Alcohol, Cannabis, Nicotine, and the Teen Brain
Why is studying development important?

- The brain grows very much from ages 9-20+.
- Much is still unknown about how child experiences and substance use affect development.

**FACT:** The brain continues to develop until the 3rd decade of life!
Past Month Use of Intoxicants

- Alcohol
- Been Drunk
- Marijuana
- E-Cigarettes
- Narcotics
- Amphet
- Sedatives
- Hallucinog
- Ecstasy
- Cocaine
- Inhalants
- Heroin

8th grade: 100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%
12th grade: 100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%
College Students

Monitoring the Future, 2018
Binge Drinking

Girls = 4+ drinks

Boys = 5+ drinks

20% of high school seniors binge drank in the past 2 weeks!
MRI

- Non-invasive
- Safe
- Structural MRI: measures brain structure
- Functional MRI: measures brain activity
The Developing Brain
Brain Basics: Gray Matter
Reward Regions Develop before Cognitive Control Regions

Somerville & Casey, 2010; van Duijvenvoorde et al., 2016; Mills et al., 2014; Baker et al., 2015
Youth At Risk Study

Baseline: Age 12-14

Year 1: 13-15

Year 2: 14-16

Year 13: 25-27

= Non-drinker

= Drinker
Brain Structure and Youth Substance Use

Bava, Jacobus, Thayer, & Tapert, 2013, ACER
Brain Function and Substance Use

Early drinking (1-2 yrs)

Pre-initiation

Continued use

Brain Activation

Substance Use

Tapert et al., 2001, ACER; Tapert et al., 2004, ACER; Squeglia et al., 2012, JSAD
Alcohol and Neurocognition during Adolescence/Young Adulthood

Alcohol Quantity/Frequency

Verbal Memory: β Coefficient = -0.27
Visuospatial Ability: β Coefficient = -0.22
Psychomotor Speed: β Coefficient = -0.17
Processing Speed: β Coefficient = -0.12

Nguyen-Louie et al., 2015, JSAD
Neurocognitive Performance (age 17, 19, 20 years old)

Jacobus et al., 2015, Neuropsychology
Brain Health Predicts Future Use

Substance Use

Ages 12-16

Ages 19-22
Earlier Onset = More Problems

The odds of developing alcohol dependence decrease by 14% with each increasing year of age at first use.

Grant & Dawson, 1997, *Journal of Substance Abuse*; Dawson et al., 2008, *ACER*
Recovery of Spatial Skills

Winward, et al., 2014, *JINS*
Recovery with Abstinence

Brain blood flow after 28 days of monitored abstinence

Mean CBF (ml/100g/min)

Baseline 28 Days

Marijuana Users

Controls

* p<.01
~Age 17
N=46

Left Insula

Medial Frontal Gyrus

Jacobus, Goldenberg, Wierenga, Tolentino, Liu, & Tapert, 2012, Psychopharm
Mood Changes

§ □ Negative mood
§ □ Depression
§ □ Anxiety

Winward, et al., 2014, ACER
Recovery with Abstinence

Jacobus et al., 2017; Psychopharm
A longitudinal study of 11,875 children from ages 9-10 through early adulthood to assess factors that influence individual brain development trajectories and functional outcomes.
TOCAN STUDY

• Targeting 200 Teens!
• Ages 16-22
• MRI
• $80 for 4 hours + referral bonus
• Picture of YOUR BRAIN!!

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