

Dangers of Youth Cannabis



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Disclosures

I have no financial disclosures

Objectives

- 1 Understand the basics of the endocannabinoid system
- 2 Understand the epidemiology of cannabis use in adolescents
- 3 Understand negative impact on mental health in adolescent youth

Endocannabinoid System

- Brain plasticity
- Learning and memory
- Neuronal development
- Cellular fate
- Nociception
- Inflammation
- Appetite regulation
- Digestion
- Suckling in the newborn
- Metabolism
- Energy balance
- Thermogenesis
- Motility
- Sleep wake
- Regulation of stress and emotions
- Addiction

Aliperti-Garcia et al. Targeting the endocannabinoid system: clinical implications. *Neuropharmacology*. 2017; 148: 103-113

Brain Development 101



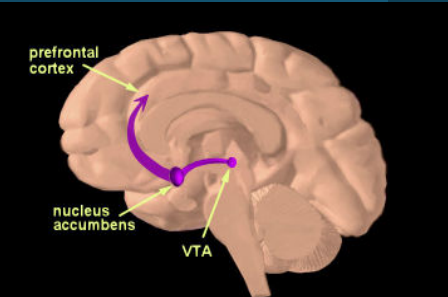
THE BRAIN DOES NOT FULLY DEVELOP UNTIL 22-25



THE BRAIN DEVELOPS FROM THE BACK FORWARD (PFC IS LAST TO DEVELOP)



ADDICTIVE PATHWAYS IMPLEMENTED PRIOR TO FULL DEVELOPMENT REMAIN

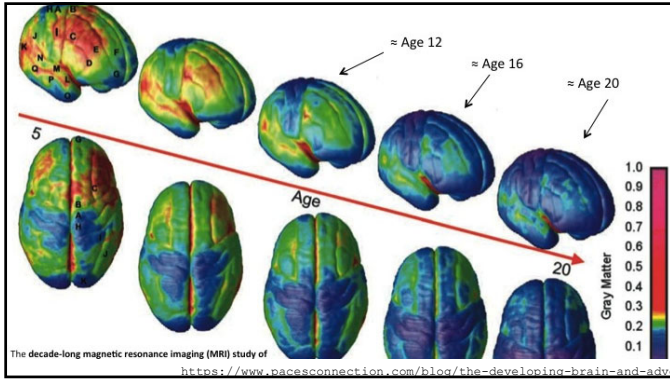


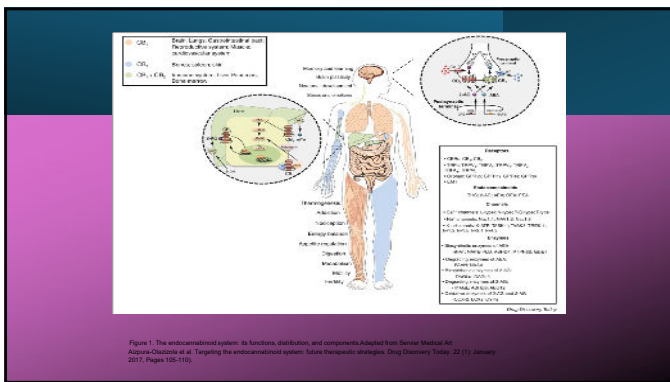
prefrontal cortex

nucleus accumbens

VTA

NIDA NIH www.drugabuse.gov





Cannabinoid Receptors


CB1

- Most implicated in psychoactive properties
- Increase during adolescence
- May play a role in genetic expression of neural development


CB2

- Mostly expressed in immune cells, spleen, GI system (some brain and placenta)


Methods of Use




PIPE



WATER PIPE



CIGARETTE/CIG
AR



INGESTED

Friedell, Cecilia. Neurobiology of Marijuana in the Adolescent.
Psychiatric Publishing Textbook of Substance Abuse Treatment, 5th
edition. 2015. Arlington, VA.

THC

- Cannabis has over 400 chemical components
- Δ -9 Tetrahydrocannabinol (THC) is the principle psychoactive compound
- Acts on the cannabinoid receptor
- Part of the Endocannabinoid receptor system

THC Content

- Advances in cultivation techniques and grower knowledge have produced vastly more potent marijuana
- THC concentration has increased from 0.5% in 1970 to 20.0% in 2018
- CBD concentration has fallen
- The variable chemistry makes it challenging to study
- Much of the research on cannabis studied lower potency MJ and therefore may not be as applicable

Types

Grass	Ganja	Hashish	Extraction (Hash Oil)
<ul style="list-style-type: none"> •Collection of leaves/stems/flowers/seeds •THC content 1-3% 	<ul style="list-style-type: none"> •Refined selection of unfertilized female flowers •THC Content 3-8% 	<ul style="list-style-type: none"> •Collection of resin glands •THC Content 10-15% 	<ul style="list-style-type: none"> •THC Content 30-35%

Fiorelli, Daniela. Neurobiology of Marijuana in The American Psychiatric Publishing Textbook of Substance Abuse Treatment, 4th Edition, 2014, Arlington Va.

CBD

- Cannabidiol is not psychoactively active
- May be responsible for most perceived medical benefits
- Exists in a ratio structure with THC
- 94% of police seizures were completely lacking CBD

Biochemistry of Cannabis

Cannabinoids have been also described as:

- Enhancing dopamine synthesis
- Dopamine release and turnover inhibition of dopamine reuptake in reward-relevant brain loci
- Activating the reward/reinforcement circuits

Green et al. Being stoned: a review of self-reported cannabis effects. Australian Professional Society on Alcohol and Other Drugs. 453-456

Prevalence Among Youth

Age Group	Use Metric	Percentage
12 th Graders	Past year	13.6%
12 th Graders	Past 30 days	6.3%
8 th Graders	Past 30 days	.7%

Johnston, L. D., Meach, R. A., Patrick, M. E., O'Malley, P. M., Schulenberg, J. E., & Bachman, J. G. (2023). Monitoring the Future national survey results on drug use 1975-2022: Overview, key findings on adolescent drug use. Ann Arbor: Institute for Social Research, University of Michigan.

Trends in Youth Cannabis Use

Johnston, L. D., Meach, R. A., Patrick, M. E., O'Malley, P. M., Schulenberg, J. E., & Bachman, J. G. (2023). Monitoring the Future national survey results on drug use 1975-2022: Overview, key findings on adolescent drug use. Ann Arbor: Institute for Social Research, University of Michigan.

Trends in Youth Cannabis Use

Age Group	Use Metric	2021-2022 Change
12 th Graders	Past year	+1.2%
12 th Graders	Past 30 days	+0.6%
8 th Graders	Past 30 days	+0.1%

Johnston, L. D., Meach, R. A., Patrick, M. E., O'Malley, P. M., Schulenberg, J. E., & Bachman, J. G. (2023). Monitoring the Future national survey results on drug use 1975-2022: Overview, key findings on adolescent drug use. Ann Arbor: Institute for Social Research, University of Michigan.

Demographics in Youth Cannabis Use

Demographic	Majority User	Rate(s)
Sex	Female	16.75% vs. 13.83%
Race	Black and Hispanic	17.19% vs. 16.14% vs. 14.60%
Other Substances	30 Day Alcohol or Tobacco use	44.90% vs. 6.48%

Goodwin RD, Silverman KD. Evolving Disparities in Cannabis Use Among Youth by Demographics and Tobacco and Alcohol Use in the U.S.: 2013-2021. Am J Prev Med. 2024 Jun;66(6):1035-1042. doi: 10.1016/j.amepre.2024.01.012. Epub 2024 Jun 24. PMID: 39272242.

Oklahoma Poison Control Information

Year	Age Group	Marijuana Related Calls
2018	0-5 yrs.	13
2022	0-5 yrs.	269

- In 2022, Oklahoma Poison Center helped manage 16 children with seizures

<https://oklahoma.gov/odhhs/about/public-information/press-releases-and-other-news/2023/oklahoma-state-legislature-and-odhhs-focus-on-protecting-child.html>

Child Overdose Data

Year	Age Group	Metric	Rate
2021	1-4 (highest age group)	ED discharge	33.1 children per 100,000
2017 - 2021	1-4 (highest age group)	Hospitalization	6.5 Children per 100,000

<https://oklahoma.gov/odhhs/about/public-information/press-releases-and-other-news/2023/oklahoma-state-legislature-and-odhhs-focus-on-protecting-child.html>

Delta-8-THC

Cannabis compound that produces a high similar to THC

No age restrictions on purchase

Derived from Hemp

Harlow AF, Meech PA, Leventhal AM. Adolescent Δ8-THC and Marijuana Use in the US. JAMA. 2024;331(10):861-865. doi:10.1001/jama.2024.0865


Trends in Delta-8-THC Use Among Youth

Age Group	Use Metric	Percentage
12 th Graders	Past 12 months	11.4%
12 th Graders	10 Times in the Past Month	35.4%

Harlow AF, Meech PA, Leventhal AM. Adolescent Δ8-THC and Marijuana Use in the US. JAMA. 2024;331(10):861-865. doi:10.1001/jama.2024.0865

Effects of Cannabis on Adolescent Brain Development

- Regular use can alter neurodevelopmental trajectories by:
 - Changing neurochemical communication
 - Genetic expression of neural development
- Overall neurotoxic



Jacobus J, Tapert SF. Effects of cannabis on the adolescent brain. Curr Pharm Des. 2014;20(13):2186-93. doi: 10.2174/1381612811319990426. PMID: 23829363; PMCID: PMC3930618.

Effects of Cannabis on Adolescent Brain Development

- Cognition
- Motivation
- Attention
- Memory
- IQ

Cognition

- Chronic heavy cannabis users performed significantly worse on measures of processing speed and memory
- 3 months without regular use performed as well as non-users
- Heavy marijuana users performed worse on perseverative responding and flexible thinking
- Impaired decision making

Jacobus J, Tapert SF. Effects of cannabis on the adolescent brain. Curr Pharm Des. 2014;20(13):2186-93. doi: 10.2174/1381612811319990426. PMID: 23829363; PMCID: PMC3930618.

Attention

- Worse in marijuana users
- While other measures of cognition return to normal with cessation, attention deficits persist
- OR for Difficult Concentration (females, Males): 2.11, 1.33

Jacobus J, Tapert SF. Effects of cannabis on the adolescent brain. Curr Pharm Des. 2014;20(13):2186-93. doi: 10.2174/1381612811319990426. PMID: 23829363; PMCID: PMC3930618.

Memory

Marijuana users report poorer performance on:

- Immediate memory
- Delayed

Prospective memory in undergraduates found no difference in cannabis users

However, cannabis users recalled fewer location-action combinations

Jacobus J, Tapert SF. Effects of cannabis on the adolescent brain. *Curr Pharm Des.* 2014;20(13):2186-93. doi: 10.2174/1569961211131999626. PMID: 23829616. PMCID: PMC3938618.

IQ

Decline in IQ from birth to 38 years in marijuana users

Greater decline in individuals with weekly use before the age of 18

Jacobus J, Tapert SF. Effects of cannabis on the adolescent brain. *Curr Pharm Des.* 2014;20(13):2186-93. doi: 10.2174/1569961211131999626. PMID: 23829616. PMCID: PMC3938618.

Cannabis Use and Adolescent Academic Performance

Adverse Event	Sex	Odds Ratio
One or more days skipping school in past month	Female	2.16
One or more days skipping school in past month	Male	1.59
C+ grade average or lower	Female	1.89
C+ grade average or lower	Male	1.73

Cannabis Use and Adolescent Mental Health

Anxiety

Sleep

Mood

Psychosis

Anxiety

High degree of comorbidity between cannabis use and anxiety disorders

Cannabis use precedes the development of anxiety

Significant relationship between adolescent cannabis users and exacerbation of anxiety symptoms later in life

Low DJR, Sarkou M, George TP. Cannabis use in adolescents and anxiety symptoms and disorders: a systematic review and meta-analysis. Am J Drug Alcohol Abuse. 2024 Mar 3;50(3):150-161. doi: 10.1080/08897260.2023.2239227. Epub 2024 Jan 29. PMID: 38285468.

Sleep

• Marijuana use associated with:

- Sleep duration
- Self reported sleep problems
- Insomnia

Farooq T, Nayak R, Shatkin JP. Exploring Interventions for Sleep Disorders in Adolescent Cannabis Users. Med Sci (Basel). 2018 Feb 8;6(1):111-163. doi: 10.3390/medsci6100111. PMID: 29418734; PMCID: PMC5872168.

Mood Symptoms for Non-Disordered Cannabis Using Adolescents

*metrics worse for CUD

Adverse Event	Sex	Odds Ratio		
Depressive episodes in a year	Female	2.06		
Depressive episodes in a year	Male	1.47		
Recent Suicidal Ideation	Female	2.35		
Recent Suicidal Ideation	Male	1.51		

Psychosis

Strong association of cannabis use and psychosis, including:

- Schizophrenia
- Schizoaffective Disorder

Cannabis and Schizophrenia

- Cannabis precipitates Schizophrenia
- Outside of Schizophrenia, there is an established Cannabis Induced Psychosis
- Dependent on THC content: higher THC, worse psychosis

Risk for Psychosis in Adolescent Cannabis Use

Measure	Adjusted Hazard Ratio (95% CI)
Cannabis Use in past 12 months, age-time < 20 years	11.21 (4.60, 27.33)
Cannabis Use in past 12 months, age-time >	1.29 (.63, 2.64)

Cannabis and Psychosis

Diagnosis	OR
Brief Psychotic Disorder	2.2
Schizophrenia	3.7
Other Non affective Psychosis	2.0

Marquis-Chevalier, et al. Cannabis, schizophrenia and other non-affective psychosis: Results of findings of a population-based cohort. Psychological Medicine 2012; 42: 1027-4

Model #	Model condition	Adjusted hazard ratios for the association between cannabis use (yes v. no) and psychotic disorders conditional on attained age-time	
		aHR	95% CI
12-19 years of age-time			
1	Unadjusted	10.23	4.87 - 21.48
2	Sociodemographic covariates only	9.45	4.50 - 19.85
3	Excluding youth aged 12 to 13 years	16.36	5.92 - 45.17
4	Excluding former cannabis users	12.22	4.67 - 32.58
5	Lifetime cannabis use instead of past 12 m	9.75	4.24 - 22.43
6	Ignoring all lookback exclusions	10.99	4.57 - 24.55
7	3-year follow-up maximum	14.56	5.50 - 38.53
8	Hospitalizations/ED visits only	26.68	7.67 - 92.76
20-33 years of age-time			
1	Unadjusted	1.38	0.76 - 2.51
2	Sociodemographic covariates only	1.31	0.70 - 2.44
3	Excluding youth aged 12 to 13 years	1.29	0.62 - 2.71
4	Excluding former cannabis users	1.25	0.52 - 3.00
5	Lifetime cannabis use instead of past 12 m	1.00	0.47 - 2.14
6	Ignoring all lookback exclusions	1.35	0.69 - 2.67
7	3-year follow-up maximum	0.98	0.22 - 4.42
8	Hospitalizations/ED visits only	1.75	0.56 - 6.42

Age of Onset of Psychosis

- Cannabis vs. No Cannabis:
 - Users 28.2
 - Never Used 31.4
- Age of Use
 - 15 or younger: 26
 - After 15: 29.1
- Earliest onset seen in those using high-potency:
 - 25.2

Source: Schizophrenia Bulletin 2014, 40(3): 1038-17

Cannabis Psychosis

- THC contributes to the development and expression of psychotic illness, especially in vulnerable populations
- Dose-dependent based on systematic review by Zammit et. Al.
- Once a psychotic disorder has developed, THC may make it worse
 - Earlier onset of symptoms, more severe and persistent psychotic symptoms, higher relapse rates and a worse prognosis due to poor treatment adherence
 - Brain volume loss significantly greater in schizophrenics who use MJ
 - May double the risk of developing psychosis (7 in 1,000 to 14 in 1,000)
- However, high CBD cannabis has been associated with fewer psychotic experiences

Conclusion

- Cannabis is being used at its highest point in history
- Cannabis works in many unknown ways in the brain, which is detrimental to adolescent brain development
- Cannabis has detrimental influence on adolescent mental health

Questions?



The contact information is presented in three stacked boxes. The top box contains an email icon and the address Jason.Beaman@okstate.edu. The middle box contains an X icon and the handle [@sanitydoc](#). The bottom box contains the LinkedIn logo and the name [Jason Beaman, D.O., M.S., M.P.H., FAPA](#) with a verified badge.
