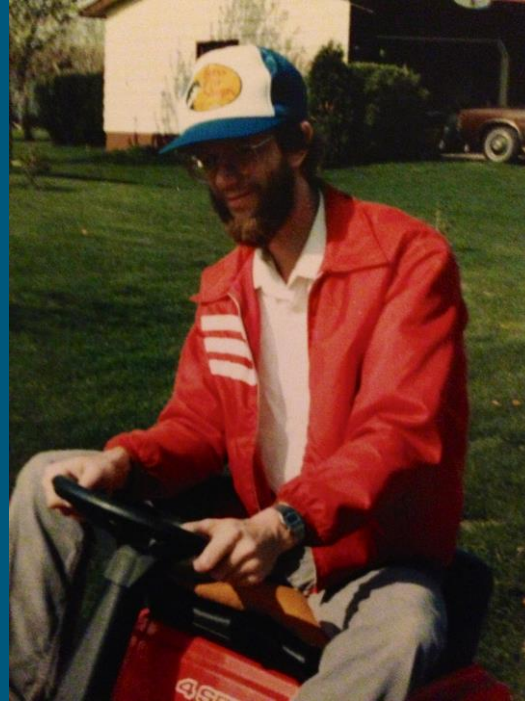


Adolescence: Sensitive Period for Development of Addiction

Sara Polley, MD (she/her)
National Medical Director, Youth Continuum
Adult, Child, Adolescent, Addiction Psychiatrist



Storytelling and Stigma



Objective

Why is the adolescent period of human development a sensitive period for the development of substance use disorders?

Ryan

17yo M history of ADHD. Family is aware of some intermittent alcohol and cannabis use along with daily nicotine vape usage.

Brought for appointment secondary to making suicidal statements on social media and cutting himself.

Family report 6 month worsening of school refusal, anger, sleep problems, and hopelessness. They feel he may have depression and would like medication.



Ryan

Is this normal teen behavior?

What is causing these changes?

What role are the substances playing?

Is he depressed?

Ryan: Adolescent Tasks

- Explore and accept physical maturity
- Establish autonomous identity
- Gain independence from family unit
- Strongly connect with peers and community
- Explore alternative values and approaches to life

Hochberg, Ze'ev & Belsky, Jay. (2013). Evo-Devo of Human Adolescence: Beyond Disease Models of Early Puberty. *BMC medicine*. 11. 113. 10.1186/1741-7015-11-113.



Ryan: Adolescent Behavior

- Difficulty with Emotional Regulation
- Pleasure seeking
- Impulsivity
- Novelty Bias
- Invincibility



Ryan: Adolescent Biology

↑ Gonadal steroid production

↑ White matter ↓ Gray matter volume

Cortical and limbic reorganization

Ryan: Adolescent Brain Maturity

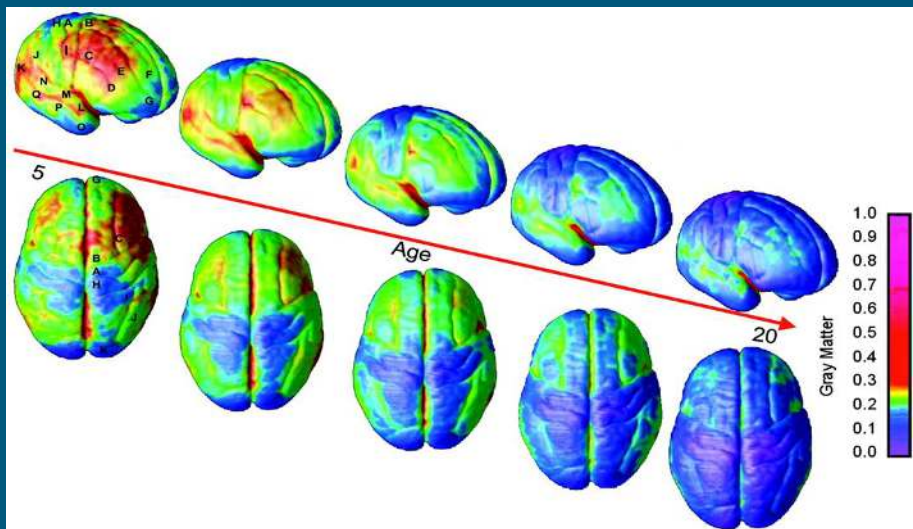


Image courtesy of V.J. Wedeen and L.L. Wald,
Martinos Center for Biomedical Imaging at
MGH

Primitive Structures

- Reward Pathway
- Emotional Response
- Energy Level



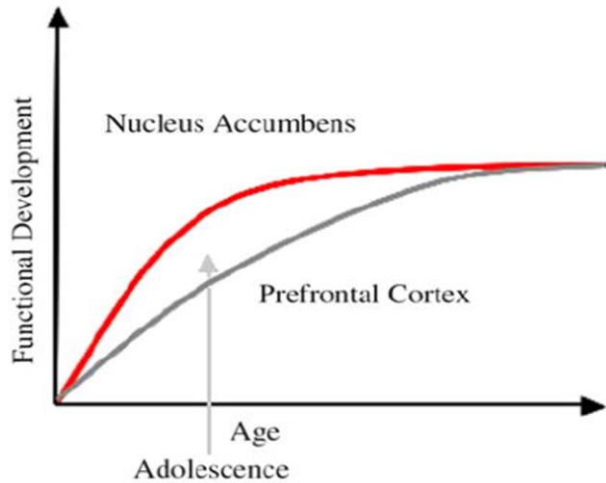
Advanced Structures

- Executive Function
- Memory Retrieval



Hazelden Betty Ford
Foundation

Impact of Functional Mismatch



A Predicable Equation

Dev Tasks + Behavior + Biology

= Risk Of Substance Use

Ryan: Gathering Information

“I smoke a half of a joint in the morning, a half before bed... I used a dab pen a couple of times...

I drink alcohol on the weekends with my friends. When we want to get messed up and have fun...

I vape whenever I can, sometimes I buy one and sometimes I use my friends.”



Source: www.councilonrecovery.org/adolescents-alcohol-abuse-growing-problem-talk-parents-can-stop/

Source: <https://www.cbsnews.com/news/heavy-teen-marijuana-use-may-cut-life-short-by-60/>

Ryan: Gathering Information

“I am here to talk about depression and ADHD. Why does my use matter?”



Source: www.councilonrecovery.org/adolescents-alcohol-abuse-growing-problem-talk-parents-can-stop/

Source: <https://www.cbsnews.com/news/heavy-teen-marijuana-use-may-cut-life-short-by-60/>

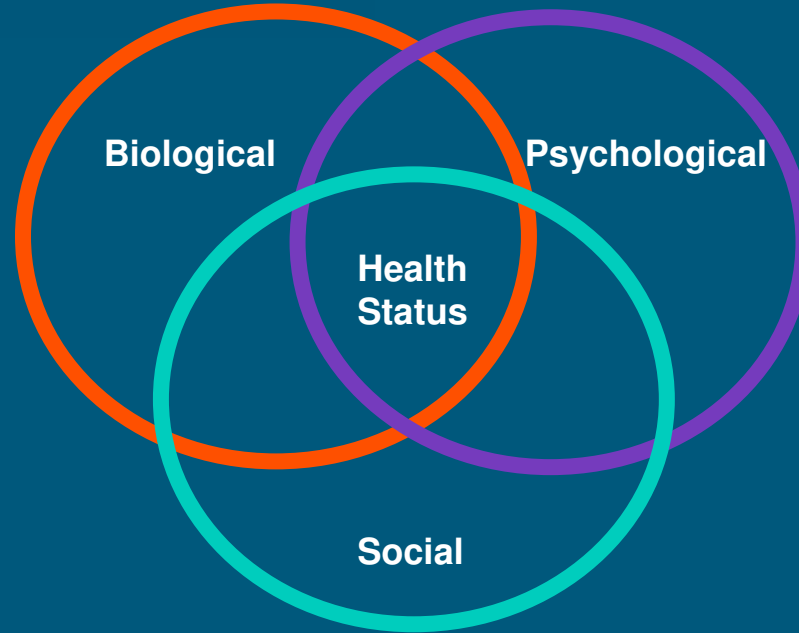
Brain Under Construction



Incomplete construction increases risk of developmental derailment

Google Images, Accessed April 1, 2022

Domains of Impact



Substance Use and Mental Health: **Biological**

Changes in Neurotransmitter Metabolism

Sleep Structure Changes

Structural Thickening in Anterior Prefrontal Cortex

Reward Pathway

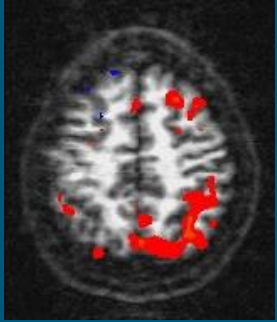
Medication Interactions

Long Term Cognitive Impacts

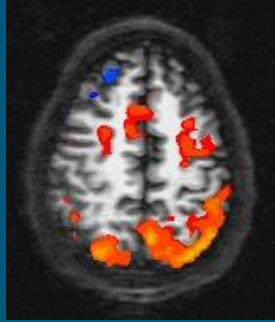
- ↓ Executive Function Skills
- ↓ Intellectual Ability
- ↓ Memory storage and retrieval
- ↔ Alters Functioning of endogenous systems
reward pathway, pain, motivation, mood regulation
- ↑ Increases risk of ADHD-like symptoms

These symptoms may persist beyond acute use depending on substance choice\concentration, duration, age of cessation

Cognitive Performance: Alcohol

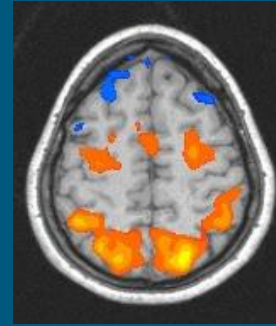


16yo Non-Drinker

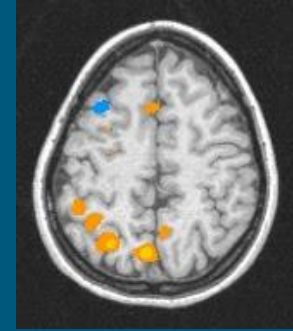


16yo Drinker

Same
Performance



Non-Drinker at 21yo



Drinker at 21yo

Significantly Impacted
Performance

Substance Use and Mental Health: Psychological

Trauma Exposure

Identity Development

Trouble with Coping Skills

Obscures Intrinsic Values

Diagnostic Uncertainty – treatment confusion

Substance Withdraw

Irritability, anger, aggression

Anxiety, nervousness

Sleep difficulty

Decreased appetite, weight loss

Restlessness

Depressed mood

abdominal pain, shakiness/tremor, sweating, fever, chills,
headache... seizure, psychosis, death

Substance Use and Mental Health: Social

Family Conflict

Prosocial Isolation

Legal Involvement

Treatment Access Issues

Stigma



A Dangerous Equation?

Substance Exposure + Plastic Brain



Impacts to Development

Biological
Psychological
Social



Risk of Development
of Lifelong SUD

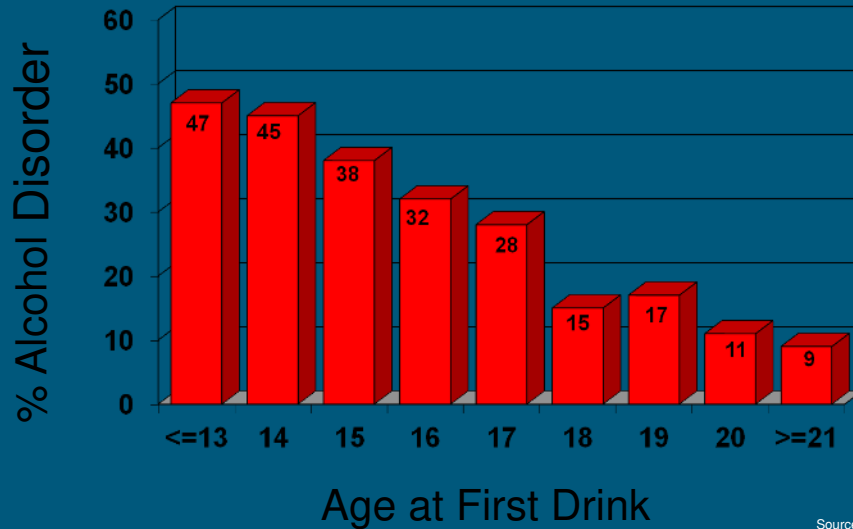


Risk of Chronic Addiction

1 in 4 teens who use **ANY SUBSTANCE IN ANY AMOUNT** will struggle with chronic addiction in adulthood

This is 5 - 8x the population risk of SUD

Alcohol Use and Addiction



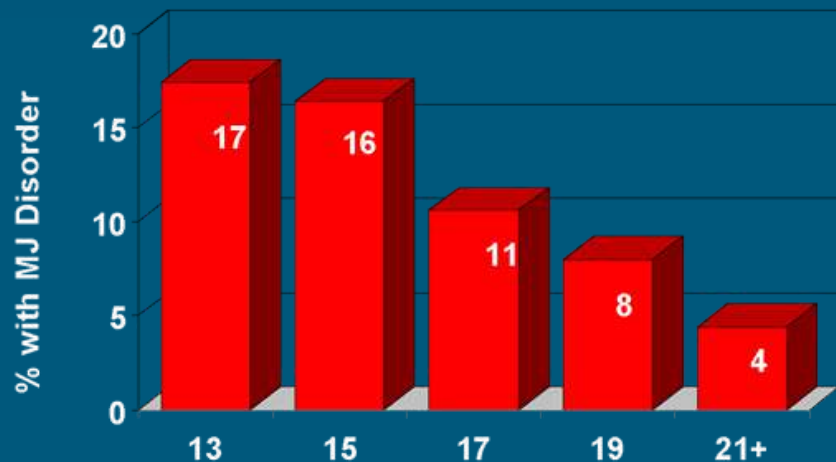
Early Age of first use increases risk of addiction to any substance later in life.

47% at 13yo
9% at 21yo

Source: Substance Abuse and Mental Health Services Administration. (2010). *Results from the 2009 National Survey on Drug Use and Health: Volume I. Summary of National Findings* (Office of Applied Studies, NSDUH Series H-38A, HHS Publication No. SMA 10-4586Findings). Rockville, MD.

Source: Hingson RW, Heeren T, Winter MR. Age at drinking onset and alcohol dependence. *Arch Pediatr Adolesc Med.* 2006;160:739-746.

Cannabis Use and Addiction



Age at First Use

Spread the word: Delay Use
17% at 13yo
4% at 21yo

Source: Substance Abuse and Mental Health Services Administration. (2010). *Results from the 2009 National Survey on Drug Use and Health: Volume I. Summary of National Findings* (Office of Applied Studies, NSDUH Series H-38A, HHS Publication No. SMA 10-4586Findings). Rockville, MD.

Cruel Trick?



<https://www.history.com/news/prehistoric-cave-paintings-early-humans>

Opportunity?



Image:
<https://teenspeak.org/wp-content/uploads/2013/05/raising-hand.jpg>



Image" <https://al-anon.org/newcomers/teen-corner-alateen/>



Image:
<https://www.asvabprogram.com/media-center-article/127>

Discussion and Questions

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References

- US DHHS, Health Resources and Services Administration, Maternal and Child Health Bureau. *Child Health USA 2010*. Rockville, Maryland: U.S. Department of Health and Human Services, 2010.
- Casey BJ, et al., *Development Reviews*. 2008; 28(1): 62-77
- Adolescents Differ from Adults in Substances Most Abused** *Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2013.*
- SAMHSA, Center for Behavioral Health Statistics and Quality, *National Survey on Drug Use and Health, 2013.*
- National Institute on Drug Abuse; National Institutes of Health; U.S. Department of Health and Human Services.
- McCabe, S.E.; West, B.T.; Morales, M.; Cranford, J.A.; and Boyd, C.J. Does early onset of non-medical use of prescription drugs predict subsequent prescription drug abuse and dependence? Results from a national study. *Addiction* 102(12):1920–1930, 2007.
- Meier, M.H.; Caspi, A.; Ambler, A.; Harrington, H.L.; Houts, R.; Keefe, R.S.E.; McDonald, K.; Ward, A.; Poulton, R.; and Moffitt, T.E. Persistent cannabis users show neuropsychological decline from childhood to midlife. *Proceedings of the National Academy of Sciences of the United States of America* Oct 2;109(40):E2657–E2664, 2012.
- Mathew, K. J., Regmi, B., & Lama, L. D. (2018). Role of family in addictive disorders. *International Journal of Psychosocial Rehabilitation*, 22(1), 65–75.
- Dennis, M.; Babor, T.F.; Roebuck, C.; and Donaldson, J. Changing the focus: The case for recognizing and treating cannabis use disorders. *Addiction* 97:(s1):4–15, 2002.
- Chan, Y.F.; Dennis, M.L.; and Funk, R.R. Prevalence and comorbidity co-occurrence of major internalizing and externalizing disorders among adolescents and adults presenting to substance abuse treatment. *Journal of Substance Abuse Treatment* 34:14–24, 2008

Other citations on slides

References

- Iversen L. How cannabis works in the brain. In *Marijuana and Madness*. Ed. Castle & Murray, 2004. Oxford University Press.
- Center for Substance Abuse Treatment. Enhancing Motivation for Change in Substance Abuse Treatment. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 1999. (Treatment Improvement Protocol (TIP) Series, No. 35.) Chapter 3—Motivational Interviewing as a Counseling Style. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK64964/>
- Logan DE, Marlatt GA. Harm Reduction Therapy: A Practice-Friendly Review of Research. *Journal of clinical psychology*. 2010;66(2):201-214. doi:10.1002/jclp.20669.
- Weaver, Michael, Hopper; John. Cannabis Conversations. ASAM Annual Conference. April 2022, <https://www.eventscribe.com/2015/APP/PresentationSlides/slideShareV3.asp?sfp=MTAyMDR8MTkwNzk5NHw1NjU1NTU4MHwtMQ=&SlidesID=193616>. PowerPoint Presentation.
- Pham, Victoria; Hurley, Brian. Cannabis: Products, Health Effects, Policies and Clinical Interventions. ASAM Annual Conference. April 2022, <https://www.eventscribe.com/2015/APP/PresentationSlides/slideShareV3.asp?sfp=MTAyMDR8MTkwNzk5MHw1NjU1NTU4MHwtMQ=&SlidesID=208289>. PowerPoint Presentation.
- Stringfield SJ, Torregrossa MM. Disentangling the lasting effects of adolescent cannabinoid exposure. *Prog Neuropsychopharmacol Biol Psychiatry*. 2021 Jan 10;104:110067. doi: 10.1016/j.pnpbbp.2020.110067. Epub 2020 Aug 11. PMID: 32791165.
- Squeglia LM, Jacobus J, Tapert SF. The influence of substance use on adolescent brain development. *Clin EEG Neurosci*. 2009 Jan;40(1):31-8. doi: 10.1177/155005940904000110. PMID: 19278130; PMCID: PMC2827693.
- Zamberletti E, Rubino T. Dos(e)Age: Role of Dose and Age in the Long-Term Effect of Cannabinoids on Cognition. *Molecules*. 2022 Feb 19;27(4):1411. doi: 10.3390/molecules27041411. PMID: 35209200; PMCID: PMC8876668.

Other citations on slides