Youth Substance Use: Effects on the Developing Teen Brain/Risk Factors

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Youth Substance Use/Abuse: A Pediatric Public Health Issue

□ Half of all lifetime cases of mental and substance use disorders begin by age 14 and three-fourths by age 24.

The first symptoms of most behavioral health disorders typically occur two to four years before diagnosis.

□Substance abuse disorders: Initial symptoms appear around age 14....about 4 years before the symptoms progress to a diagnosable disorder.

□90% of adults with substance use/abuse problems began use before the age of 18.

One of the most preventable brain diseases is substance addiction.











PROTECTING Youth Mental Health

The U.S. Surgeon General's Advisory

Protecting Youth Mental Health: An advisory issued December 7, 2021 by the U.S. Surgeon General, Dr. Vivek Murthy.

- Dr. Murthy called for a whole-of-society effort to mitigate the mental health impacts of the pandemic, to address longstanding challenges, and to prevent future mental health challenges.
- The pandemic confronted children and adolescents with unprecedented challenges and trauma, disrupting major elements of their daily lives. Since the pandemic began, symptoms of stress, anxiety, depression and other mental health concerns have increased among young people.
- During the pandemic, children, adolescents, and adults may have relied on healthy or unhealthy coping mechanisms such as substance use to support strong emotions: stress, uncertainty, anxiety, frustration, anger, fear, and grief.
- Adolescents who struggle with feelings of stress, depression and anxiety can experience uncomfortable emotional states that may make them more vulnerable to substances (alcohol and other drugs) that provide distraction or numbing.

Teen Brain Development: Emotional Disregulation, a Factor in Youth Substance Use.

- Adolescence involves the maturation of self-regulation of emotions and behaviors.
- Two vital areas of the brain control emotional regulation:
 - 1) The amygdala, which is the trigger point of emotion and arousal.
 - 2) The prefrontal cortex, which helps in reasoning, inhibition and decision making.
- Emotion skills, such as the ability to interpret and manage emotions, serve as a protective factor against risk-taking behavior among adolescents.
- Two developmental periods, <u>early childhood</u> and <u>adolescence</u>, where self-regulation skills increase dramatically due to neurobiological changes, are timely opportunities for intervention.



Adolescence is a period of profound brain maturation and a period of opportunities and vulnerabilities.



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Science Behind Teen Brain Development: Insights gained due to brain imaging techniques.





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What was Learned?

Imbalance in Adolescent Brain Development The brain maturation process is not complete until about age 25-30.

<u>Prefrontal cortex</u>, which is underdeveloped, governs:

- ≻Judgment
- ➤Impulse control
- ➢Planning/Organizing
- ➤Goal setting
- Decision making
- Evaluating risks and consequences

Teen brain activity is more pronounced in the <u>amygdala</u> (emotion/reward center). Teens rely more on emotion/reward center of the brain to make decisions.



Adolescent Brain Development: Sensation Seeking

- The brain is made up of nerve cells that send messages to each other by releasing chemicals called neurotransmitters.
- At the onset of puberty, dopamine levels in the prefrontal cortex and the limbic system increase.
- Increases in dopamine have been linked to risk taking and the use of addictive drugs.
- Dopamine is the chemical responsible for motivating our actions and repeating pleasurable experiences. This release can strongly reinforce the act of taking the drug, making the user want to take the drug again and again despite negative consequences.
- Teens who are more highly motivated to seek novel or intense sensations are more likely to initiate alcohol and other drug use.





Substance Use and the Developing Brain

- Alcohol and other drugs (e.g. marijuana and nicotine) increase dopamine levels in the brain.
- As use continues, the brain needs more of the substance to feel its positive effects.
- This effect is known as tolerance. It can be especially dangerous when heroin and cocaine are used.
- Use of substances may compromise an adolescent's mental and emotional development.



Alcohol's Effects on the Teen Brain

- Impairs motor coordination
- Slows reaction time
- Distorts sensory perceptions
- Affects memory, learning, and concentration
- Affects problem solving
- Impairs judgment, leading to risky decision making and behaviors.
- Increases the risk for mental health problems
- Increases risk of addiction: Teens may become alcohol dependent in 6 months to 3 years VS 10-15 year pattern for adults
- Occasional heavy drinking (binge drinking) impacts teen brain health.



Alcohol's Effects on the Teen Brain

- Alcohol interferes with new memories. Teenagers who drink suffer in cognitive performance, especially memory.
- Material for an exam or a list of vocabulary words is more difficult to recall for teens who live under the influence.
- Memory could be affected for up to a month after a binge-drinking episode. MRI's show the hippocampus is smaller in teens who abuse alcohol.



Alcohol Use Can Put Teens at Risk for:

- Unwanted, unplanned, and unprotected sexual activity
- Disruption of normal growth or sexual development
- Delay of puberty and cause slow bone growth
- Impotence in males and complications with hormonal cycles in females.

- Physical and/or sexual violence
- Increased risk of suicide, suicide ideation, and homicide
- Motor vehicle crashes and other unintentional injuries (falls, drowning)
- Alcohol poisoning/death
- Legal problems/arrests
- Misuse of other substances

Marijuana and the Developing Teen Brain



- Average marijuana THC potency was less than 1% in 1972. Today the average THC potency is 15%.
 Marijuana concentrates (e.g. hash oils, waxes and edibles can contain an average of 50% to 90% THC levels.
- Marijuana Can Alter the Brain Structure and Function in Teen and Young Adult Brains. THC stimulates neurons in the reward system to release *dopamine* at levels higher than typically observed in response to natural stimuli contributing to the "high" that users seek.



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Why is the Brain Sensitive to Marijuana?

Marijuana can Bind to the Cannabinoid Receptors, which are Widespread Throughout the Brain and Body

Two main types of cannabinoid receptors:

CB1 receptors are located primarily in the brain, but they also are found in blood vessels and heart cells.

CB2 receptors are primarily located outside of the brain, in the peripheral nervous system and glands.

<u>Marijuana</u> (by binding to cannabinoid receptors) can have a widespread effect on the brain, heart, cardiovascular system, nervous system, reproductive system, and immune system.



Teen Brain Marijuana/Endocannabinoid System

- 1. Marijuana has its strongest longterm impact on young users whose brains are building new connections.
- The endocannabinoid system is important for maintaining brain health and proper development, and THC interferes with its proper functioning!
- 3. Regular marijuana use in adolescence may have lasting effects on impulse control memory, learning, motivation, and IQ.





Marijuana and Teen Health

Vulnerable Nature of Adolescent Neurodevelopment

- Altered brain development
- ➢Risk for addiction
- Hormonal imbalance in males and females: lower testosterone levels in males...Disrupts menses in females.
- ➤Testicular cancer risk
- Oral health or cardiac complications
- Problems with learning, memory, attention
- ➤Impaired judgment
- ➢ Reduced impulse control



- Loss of interest and motivation
- Distorted perceptions
- Impaired motor coordination
- Impaired athletic performance
- ➤Impaired driving
- Mental health risks (psychosis, depression, anxiety, schizophrenia.....)
- Increased risks with co-morbidities: ADHD, learning disability, depression, anxiety, or PTSD.
- ➢ Decrease in IQ points

E-Cigarettes/Toxins

Electronic cigarettes are battery powered devices that people use to heat liquid into a vapor that can be inhaled. They are also called e-cigarettes, e-cigs, or vapes. **The inhaled vapor may contain nicotine (the addictive drug in tobacco), marijuana, flavorings, and toxins including ones that cause cancer.**





Cig-a-Like	Variations	Vape Pens	Mods	Pod-Based
E-cigarettes came onto the market around 2007. Most delivered nicotine and were disposable.	Variations on the first e-cigarettes included products like e-hookah and rechargeable versions.	These have batteries that can reach higher temperatures, have refillable e-liquid cartridges and allow users to control how often they inhale.	Large size modifiable e-cigarettes allow for more aerosol, nicotine and other chemicals to be breathed into the lungs at a faster rate.	These e-cigarettes look like USBs and contain disposable pods with higher amounts of nicotine of than previous generations.

How does Vaping Affect the Developing Teen Brain?



- Most e-cigarettes contain nicotine, which is highly addictive and can harm adolescent brain development.
- Using nicotine during adolescence can harm parts of the brain that control attention, learning, mood, and impulse control.
- Each time a new memory is created or a new skill is learned, stronger connections or synapses are built between brain cells. Nicotine changes the way these synapse/connections are formed.
- As with most addictive substances, nicotine activates the brain's reward circuits and also increases levels of dopamine in the brain, which reinforces rewarding behaviors. Pleasure caused by nicotine's interaction with the reward circuit motivates people to use nicotine again and again, despite risks to their health.
- Nicotine may increase the risk for future addiction to other drugs.
- Studies show that youth who use e-cigarettes are more likely to start smoking cigarettes and other smokable tobacco product within the next year.





Teen prescription drug misuse can start with sports injuries, surgery, or dental work.

Many teens believe prescription drugs are not as dangerous as illegal drugs.

Approximately 1 out of every 5 teens has taken prescription drugs not prescribed for them.

This trend spans across geographic, racial, ethnic and socioeconomic populations.

Opioids Affect the Brain and the Body



Opioids act/inhibit pain by attaching to and activating **opioid** receptor proteins, which are found on nerve cells in the:

brain,

brain stem,

spinal cord,

gastrointestinal tract, and other organs in the body.

Opioid Addiction

- Opioids increase the amount of dopamine, a neurotransmitter, in a part of the brain called the limbic reward system.
- Dopamine causes intense feelings of pleasure, which drives users to seek out the drug again and again, despite harmful consequences.



Why Young People May Abuse Opioids

- They may be prescribed medications for pain and begin to misuse their medication.
- As tolerance to pain pills begin to increase, they dose on their own to increase the effect.
- They use to cope with emotional stress or pain (to self-medicate their anxiety and depression).
- They experiment with opioids as a way to get high.

Taking too many prescription opioids can stop a person's breathing leading to death.

Adolescent Substance Use: Risk Factors

SELF

Genetics
Temperament
Adverse Childhood
Experiences (ACEs)
Approval of use
Lack of perception of harm

PEERS

Peers who useApproval of use by peersLack of perception of harm

SCHOOL

Lack of school connectedness

- □ Inconsistent enforcement of policies
- ☐ Mixed messages, unclear rules, and expectations

Times of transition

FAMILY

Substance abusing family member

Approval of useLack of perception of harmAvailability/Access

COMMUNITY/SOCIETY
Social Norms
Availability/Access
Lack of perception of harm
Mixed messages
Media

ABCD STUDY



Adolescent Brain Cognitive Development

- The largest long-term study of brain development and child health was launched in 2015.
- The next phase of the ABCD Study, which began in 2020, will delve into the effects of substance use, as well as environmental, social, genetic, and other biological factors on the developing adolescent brain.

THANK YOU! Dr. Loretta C. Novince lorettanovincephd@gmail.com

SOURCES:

- □National Institute on Drug Abuse
- □National Institutes of Health
- U.S. Department of Health and Human Services
- Center for Disease Control and Prevention (CDC)
- □Substance Abuse and Mental Health Services Administration (SAMHSA)

Be Part of the Solution Send Clear Messages Youth Drinking & Drug Use are

> Unsafe Unhealthy Illegal



"Uniting the Community to Promote Positive Choices" www.lcahealthyyouth.com