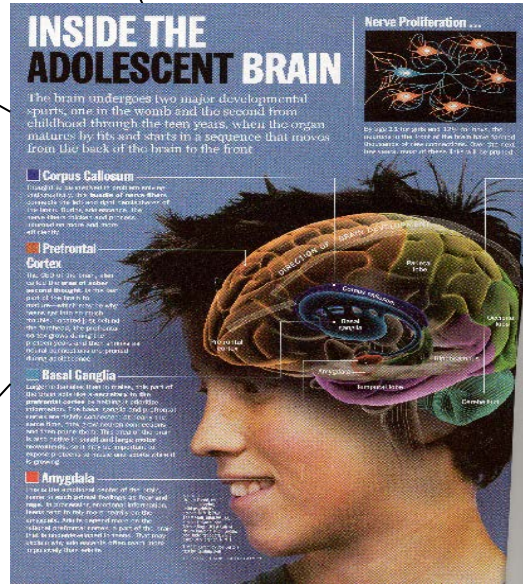


I. Overview of brain development

IV. Summary

III. Youth Serving Workers

II. Developing brain: drug use, mental health, early experiences



Possible Sources of Confounds when Interpreting Studies on Brain Development and Health



1. **Confirmation bias**
2. **Small sample sizes**
3. **Too small a time window**
4. **Community-level vs. individual-level data**
5. **Direct links between brain functions and structures and human behavior are problematic**



Possible Sources of Confounds when Interpreting Studies on Brain Development and Health



- **One more introductory note about this talk: My “spotlight” on brain development and its impact on adolescent behavior and health does not diminish the impact of environment and social determinants on adolescent behavior.**
- **I will be integrating into today’s discussion the important role of non-biological influences.**



Major Points from My Talk



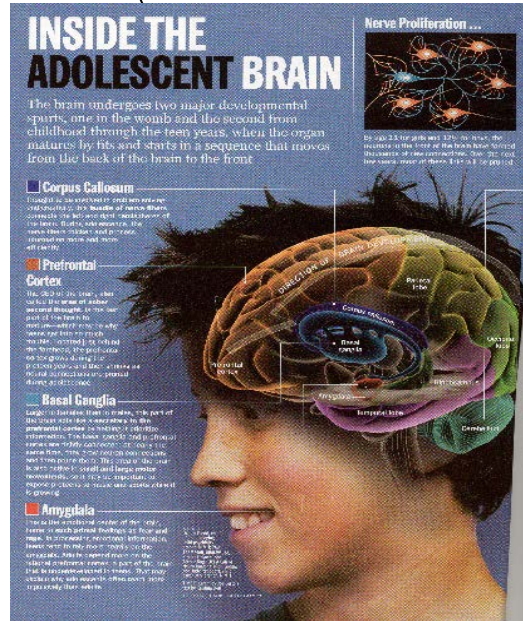
- 1. The maturation of the adolescent brain likely contributes to behaviors that are characteristic of this developmental period.**
- 2. This maturation also informs our understanding of risk for substance use disorders and other behavioral disorders.**
- 3. Youth serving workers & educators can leverage teen brain science when working with adolescents and parents.**

Major Points from My Talk



1. The maturation of the adolescent brain likely contributes to behaviors that are characteristic of this developmental period.
2. This maturation also informs our understanding of risk for substance use disorders and other behavioral disorders.
3. **Youth serving workers & educators can leverage teen brain science when working with adolescents and parents.**
 - i. **teaching youth about brain development**
 - ii. **use evidenced-based prevention programs**
 - iii. **treat teen behavioral disorders as early as possible**
 - iv. **use evidence-based treatment programs**
 - v. **increase youth "cannabis and vaping IQ"**
 - vi. **educate parents**

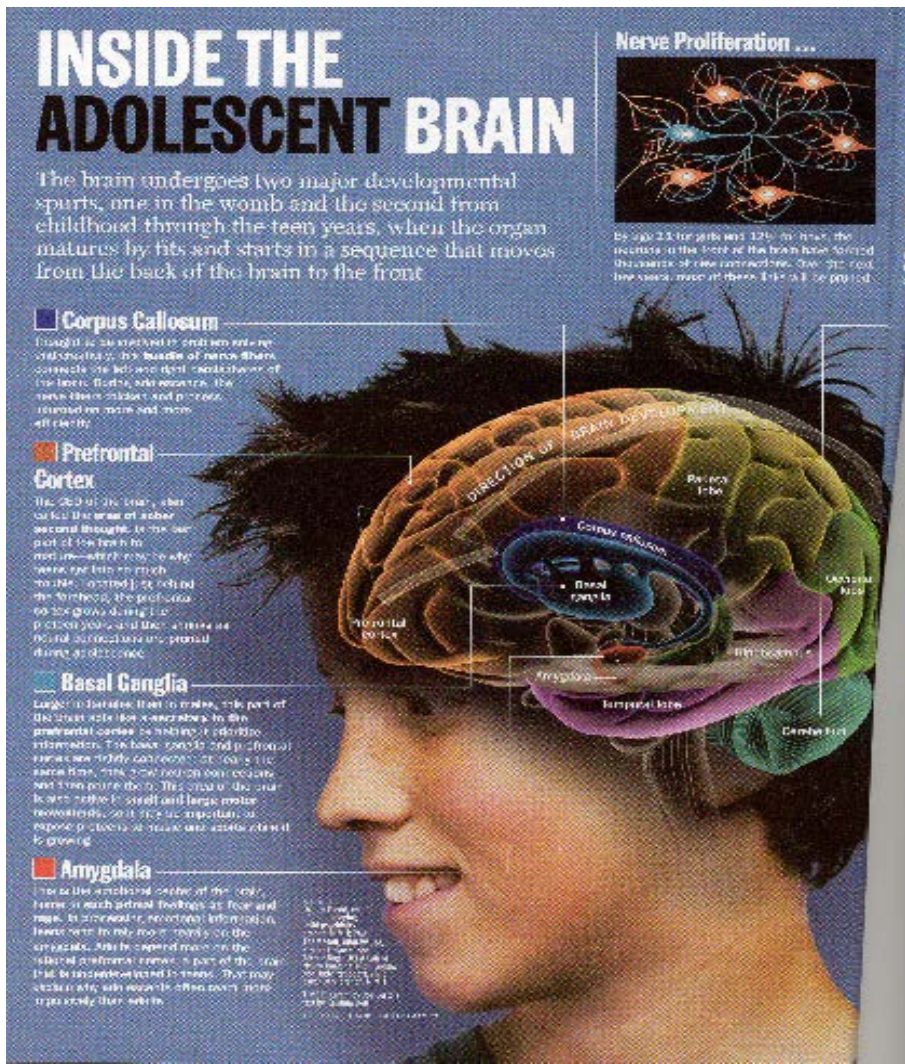
I. Overview of brain development



- Based on research by neuroscientists, brain maturation continues through adolescence, until approx. age 25

INSIDE THE ADOLESCENT BRAIN

The brain undergoes two major developmental spurts, one in the womb and the second from childhood through the teen years, when the organ matures by fits and starts in a sequence that moves from the back of the brain to the front.



Nerve Proliferation ...
By age 25, the brain has 125 billion neurons. The majority of the brain has formed by age 25, but the brain continues to grow and mature until age 25.

Corpus Callosum
Thought is an electrical phenomenon. The brain's electrical activity is carried by the Corpus Callosum, the bundle of nerve fibers that connects the left and right hemispheres of the brain. It's the brain's main highway, and it's made of white matter and myelin sheath.

Prefrontal Cortex
The CEO of the brain, also called the seat of higher-level thought. It's the last part of the brain to mature, and it's the most important for decision-making and planning. It's located at the front of the brain, and it's the last to grow during the adolescent period.

Basal Ganglia
Larger in size than the brain, this part of the brain is the seat of movement, emotion, and motivation. It's the brain's control center, and it's the last to mature. It's located at the base of the brain, and it's the last to grow.

Amygdala
This is the emotional center of the brain. It's the seat of fear, anger, and aggression. It's the brain's alarm system, and it's the last to mature. It's located at the base of the brain, and it's the last to grow.

Labels in the diagram:
- Prefrontal Cortex
- Corpus Callosum
- Basal Ganglia
- Amygdala
- Cerebellum
- Brainstem
- Temporal lobe
- Occipital lobe
- Parietal lobe
- Frontal lobe

A Developing Brain = Less Brakes on the "Go" System

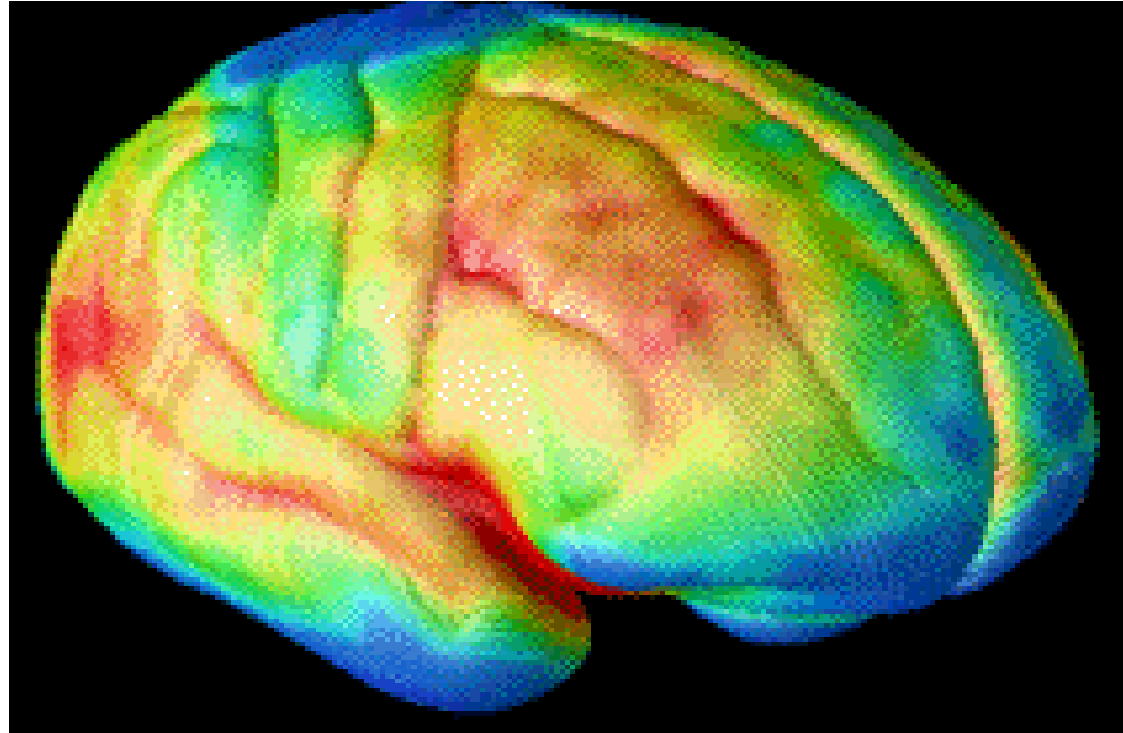


Maturation Occurs from Back to Front of the Brain and Inside to Outside

Images of Brain Development in Healthy Youth
(Ages 5 - 20)

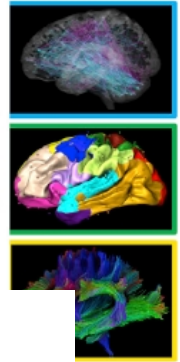
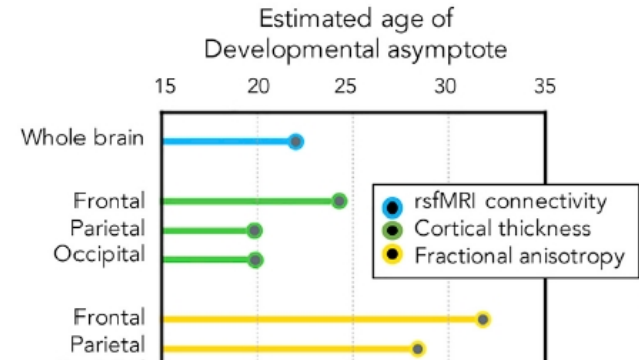
**Frontal: later
(judgment)**

**Limbic: earlier
(emotion, motivation)**

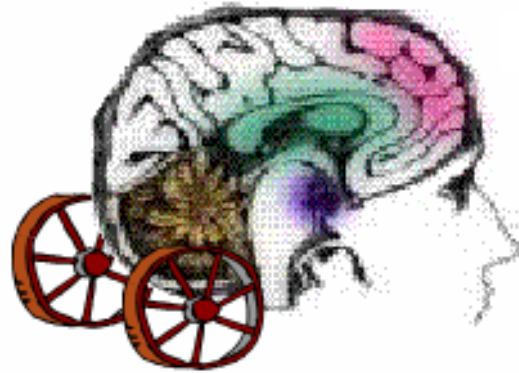


Blue represents maturing of brain areas

Source: PHAS USA 2004 May 25; 101(21): 8174-8179. Epub 2004 May 17.



- **During adolescent brain development, the brain is not functioning at full and optimal capacity.**



adapted from Somerville, 2016

Implications of Brain Development for Adolescent Behavior

(Winters et al., 1995)



- **Preference for**
 1. **physical activity**
 2. **high excitement and rewarding activities**
 3. **activities with peers that trigger high intensity/arousal**
 4. **novelty**
- **Less than optimal..**
 5. **control of emotions**
 6. **consideration of negative consequences**
- **Greater tendency to...**
 7. **be overly attentive to social information**
 8. **take risks**

Implications of Brain Development for Adolescent Behavior

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**Contributors for
unhealthy behaviors?**

Implications of Brain Development for Adolescent Behavior

(Winters et al., 1995)



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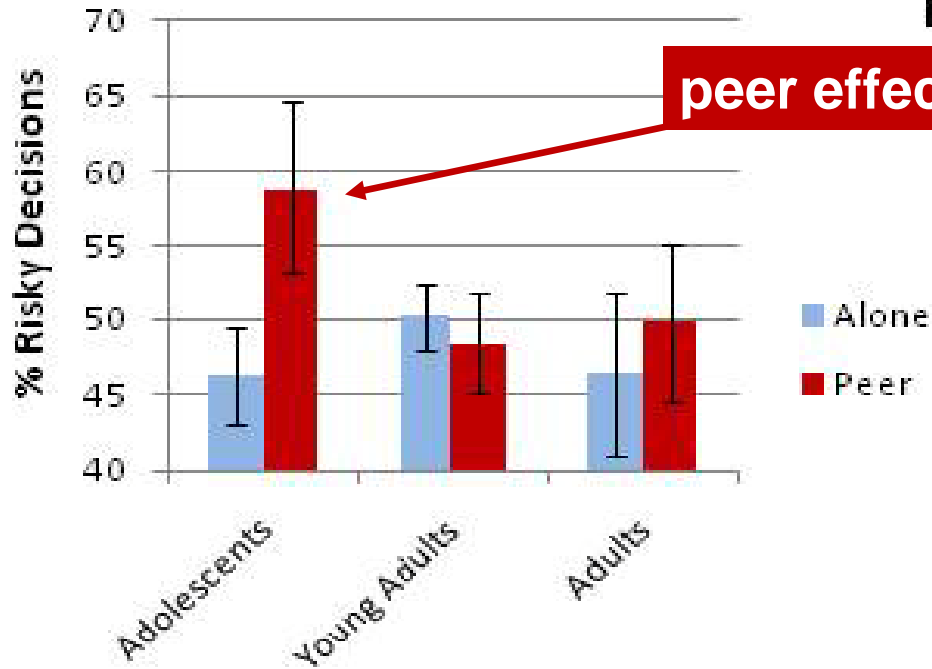
**Contributors for healthy
or personal growth?**

Risk-Taking – Context Matters!

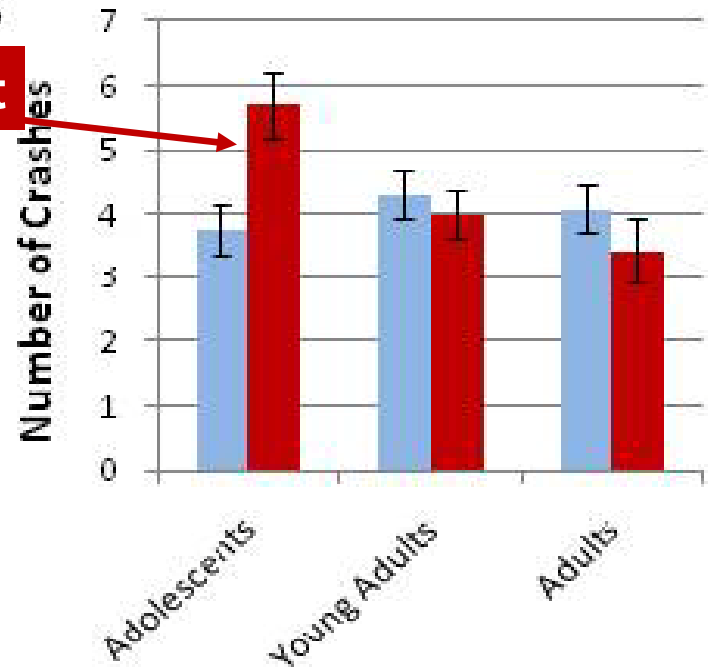
- **Based on science of brain development, a modern view of risk taking in adolescence is...**
 - **evolutionarily adaptive**
 - **normative; important to development**
 - **significant individual differences**
 - **is due primarily to emotional and contextual, not cognitive, factors**

Impact of Peer Presence on Risky Driving in Simulated Context

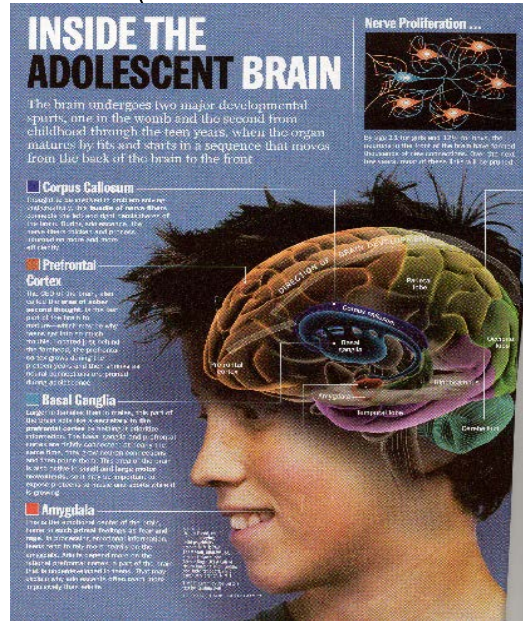
A



B



I. Brain development



II. Developing brain: drug use, mental health, early experiences

i. Developing brain and drugs

INSIDE THE ADOLESCENT BRAIN

The brain undergoes two major developmental spurts, one in the womb and the second from childhood through the teen years, when the organ matures by fits and starts in a sequence that moves from the back of the brain to the front.

Nerve Proliferation ...



By age 13, for girls and 15% for boys, the neurons in the front of the brain have formed thousands of new connections. One-third of the new ones are still being pruned.

Corpus Callosum

Thought is an electrical signal that travels across the brain. In the **Corpus Callosum**, bundles of nerve fibers connect the left and right hemispheres of the brain. It's the main highway for information, allowing the two sides of the brain to work together.

Prefrontal Cortex

The **Prefrontal Cortex** is the area of the brain that is the last to mature. It's the part of the brain that is most involved in decision-making, planning, and impulse control. It's the part of the brain that is most affected by drugs.

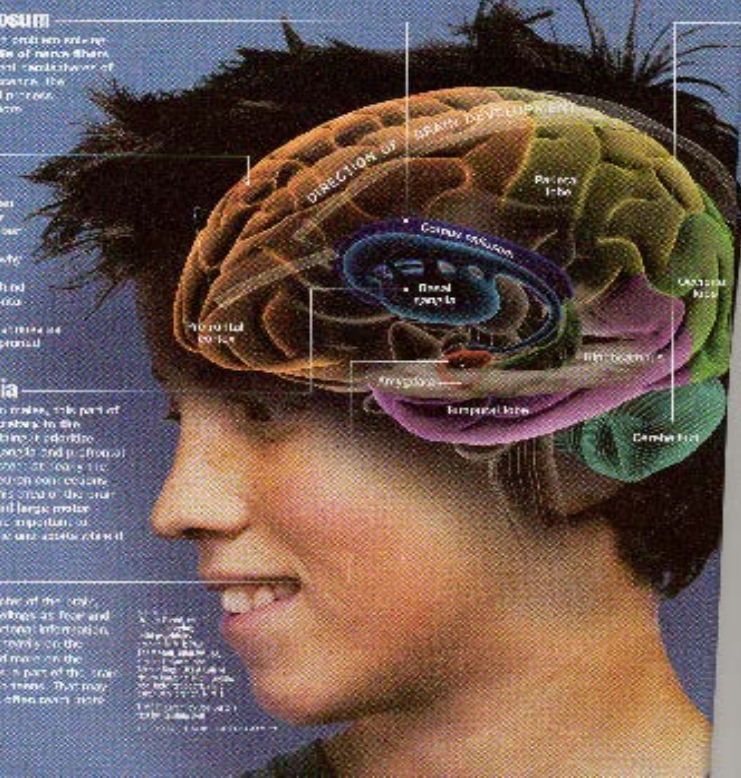
Basal Ganglia

Larger in females than in males, this part of the brain is involved in movement, learning, and emotion. The basal ganglia help to control the body's movements and are involved in the brain's reward system. They are also involved in the brain's ability to learn from experience.

Amygdala

This is the emotional center of the brain. It's the part of the brain that is most involved in processing information about the body's internal state. It's the part of the brain that is most affected by drugs.

Source: National Institute of Mental Health, National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism, National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism, National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism.

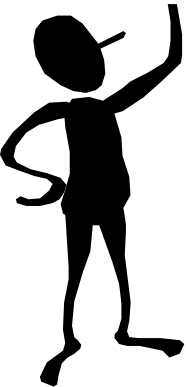


Implications of Brain Development for Drug Abuse Vulnerability

Are adolescents more susceptible than adults to drugs?

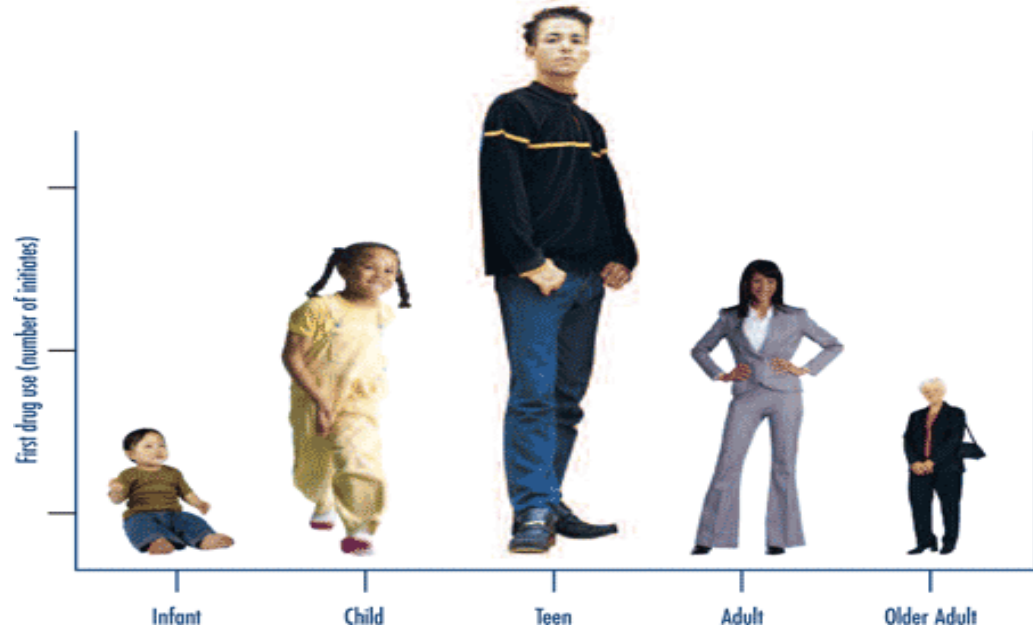
Several lines of evidence
(acknowledgement to Linda Spear, Ph.D.)

Unethical to give human adolescents alcohol in the laboratory;
much of the best evidence comes from adolescent rat studies.



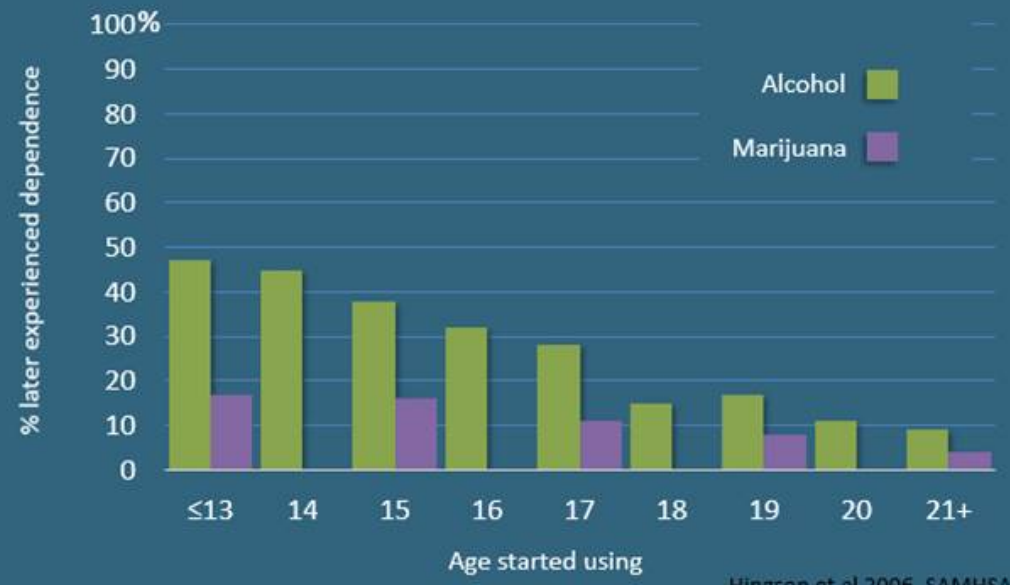
Evidence from epidemiological studies

Drug use starts early and peaks in the teen years





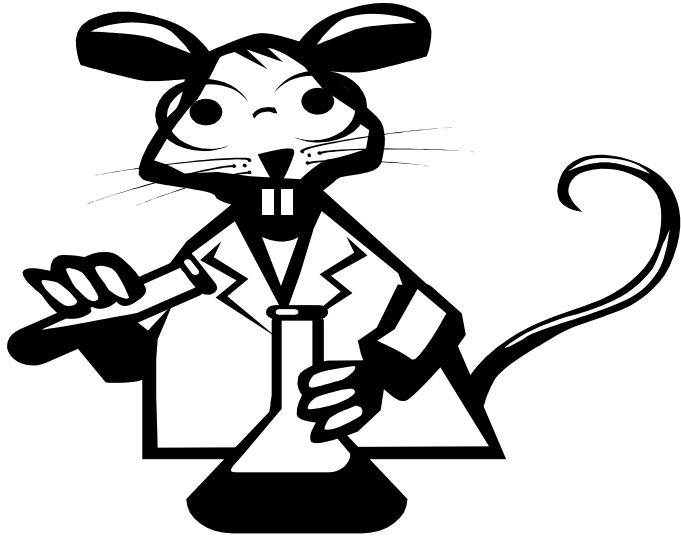
Age at substance use onset and later addiction



Hingson et al 2006, SAMHSA 2010

Implications of Brain Development for Drug Abuse Vulnerability

Alcohol

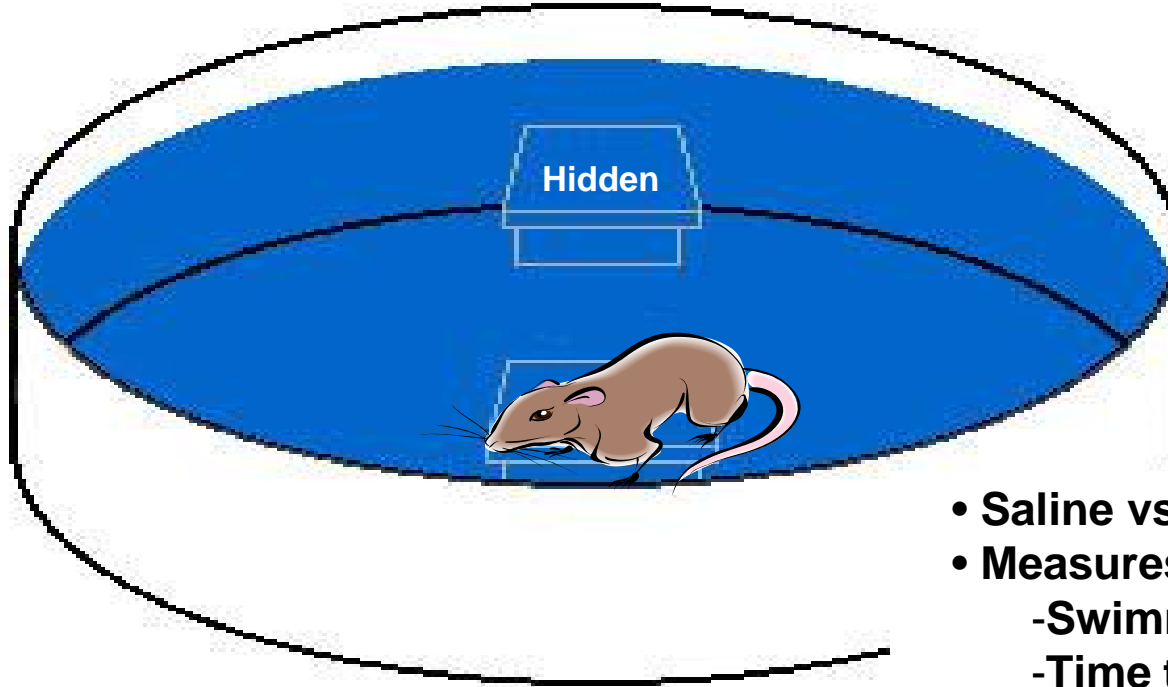
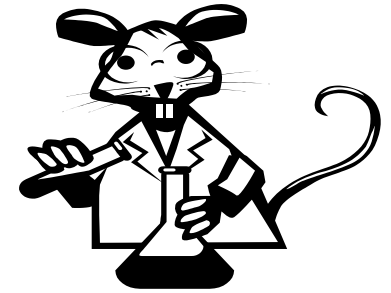


Are adolescents more susceptible to alcohol than adults?

- 1. Adolescent mice are less sensitive to the sedative and motor impairment effects of intoxication.**
- 2. Adolescent rats are more sensitive to the social disinhibition effects of alcohol.**



The Water Maze Test



- Saline vs alcohol
- Measures
 - Swimming speed
 - Time to find platform

Are adolescents more susceptible to alcohol than adults?

1. Adolescent mice are less sensitive to the sedative and motor impairment effects of intoxication.
2. Adolescent mice are more sensitive to the social disinhibition effects of alcohol.

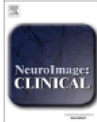
#2 and **#3** : May contribute to **binge drinking** and increased risk to **alcohol dependence**.

Wanna look
for some cheese
with me?



Sure!





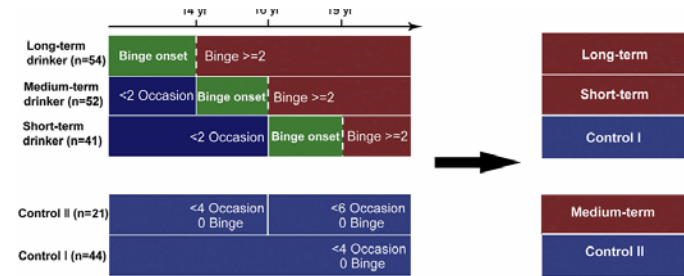
Impact of Binge Drinking

Adolescent binge drinking disrupts normal trajectories of brain functional organization and personality maturation

Ruan et al., 2019



- Longitudinal design; assessed at ages 14, 16 and 19
- Accumulating effect of binge drinking....
 - Neuroimaging data: disruption in the maturation of frontal connectivity (caution: small sample with neuroimaging data at baseline)
 - Personality data: slower developmental improvement of impulse control



Implications of Brain Development for Drug Abuse Vulnerability

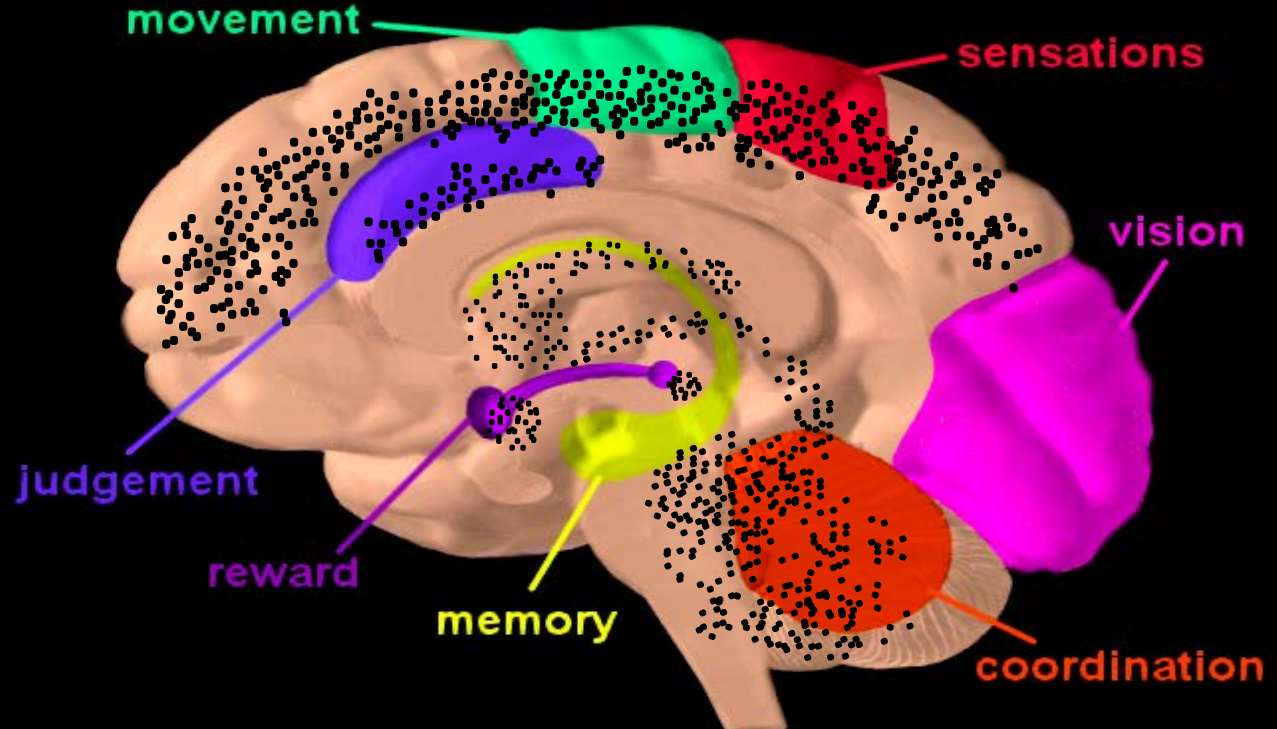
Marijuana



Marijuana Binds Cannabinoid Receptors Located Throughout the Brain

(source NIDA)

- Brain Development
- Memory & Cognition
- Motivational Systems & Reward
- Appetite
- Immunological Function
- Reproduction
- Movement Coordination
- Pain Regulation & Analgesia



Slide courtesy of Maureen Boyle, PhD

Eight Adverse Health Effects of Chronic Cannabis Use (Volkow et al., 2014)

“Low Level of Confidence”

- Lung cancer

“Medium Level of Confidence”

- Altered brain development
- Progression to use of other drugs
- Increased risk of schizophrenia, depression and anxiety disorders (in persons with a predisposition to such disorders)

“High Level of Confidence”

- Addiction
- Motor vehicle accidents
- Diminished life achievement (including cognitive impairment and poor educational outcome)
- Symptoms of chronic bronchitis



Some Adverse Health Effects of Chronic Cannabis Use More Pronounced with Youth Onset (Volkow et al., 2014)

“Low Level of Confidence”

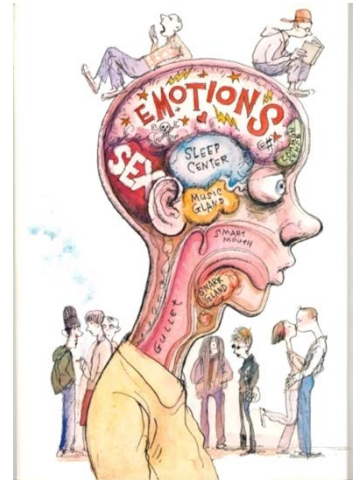
- Lung cancer

“Medium Level of Confidence”

- Altered brain development
- Progression to use of other drugs
- Increased risk of chronic psychosis disorders (including schizophrenia and depression) in persons with a predisposition to such disorders

“High Level of Confidence”

- Addiction
- Motor vehicle accidents
- Diminished life satisfaction and achievement (including cognitive impairment and poor educational outcome)
- Symptoms of chronic bronchitis



Source: US News & World Report, 2005

The Dunedin Study (New Zealand) (N=1,037)



13 yrs
(Pre-initiation)

1



18 yrs

2

21 yrs

3



32 yrs

4

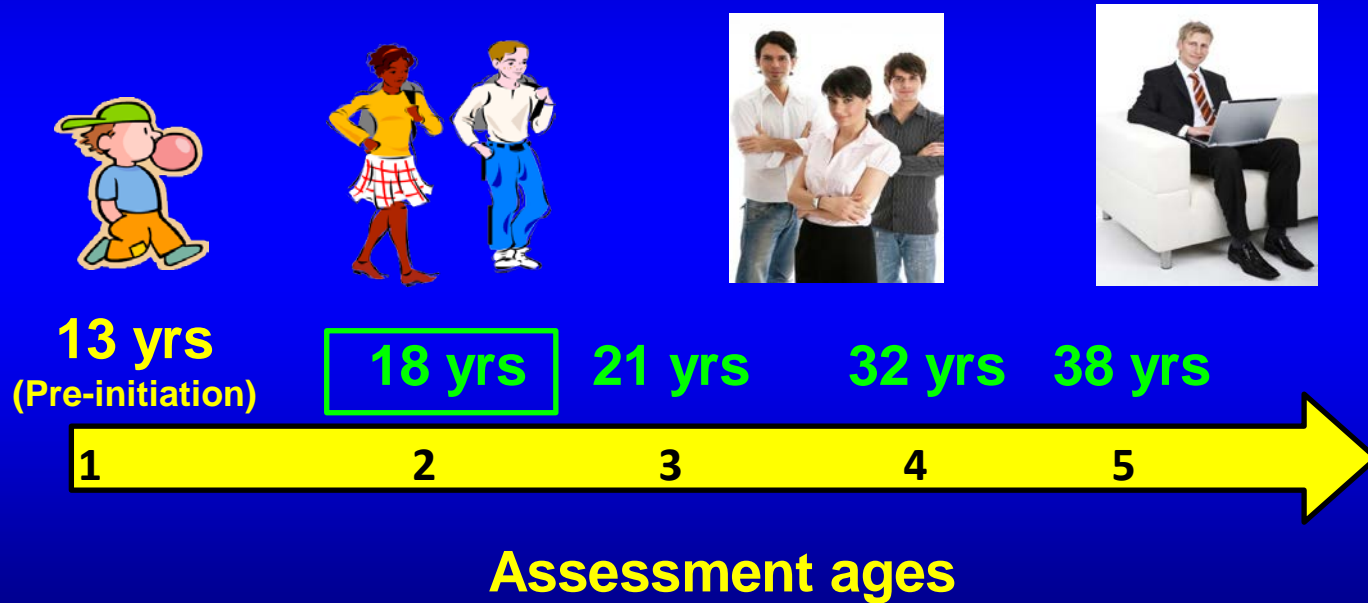


38 yrs

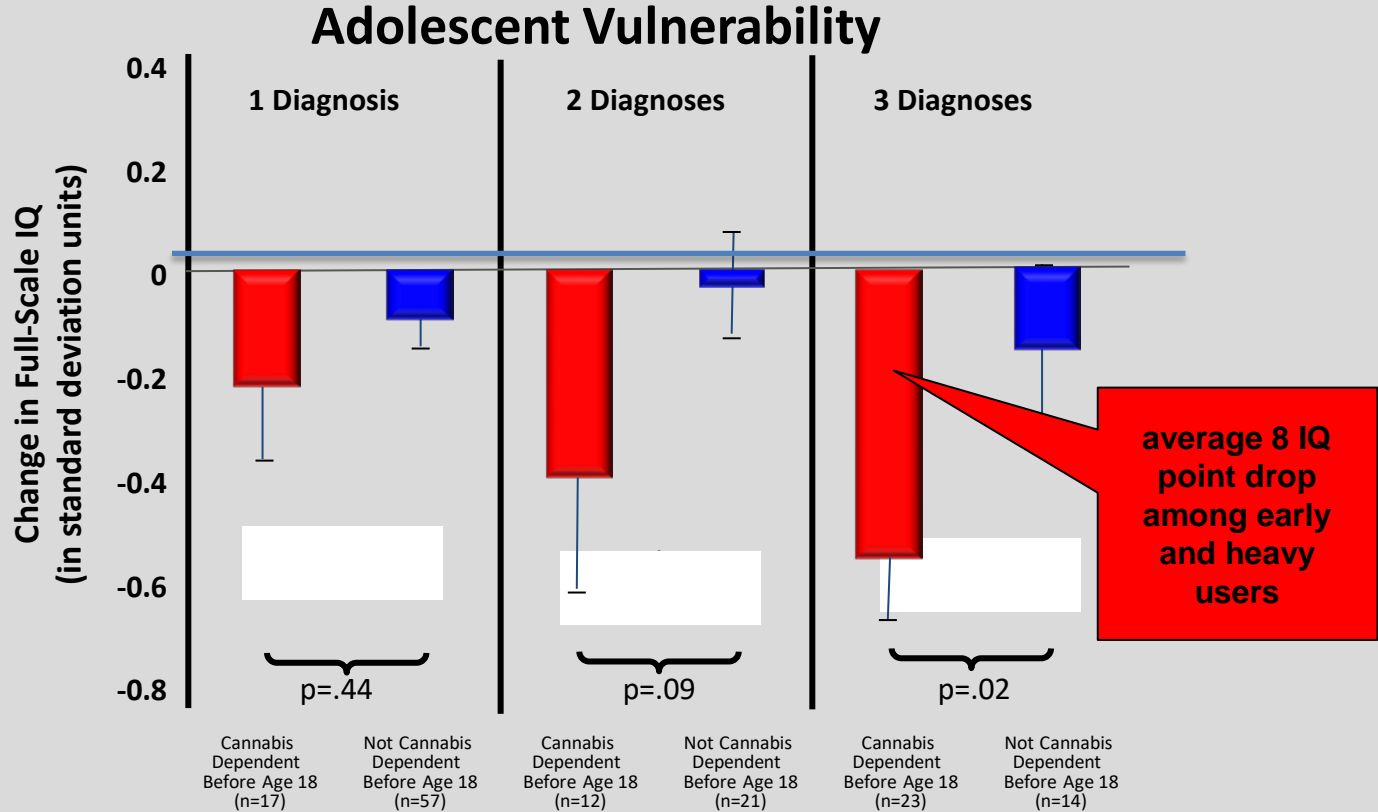
5

Assessment ages

The Dunedin Study (New Zealand) (N=1,037)

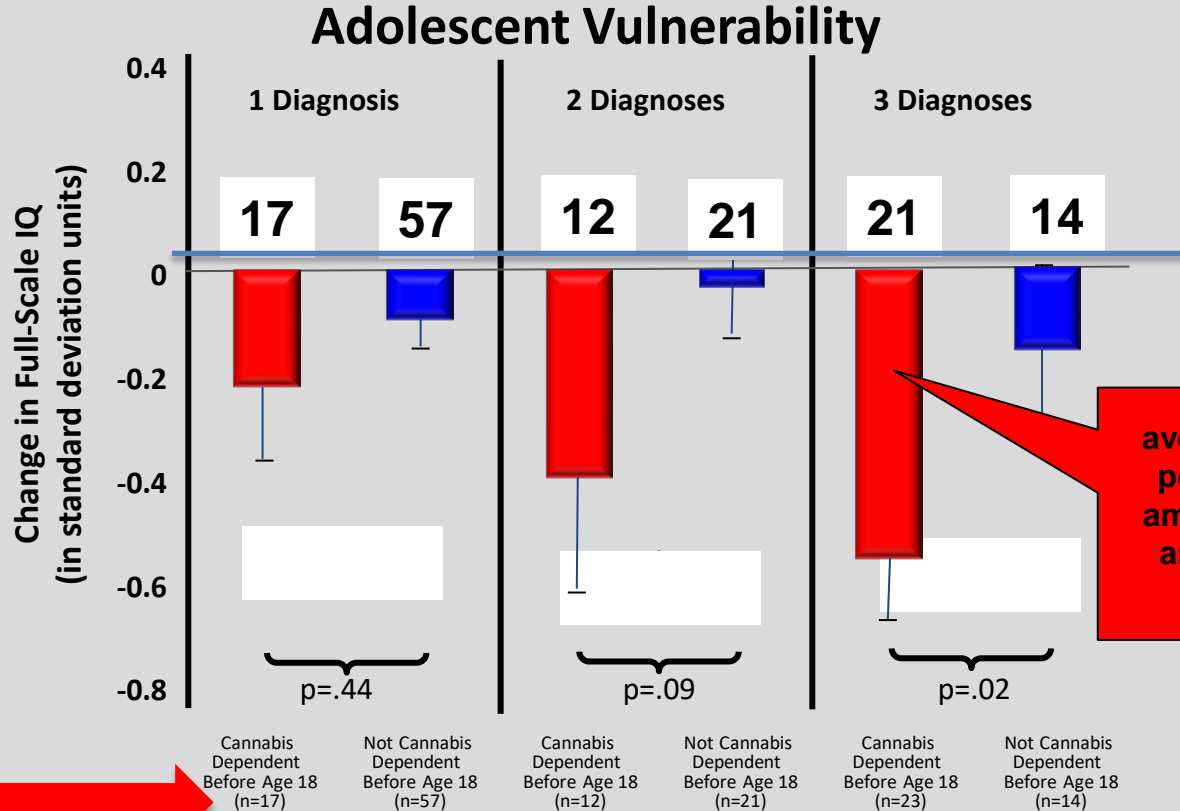


Marijuana and Cognitive Development



Source: Meier MH et al., PNAS Early Edition 2012

Sample Sizes Far from Ideal!!

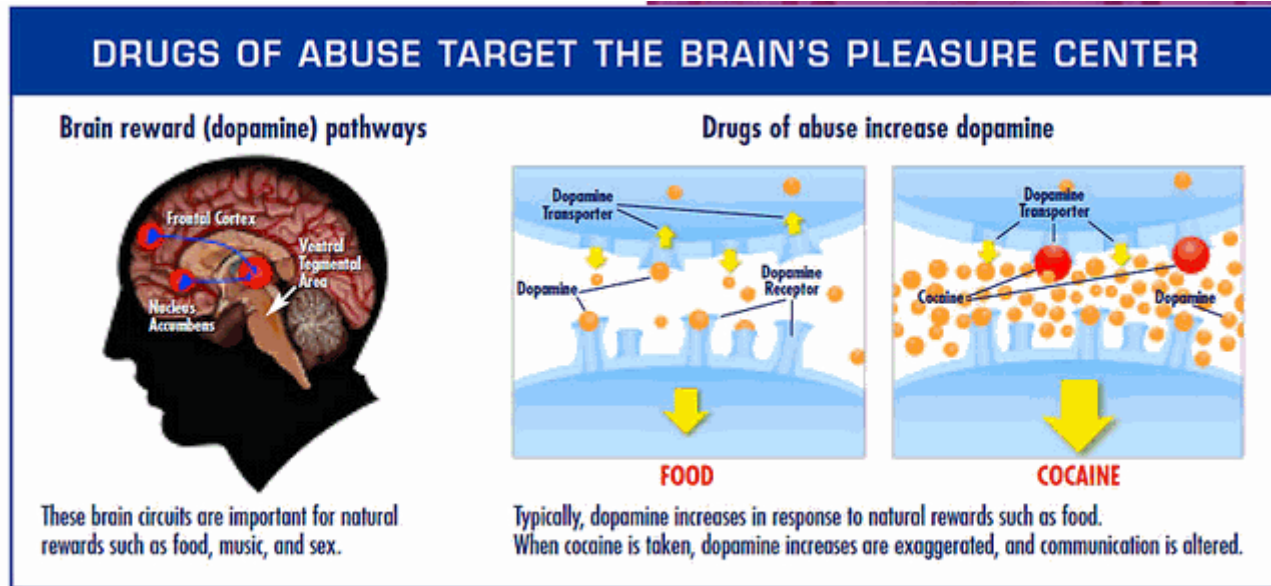


WHY?

1. Could there be inherent risk factors of brain development that contribute to drug use?

- **Preference for**
 1. **physical activity**
 2. **high excitement and rewarding activities**
 3. **activities with peers that trigger high intensity/arousal**
 4. **novelty**
- **Less than optimal..**
 5. **control of emotions**
 6. **consideration of negative consequences**
- **Greater tendency to...**
 7. **be attentive to social information**
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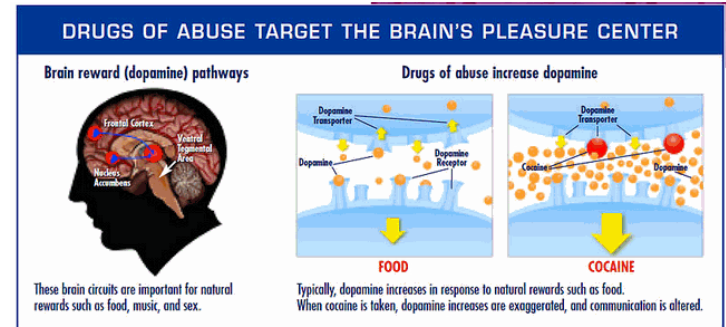
2. Adolescent pleasure centers in the brain may be more sensitive to the acute effects of drugs than pleasure centers in the adult brain.



Courtesy National Institute on Drug Abuse, National Institute of Health

2. Adolescent pleasure centers in the brain may be more sensitive to the acute effects of drugs than pleasure centers in the adult brain. (Chambers, Taylor and Potenza, 2003)

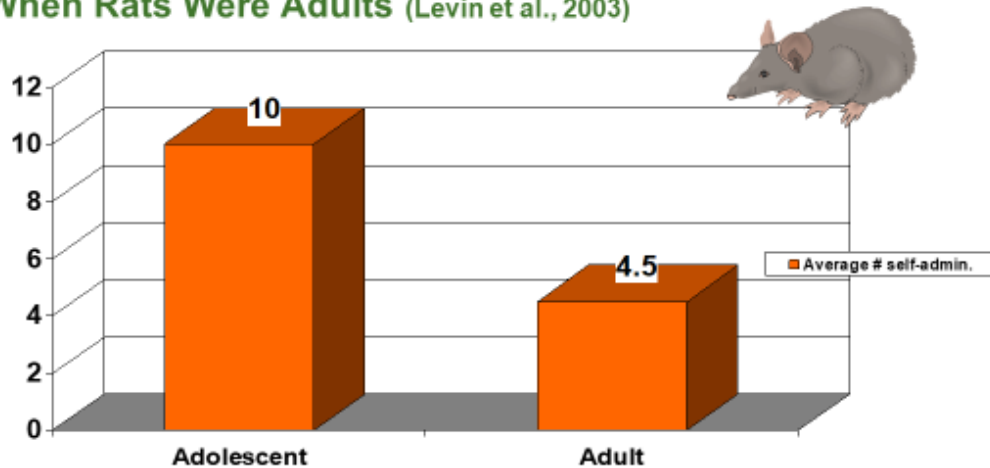
- Evidence that dopamine activity is more “robust” during adolescence.
- If dopamine production is more pronounced or “robust” during adolescence, risk of drug abuse could be heightened
 - > sensitivity to initial drug effects
 - > motivation to continue use
 - > difficulty to reduce use



Courtesy National Institute on Drug Abuse, National Institute of Health

3. Early Use May Create a Biological Priming or Gateway Effect

Average Number of Self-Administered Doses of Nicotine When Rats Were Adults (Levin et al., 2003)



Age of Rats When First Exposed to Nicotine. All Data Collected When Rats were Adults.

Nicotine Gateway Effects on Adolescent Substance Use

Michelle Ren, MS*
Shahrdad Lotfipour, PhD†

*University of California, Irvine, Department of Pharmaceutical Sciences, Irvine, California
†University of California, Irvine, Department of Emergency Medicine and Pharmaceutical Sciences, Irvine, California

Section Editor: Travis Zitek, MD

- Literature suggests: Disruption of nicotinic acetylcholine receptors (nAChR) development with early nicotine use may alter the release of reward-related neurotransmitters, and thus increase the likelihood of future drug seeking behaviors, including drugs other than nicotine.
- There is a “large collection of clinical and preclinical evidence that adolescent nicotine exposure influences long-term molecular, biochemical, and functional changes in the brain that encourage subsequent drug abuse.”

ii. Brain development and behavioral disorders

INSIDE THE ADOLESCENT BRAIN

The brain undergoes two major developmental spurts, one in the womb and the second from childhood through the teen years, when the organ matures by fits and starts in a sequence that moves from the back of the brain to the front.

Corpus Callosum

Thought to be involved in emotion and eye coordination, this bundle of nerve fibers connects the left and right hemispheres of the brain. During adolescence, the nerve fibers mature and myelinate, allowing for faster and more efficient signaling.

Prefrontal Cortex

The CEO of the brain, also called the area of higher thought, is the last part of the brain to mature. It's here that you learn to weigh the pros and cons, make decisions, and control impulses. The prefrontal cortex continues to develop through the teenage years and then continues to mature into the prefrontal cortex of adulthood.

Basal Ganglia

Larger in females than in males, this part of the brain acts like a switchboard in the prefrontal cortex, helping it receive information. The basal ganglia and prefrontal cortex are highly connected, so as the brain develops, the basal ganglia continue to grow and mature. The basal ganglia are made up of small and large motor neurons, so it's the maturation of these neurons that allows the basal ganglia to grow.

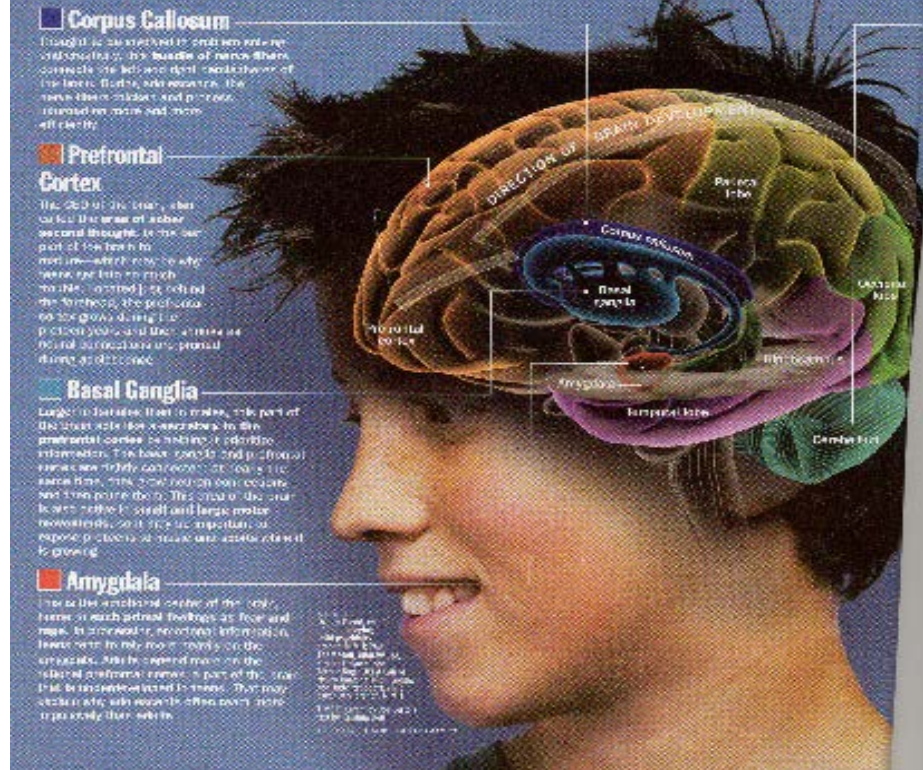
Amygdala

This is the emotional center of the brain, home to such primal feelings as fear and rage. It processes, receives information, and sends it to the rest of the brain. The amygdala is highly connected to the rest of the brain, so it's the maturation of these neurons that allows the amygdala to grow.

Nerve Proliferation ...



By age 13, for girls and 15% for boys, the neurons in the front of the brain have formed thousands of new connections. One-third of the space made of these fibers is pruned.

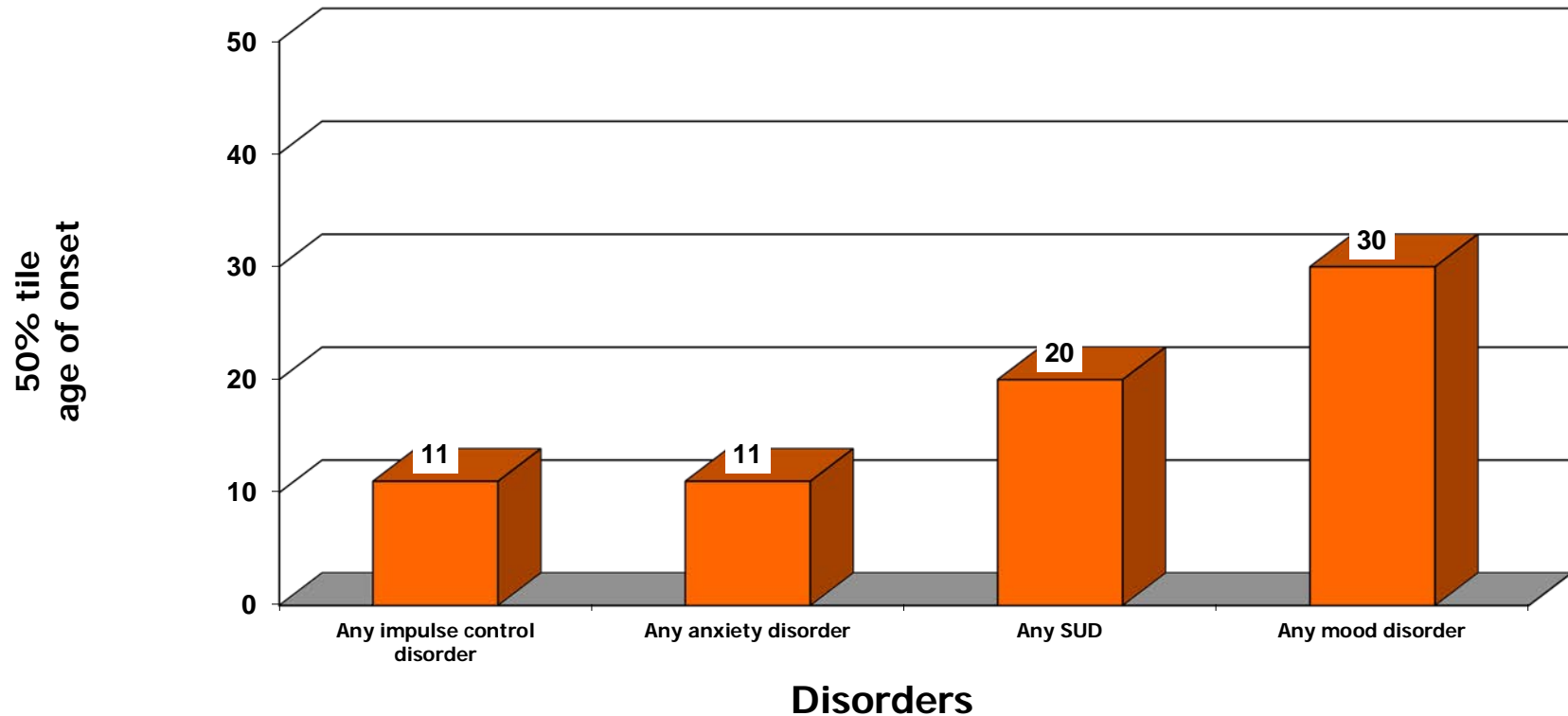


Source: National Institute of Mental Health, National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism, National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism, National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism.

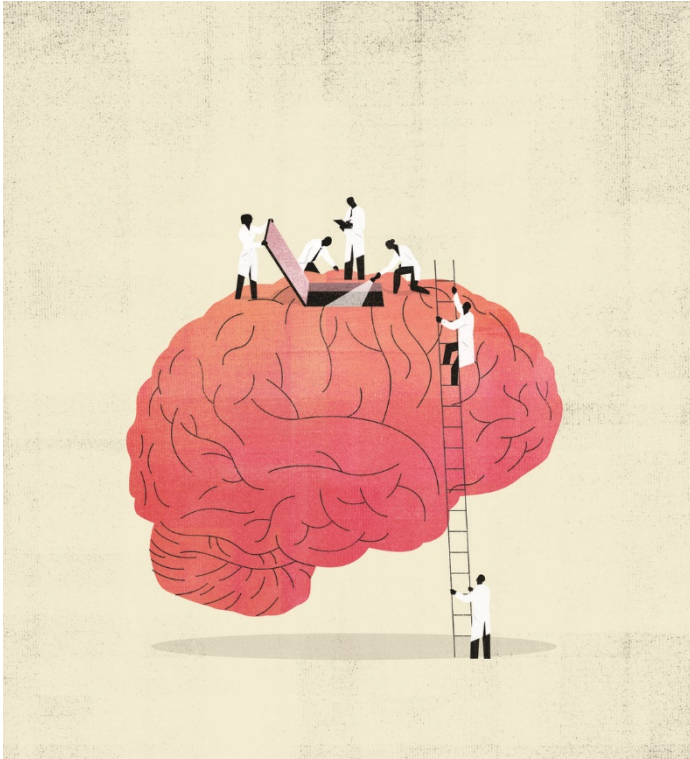
Adolescence and Behavioral Disorders

- **Alterations in neurodevelopment have been linked to several adolescent-onset mental and behavioral disorders (Charney et al., 2013):**
 - **ADHD**
 - **Affective Disorders**
 - **Anxiety Disorders**
 - **Autism**
 - **Obsessive-Compulsive Disorders**
 - **PTSD**
 - **Schizophrenia**

Ages at the 50 Percentile of the Age-at-Onset Distribution for Major Disorders (Kessler et al., 2005)



Adolescent Use of *Marijuana* and Behavioral Disorders



Miller's Review of the Marijuana and Mental Health Connection



Disorder	Cross-Sectional Data	Longitudinal Data
Schizophrenia	++	++
Bipolar	+	
Anxiety Disorders	+	+
Depressive Disorders	+	+
Risk of Suicide	+	

Key: ++ = several studies; + a few studies

Yellow box = risk greater when MJ use onset during youth.

Miller, C. L. (in press). The impact of marijuana on mental health. In K. Sabet & K.C. Winters, *Contemporary health issues on marijuana*. NY: Oxford Press.

The contribution of cannabis use to variation in the incidence of psychotic disorder across Europe (EU-GEI): a multicentre case-control study

Marta Di Forti, PhD   • Diego Quattrone, MD • Tom P Freeman, PhD • Giada Tripoli, MSc •

Charlotte Gayer-Anderson, PhD • Harriet Quigley, MD • et al. [Show all authors](#) •

- 901 patients with first episode psychosis across 11 clinic sites in Europe
- Compared 1237 population controls from those same sites
- Cannabis use was associated with increased odds of psychotic disorder compared with never users
 - **Daily use of low potency cannabis** = adjusted odds ratio, **3.2** (95% CI 2.2 – 4.1)
 - **Daily use of high potency cannabis** = adjusted odds ratio, **4.8** (95% CI 2.5 – 6.3)

Source: Lancet Psychiatry, 2019

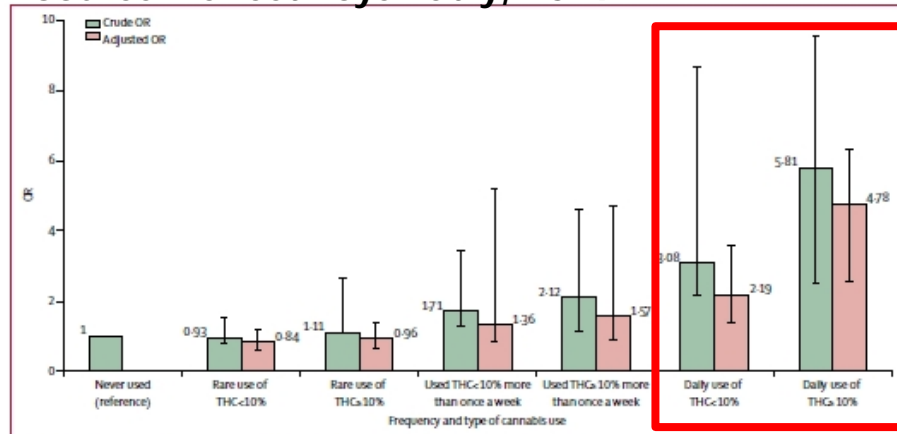


Figure 1: Crude and fully adjusted ORs of psychotic disorders for the combined measure of frequency plus type of cannabis use in the whole sample. Crude ORs are adjusted only for age, gender and ethnicity and fully adjusted ORs are additionally adjusted for level of education, employment status, and use of tobacco, stimulants, ketamine, legal highs, and hallucinogenics. Error bars represent 95% CIs. OR=odds ratio.

Cautionary Notes

- **Reverse causation (self-medication).**
- **Early drug use may be a marker of underlying genetic risk and not causative, or only partially causative.**



iii. Impact of early experiences on the developing brain and subsequent health and well-being

INSIDE THE ADOLESCENT BRAIN

The brain undergoes two major developmental spurts, one in the womb and the second from childhood through the teen years, when the organ matures by fits and starts in a sequence that moves from the back of the brain to the front.

Nerve Proliferation ...



By age 13, for girls and 12% for boys, the neurons in the front of the brain have formed thousands of new connections. One-third of the axons made at birth will be pruned.

Corpus Callosum

Thought to be involved in emotion and eye coordination, this bundle of nerve fibers connects the left and right hemispheres of the brain. It also contains neurons, the nerve fibers, axons, and myelin sheath that surround them and carry all sorts of electrical signals.

Prefrontal Cortex

The CEO of the brain, also called the area of higher thought, is the last part of the brain to mature. It's the area that helps you think, plan, and make decisions. It's also the area that helps you control your emotions and impulses. It's the area that helps you think about the future.

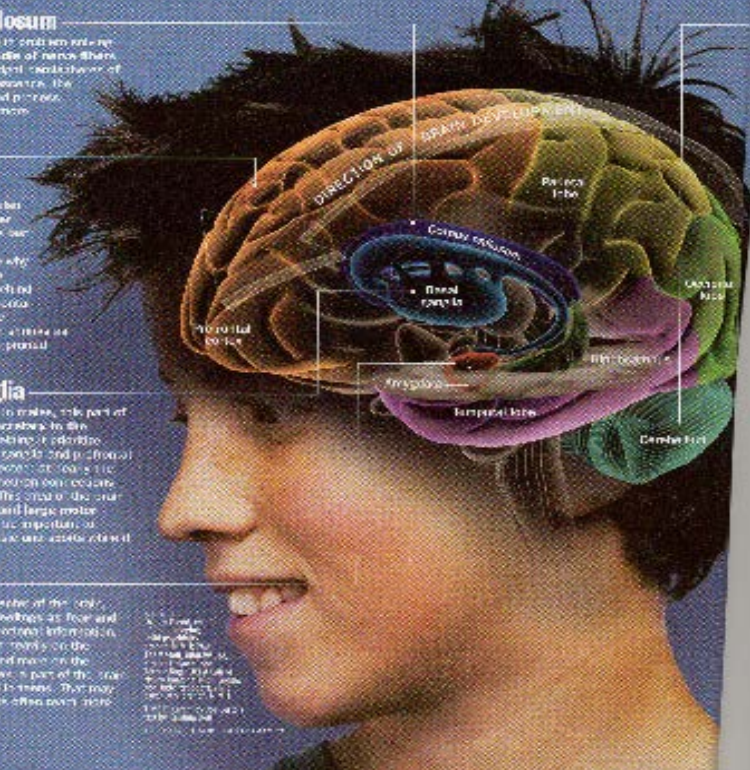
Basal Ganglia

Larger in females than in males, this part of the brain acts like a switchboard in the prefrontal cortex, helping it receive information. The basal ganglia and prefrontal cortex are highly connected. It's the area that helps you think, plan, and make decisions. It's also the area that helps you control your emotions and impulses. It's the area that helps you think about the future.

Amygdala

This is the emotional center of the brain, home to such primal feelings as fear and rage. It processes, receives information, feeds into the rest of the brain, and the amygdala. It's the area that helps you think, plan, and make decisions. It's also the area that helps you control your emotions and impulses. It's the area that helps you think about the future.

Source:
National Institute of Mental Health
National Institute of Child Health and Human Development
National Institute on Drug Abuse
National Institute on Alcohol Abuse and Alcoholism
National Institute on Drug Abuse
National Institute on Alcohol Abuse and Alcoholism
National Institute on Drug Abuse
National Institute on Alcohol Abuse and Alcoholism

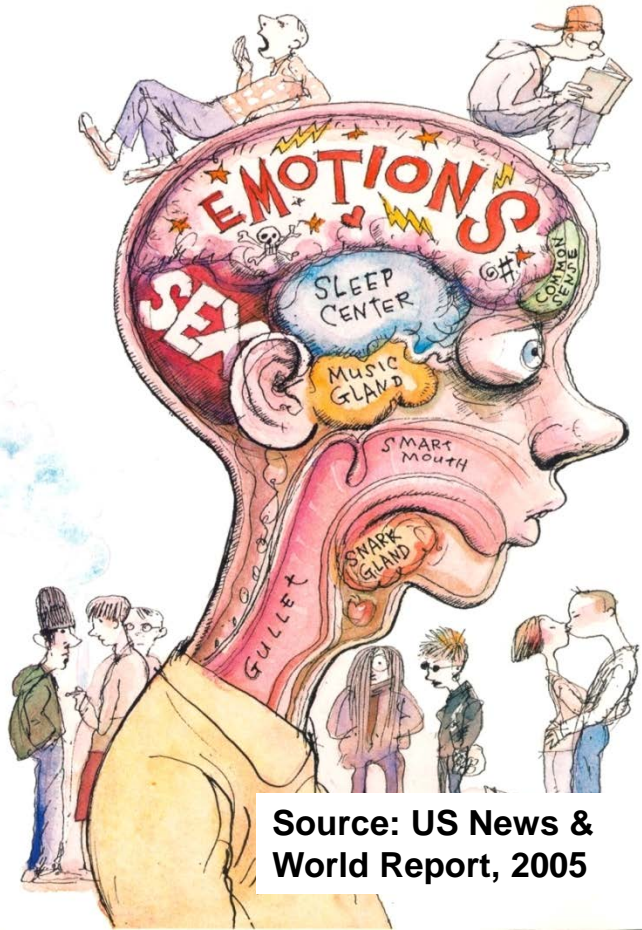


A Developing Brain

> Impact from Environment?

- “Exposure to both positive and negative elements before adolescence can imprint on the final adult topography in a manner that differs from exposure to the same elements after adolescence.”

(Anderson, 2003, *Neuroscience & Biobehavioral Reviews*)



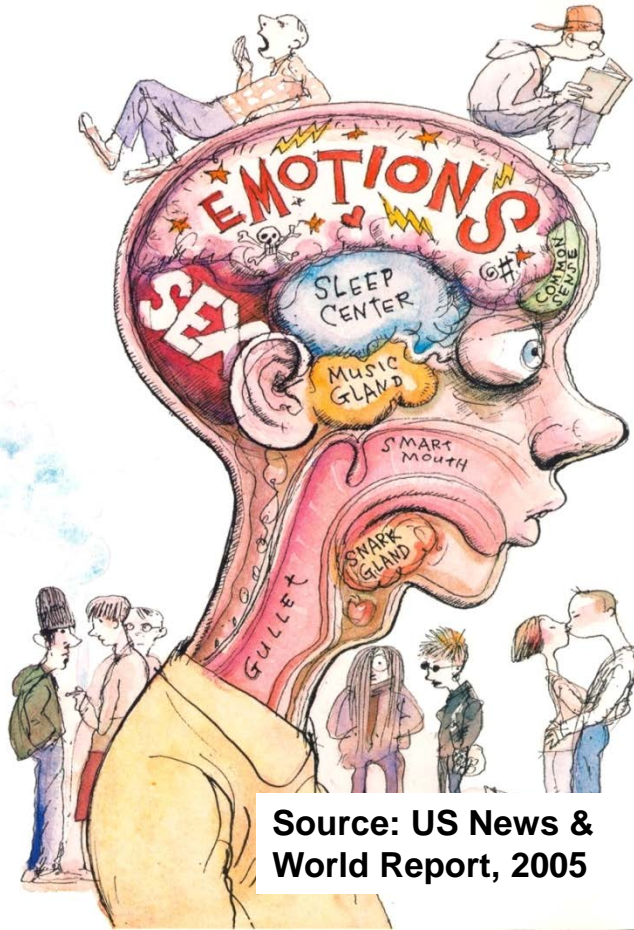
Source: US News & World Report, 2005

A Developing Brain

> Impact from Environment?

<https://developingchild.harvard.edu/science/deep-dives/mental-health/>

- “The interaction between genetic predispositions and sustained, stress-inducing experiences early in life can lay an unstable foundation for mental health that endures well into the adult years.”



Source: US News &
World Report, 2005



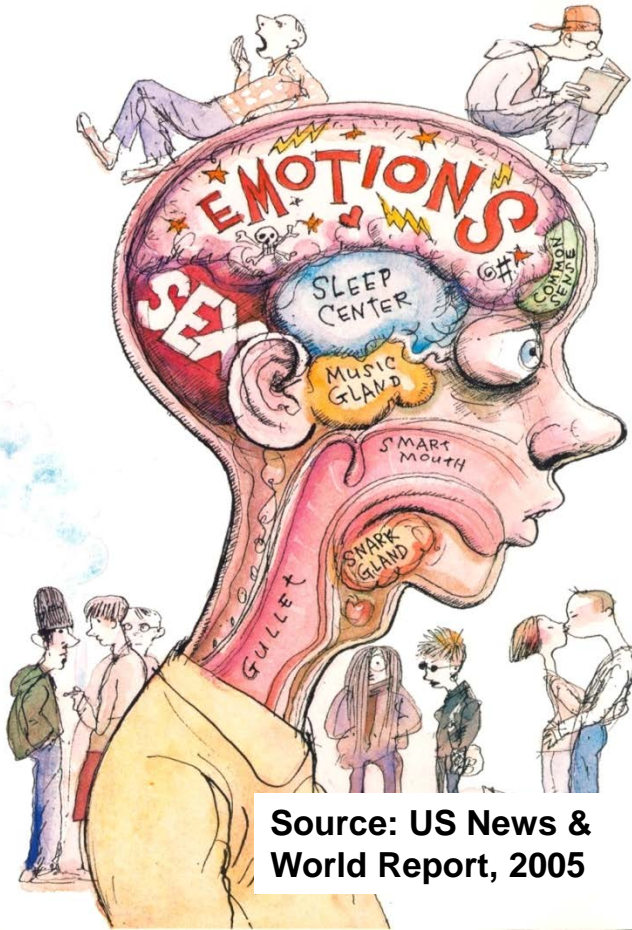
A Developing Brain

> Impact from Environment?

<https://developingchild.harvard.edu/science/deep-dives/mental-health/>

Rays of Hope!

- "Some individuals demonstrate remarkable capacities to overcome the severe challenges of early, persistent maltreatment, trauma, and emotional harm."
- "Most potential mental health problems will not become mental health problems if we respond to them early."



Source: US News &
World Report, 2005

Early experiences can alter brain development in positive ways



<https://www.cdc.gov/ncbddd/childdevelopment/early-brain-development.html>

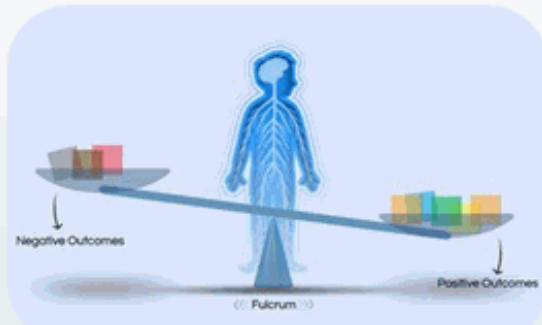
“Nurturing and responsive care for the child’s body and mind is the key to supporting healthy brain development.”

Early experiences can alter brain development in positive ways



Center on the Developing Child
HARVARD UNIVERSITY

<https://developingchild.harvard.edu/>



The science of early childhood is a source of new ideas that could be used to develop more effective policies & services focused on the early years of life.

[Browse Key Concepts](#) | [Browse Deep Dives](#)

Early experiences can alter brain development in positive ways



Preschool is a sensitive period for the influence of maternal support on the trajectory of hippocampal development

Joan L. Luby^{a,1}, Andy Belden^a, Michael P. Harms^a, Rebecca Tillman^a, and Deanna M. Barch^{a,b,c}

^aDepartment of Psychiatry, Washington University in St. Louis, St. Louis, MO 63110; ^bDepartment of Psychological & Brain Sciences, Washington University in St. Louis, St. Louis, MO 63130; and ^cDepartment of Radiology, Washington University in St. Louis, St. Louis, MO 63110

More parental support = more hippocampus volume



Early experiences can alter brain development in negative ways

WHAT ARE ACES?

AND HOW DO THEY RELATE TO TOXIC STRESS?

SAMHSA
Substance Abuse and Mental Health
Services Administration



- The impact of child traumatic stress can last well beyond childhood. Associated with...
 - learning problems
 - mental illness; diminished level of functioning
 - increased use of a health services, including mental health services

Early experiences can alter brain development in negative ways



- Children deprived of parents early in life (orphans), compared to children with parents, revealed....
 - increased gastrointestinal symptoms
 - pattern of gut microbiomes linked to..
 - concurrent and future anxiety
 - prefrontal cortex activation to emotional faces



Early experiences can alter brain development in negative ways



Infant Stress Affects Teen Brain
(Davidson et al., 2012; *Nature Neuroscience*)

■ **For *some* girls, stressful experiences in the first year of life was associated with.....**

1. altered hormonal changes; and
2. abnormal development of connections between regions of the brain that control fear and stress responses

Brain development, depression and suicidality



- Some experts have warned that the rate of adolescents who have seriously considered committing suicide is increasing at an alarming rate.
- Suicide was the 10th most common cause of death among Americans of all ages in 2017,
 - Yet it was the second leading cause of death among young Americans in the U.S. age 15 to 24 (Curtin & Heron, 2019).

Brain development, depression and suicidality



- In my home state of Minnesota, a recent state-wide student health survey indicated that 13% of 11th grade students reported “seriously considered suicide”.

Source: <https://www.mprnews.org/story/2019/10/17/survey-finds-mn-students-feel-less-safe-less-healthy>

- Suicide rates vary across tribes and communities, but AI/AN people overall face a disproportionate burden of suicide.
 - In 2017, the age-adjusted suicide rate was 51% (males) and 80% (females) higher compared to the general population (<https://www.cdc.gov/nchs/products/index.htm>).

Implications of Brain Development for Adolescent Behavior

(Winters et al., 1995)



- **Preference for**

1. **physical activity**
2. **high excitement and rewarding activities**
3. **activities with peers that trigger high intensity/arousal**
4. **novelty**

- **Less than optimal..**

5. **control of emotions**
6. **consideration of negative consequences**

- **Greater tendency to...**

7. **be overly attentive to social information**
8. **take risks**

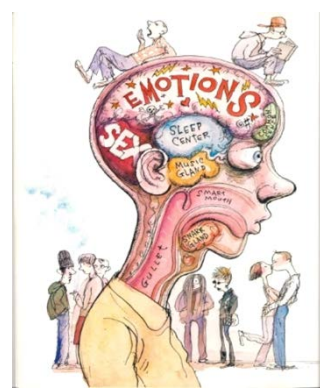
**Contributors for suicide
ideation?**

Screening adolescents for depression

- **Patient Health Questionnaire-9**

(<https://www.mdcalc.com/phq-9-patient-health-questionnaire-9>)

- Screening tool for depression
- 9 questions, 1 of which screens for suicide thinking (“thoughts you would be better off dead, or thoughts of hurting yourself in some way?”)



Suicide Resource



Urban Indian Health
Knowledge Resource Center

The National Council of Urban Indian Health (NCUIH), in partnership with the Action Alliance's AI/AN Task Force, put forward a resolution in 2015 to create an "Annual National American Indian and Alaska Native Hope for Life Day (Suicide Prevention Awareness Day).

That initiative involved the development of the National Hope for Life Day Toolkit. This resource seeks to help community leaders, grassroots organizers, and health care professionals working in AI/AN communities implement a community-wide Hope for Life Day.

Source: https://www.ncuih.org/krc/news?article_id=293

SEPTEMBER 10, 2019

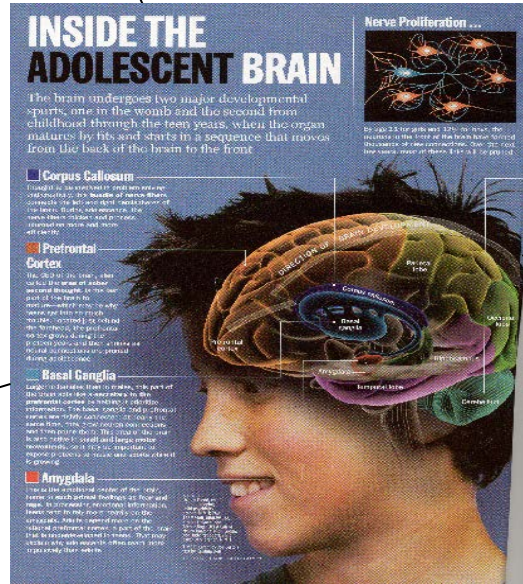
American Indian/Alaska Native
Hope for Life Day



National Council of
Urban Indian Health



I. Brain development

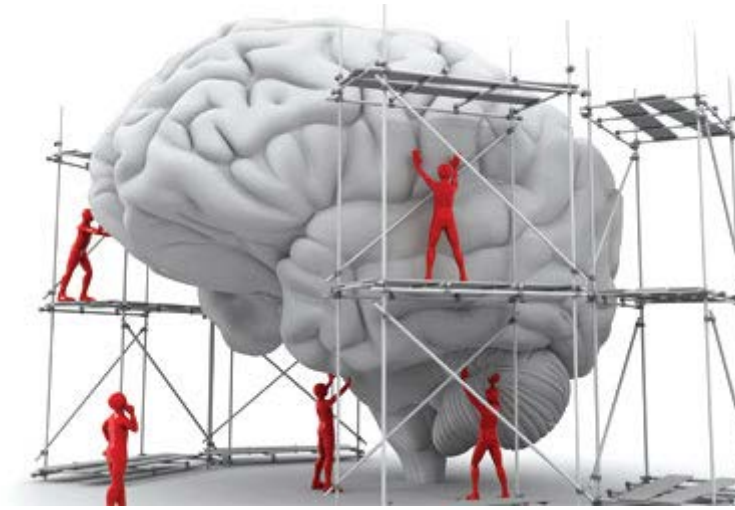


II. Developing brain, drug use and mental health

III. Youth Serving Workers

Brain Development: Implications for Youth Serving Workers & Educators

- i. Teach youth about brain development and its importance to health and personal growth**



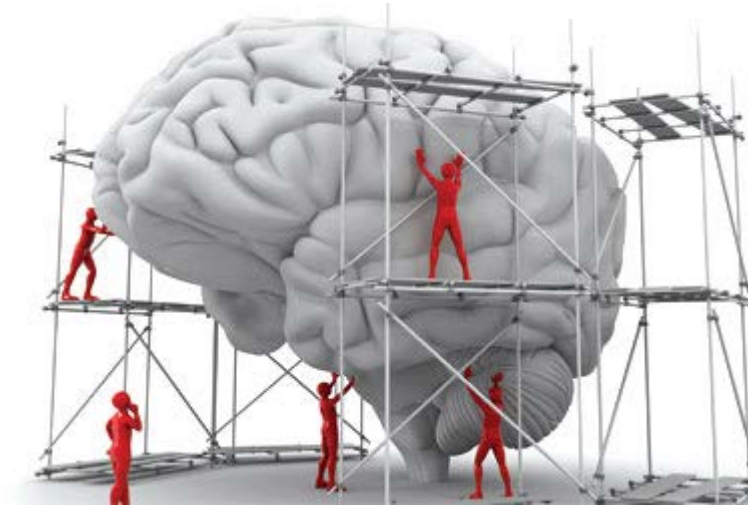
Implications of Brain Development for Adolescent Behavior



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Brain Development: Implications for Youth Serving Workers & Educators

- **Teach “adaptive” decision making**
 - taking risks that promote “personal-growth”
 - “on second thought” skills
 - how to avoid peer pressure to engage in delinquency

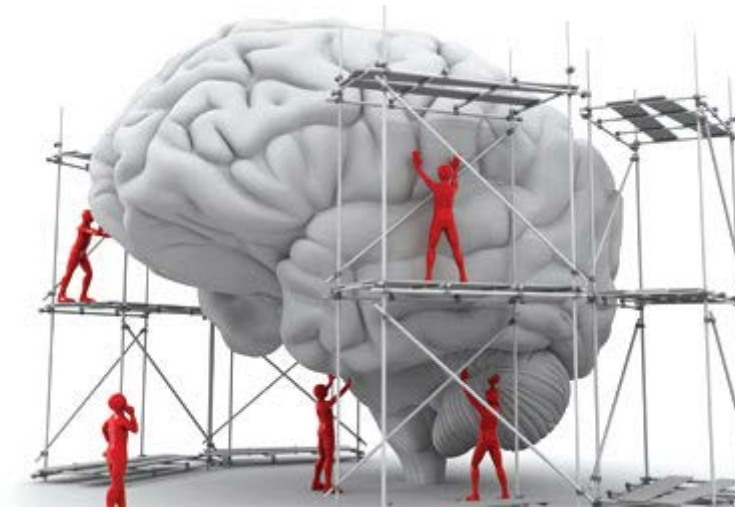


Brain Development: Implications for Youth Serving Workers & Educators

- i. Interested in a “teen brain” resource to help teach youth about brain development?**

send me an e-mail:

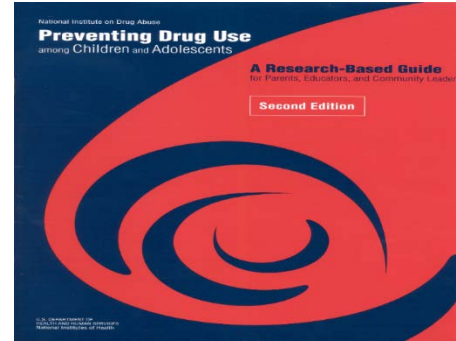
winte001@umn.edu



Brain Development: Implications for Youth Serving Workers & Educators

ii. Use evidenced-based *prevention* programs

- Keys to effective prevention are in the research literature
 1. National Institute on Drug Abuse
<https://www.drugabuse.gov>
 2. Cochran literature review
<https://www.cochranelibrary.com/cdsr/about-cdsr>
 3. ISSUP's prevention curriculum
<https://www.issup.net/training/universal-prevention-curriculum>



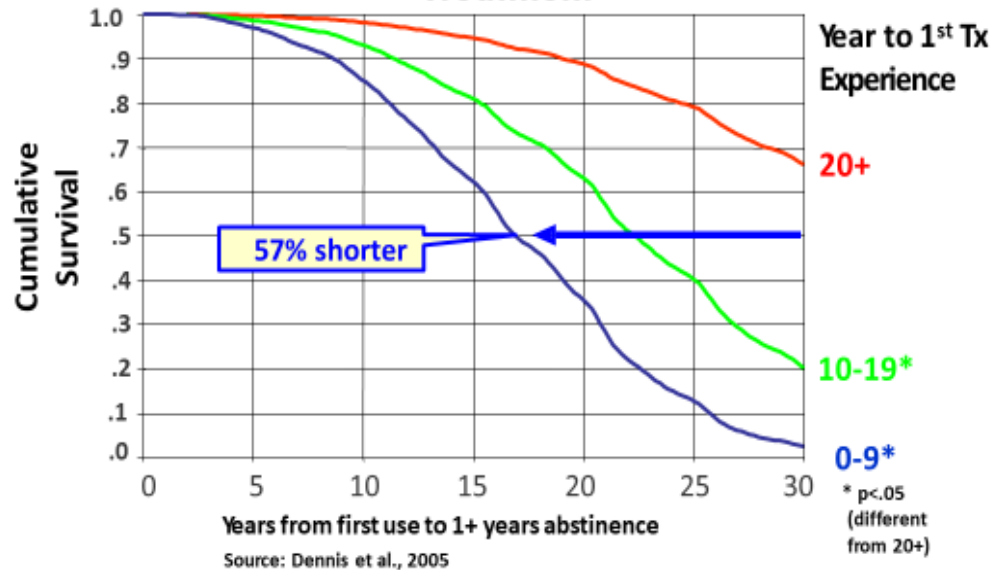
Trusted evidence.
Informed decisions.
Better health.



Brain Development: Implications for Service Providers

iii. Earlier the *treatment*, the better

“Careers” are Shorter the Sooner People Access Treatment





Brain Development: Implications for Service Providers

iv. Use evidenced-based *treatment*

Treatment: Recent literature summary and meta-analysis (Hogue et al., 2018; **NIDA, 2014; Tanner-Smith et al., 2012)**

Treatment “as usual” is no better than prevention education only or no treatment.

A wide range of more recent evidenced-based treatment do significantly better.

MET, CBT and family therapy



Brain Development: Implications for Youth Serving Workers & Educators

v. Increase the “cannabis and vaping IQ” of adolescents



- Sources of exercises and quizzes

- Cannabis:

- www.dfaf.org (*Busting the Top Ten Myths of Marijuana*)

- Vaping:

- Google “CDC educating kids on vaping”
<https://www.cdc.gov/tobacco/features/back-to-school/e-cigarettes-talk-to-youth-about-risks/index.html>

Brain Development: Implications for Service Providers & Educators

vi. Teach parents about brain development

P = Promote activities that capitalize on the strengths of the developing brain.

A = Assist children with challenges that require planning.

R = Reinforce their seeking advice from adults; teach decision making.

E = Encourage a lifestyle that promotes good brain development.

N = Never underestimate the impact of a parent being a good role model.

T = Tolerate the “oops” behaviors due to an immature brain.



Parent Resources

1.

Mentor
International

**DRUG PREVENTION
FOR PARENTS**

MENTOR INTERNATIONAL'S SELECTION OF SUBSTANCE
ABUSE PREVENTION RESOURCES FOR PARENTS

2.



**THE PARTNERSHIP™
AT DRUGFREE.ORG**

3. **Prevent_Intervene_Get
Treatment_Recover**

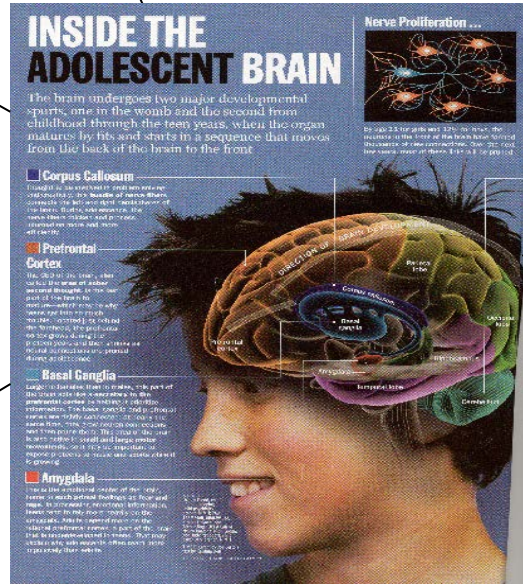
www.drugfree.org

I. Brain development

IV. Summary

III. Youth Serving Workers

II. Developing brain, drugs and mental health



Summary

- **Adolescence is an extended period of transition from reliance on adults to independence**
- **Normal adolescence is characterized by....**
 - **increase in conflicts with family members**
 - **desire to be with one's friends**
 - **resistance to messages from authority**
 - **irritability**
 - **risk taking**
 - **proclamations of sheer boredom**



Summary

**reward incentives >
perception of
consequences**

JUST DO IT.



Summary

- **Several lines of evidence suggesting that adolescence is a period of vulnerability to the effects of drugs, and a period linked to the onset of some mental disorders.**
- **It is also a time when personal growth can be shaped in ways that are unique to adolescence**



Summary

- **Employ teen-brain friendly and evidence-based prevention and treatment**
 - **Prevention: decrease risk, increase protective factors**
 - **Treatment: employ these techniques**
 - Motivational interviewing
 - CBT
 - Family therapy
 - **Teach parents to strengthen parenting with brain development science**



Teen Brain Development Quiz



1. There are several health indices suggesting that teenagers take less risk than in years past.
True (increased rate of “abstaining” from all substances; lower rate of teenage pregnancies and certain delinquency behaviors)

2. What lifestyle choices during adolescence promote good brain development?
 - i. **no drug use**
 - ii. **healthy lifestyle (good diet, exercise, sufficient sleep; active social life)**

3. Which is more harmful to the developing brain?
 - a. **Chronic, heavy use of marijuana?**
 - b. **Chronic, heavy drinking?****Good question!!**



THANK YOU
winte001@umn.edu

Questions and Discussion

