

Why is the Adolescent Brain More Likely to Experience Addiction Than Adults? A Comprehensive Review of Psychological, Social, and Biological Factors.

Abstract

Substance use disorders within adolescence remain prevalent in our society, as the developing brain of youth is especially vulnerable to addiction. This paper examines studies that investigate factors associated with addiction and adolescent substance use disorders. The pieces of literature synthesize topics of brain development, social media-related evidence, and, ultimately, drug exposure. These studies reveal a consistent theme of brain development and the importance of prevention in early years to avoid addiction later in life. There is a primary focus on brain development that covers dopamine pathways, impulse control, and the developing prefrontal cortex. Additionally, psychological, social, and environmental factors reveal stress-related anxiety, peer influence, and the environment. Overall, evidence surrounding early exposure to substance use indicates that addiction in youth is a comprehensive development that consists of multiple causes and requires prevention along with treatment.

Introduction

Addiction within adolescence is influenced by many more significant factors than solely experimentation alone. According to research, addiction develops through a combination of psychological, social, and environmental factors, making teenage years especially vulnerable to the risk of dependence on substances (Gray and Squeglia). This literature review examines the question of why the adolescent brain is more vulnerable to addiction than adults and analyzes current research while emphasizing the importance of early prevention.

A total of 15 articles were selected to identify the biological, psychological, and environmental factors that shape the development of addiction. These articles were primarily found through PubMed, NIDA, and APA PsycNet. Specific keywords such as “adolescent substance use disorder,” “substance use risk factor,” and “adolescent brain development” were used to find relevant research that highlights the complex evolution of addiction within youth. Studies including peer-reviewed journal articles, meta-analyses, and original research made up the inclusion criteria to focus on the main causes of substance use disorders. The focus was to form a deep understanding of the factors that increase vulnerability in adolescent brain development toward addiction compared to the adult brain.

Methods/Discussion

Addiction is defined as a chronic medical condition involving a compulsive need to use substances or engage in behaviors despite harmful consequences. Consequences caused by addiction that invade daily life include significant changes in how the brain works and a loss of control. The developmental disorder of addiction is a result of brain development, genetics, and environmental or social circumstances. In adolescence, teenage brains are actively developing and lack the skills needed to regulate their impulses and make healthy decisions. The early start of substance abuse in an individual's life can lead to further addiction later in life and pose the risk of long-term health consequences (National Institute on Drug Abuse). Addiction typically develops over time, which brings up the significance of early prevention. In the critical time period of adolescence, identifying signs of unhealthy habits toward substances and shifting to healthy coping mechanisms can reduce the chances of long-term addiction.

Microglia make up about 10% of all brain cells and serve as the immune cells of the nervous system. They protect the brain from infections or injury, remove damage and harmful substances, and are activated when substance use is present, causing damage to the brain. The brain accumulates inflammation from repeated drug use and the constant activation of microglia. With a large amount of distress within microglia, normal communication of brain cells can be disrupted and lead to greater consequences such as problems with learning, memory, and addictive behaviors. Microglia have an important role in the development of addiction through their response to substance abuse and the effects on brain circuit function. The active brain development during adolescence sets up a system of imbalance within self-control systems and opposing reward systems. Since the prefrontal cortex is still developing during this time, teenagers possess an increased risk of impulsivity and the engagement of risky behaviors. Impulse control, decision making, and judgement are all aspects that the prefrontal cortex is in charge of. The opposing timings of development with these two systems can lead to adolescents prioritizing immediate rewards over future consequences (Martinez and Mahler).

Cannabis and E-cigarettes are two main causes of substance use disorders among adolescents. With the widespread usage of social media among youth, content reflects drug use, creates exposure, and influences viewers to use substances. Cannabis especially changes the dynamics behind developing brains and is associated with negative effects on reward systems. During development, peer influence is additionally prevalent because social acceptance is a large component of adolescence. The endocannabinoid system contributes to brain development and focuses on overall neural communication. Cannabis affects this system by interacting with cannabinoid receptors and the main areas, including memory, learning, and reward processing.

Adolescent cannabis usage disrupts developmental factors such as cognitive function, decision-making, and attention span (Vassey et al.).

The human brain contains neural circuits that control behavior that shift when substance use is consistent. These circuits become damaged, leading to worse memory, decision making, and self control. Addiction shifts communication within the neurons by changing neural circuits in the form of reward and impulse control. Individuals that contain substance use disorders typically struggle with self-control and working memory as a result of shifts in the prefrontal cortex and neural circuits. Substance use ultimately leads to an increase in the amount of dopamine release, which makes substances feel more rewarding and reinforces future use. Alterations within aspects of the brain can pose a risk to becoming less responsive to other activities that offer natural dopamine, such as social interactions or hobbies (Chambers et al.).

Environmental factors can activate changes in circuits and trigger cravings for substances or possible relapses. Addiction develops through different interactions within environmental, genetic, and social situations. A stressful environment increases the chances of substance abuse; in contrast, easy access to substances similarly increases the opportunities available for use.

Substance abuse exposure in homes additionally normalizes usage since adolescents tend to view drug use as normal behavior. Adolescents often use their parents as an example for behavior, meaning that they may be more likely to experiment with substances after seeing it in their own household. Early exposure can lead to an increased risk of addiction by diminishing the perceived risks of drugs and alcohol. Environmental factors and a family history of drug usage can combine to ultimately increase the overall risk of addiction for adolescents (National Institute on Drug Abuse).

Peer influence is the strongest during teenage years because the feeling of social belonging becomes especially important, leading many adolescents to prioritize social acceptance over long-term consequences. Individuals who are deemed more popular in social settings show stronger connections to substance use, influencing others to use drugs. In the teenage years, peer acceptance is a strong motivator, and adolescents tend to mimic the behavior seen by others (Song et al.). The perspective held by many adolescents of “everyone is doing it” leads to experimentation and possible development of substance use disorders. On the other hand, positive peer relationships that include unconditional support along with healthy hobbies serve as a protective factor against addictive behaviors by providing healthy coping mechanisms and reducing exposure to substance use within peers.

Young adults with dependence on cigarettes and high levels of stress had poor memory compared to individuals with no dependence. Chronic stress can harm normal attention span, learning, and memory, while also serving as a risk factor to dependence on substances. Impairment of cognitive abilities as a result of chronic stress can lead to difficulties in everyday learning and set up a dangerous cycle of dependency on substances to cope with anxiety. Social isolation is a risk factor for developing addiction by increasing levels of stress while limiting the availability of emotional support (Volkow). Impairment on memory affects more than solely retaining information; individuals may notice a negative effect on relationships, school, work, and overall mental health.

A common misconception associated with addiction is the belief that dependence comes from a lack of willpower. Addiction is a complex disorder that results from a combination of genetics, behavior, environment, mental health, and social situations. Substance use disorders develop over

time by repeated use of a drug that ultimately changes brain function while impairing behavior and decision-making. Genetic factors can increase risk of addiction regardless of age by altering how the brain responds to certain experiences of exposure to substances (National Institute on Drug Abuse). Adolescents who possess genetic dependency on substances, grow up in an environment where drugs are prevalent, and struggle with chronic stress or poor mental health are at a greater risk of developing addiction, as these factors work together to increase vulnerability to drugs.

The beginning of adolescence is a time period where individuals are at risk for developing long-term substance use disorders as a result of an immature prefrontal cortex and vulnerability. When the brain is undergoing major events of biological growth, individuals are more sensitive to cannabis, nicotine, and alcohol. Alcohol exposure can impair growing aspects of the brain that are responsible for learning and retaining information by disrupting the natural communication within neural connections. The neural systems that control overall judgement are actively maturing within adolescence, increasing the vulnerability to consistent usage of drugs or alcohol. The exposure to alcohol furthermore alters brain chemistry by damaging reward systems and risking future potential use. Prevention is especially significant during teenage years since it allows for early intervention before substance use takes over main aspects of an individual's life (Moss et al.).

Results and Synthesis

Research strongly suggests that early exposure to drugs while the brain is still developing increases the risk of later addiction in an individual's life, and repeated exposure can further lead to damaged neural circuits along with impaired decision-making. Adolescence is a significantly

vulnerable time for developing the start of a substance use disorder due to the fact that the prefrontal cortex is immature, leading to a sensitive reward system and underdeveloped impulse control. A combination of environmental, genetic, and social factors works together to form addiction by impairing an individual's brain function and natural response to substance exposure.

While it remains difficult to fully comprehend the amount each factor contributes to addiction risk, research suggests that addiction is a multifactorial disorder caused by psychological, biological, and social factors. Addiction should not be viewed as having one simple cause; similarly, treatment should address multiple different factors. To understand the complexity of substance use disorders, more research following adolescents into adulthood should be conducted to better examine the effects of early exposure to drugs. Additionally, with the constant surge in social media among youth, researchers should continue viewing the risk factors that determine how digital platforms can undermine possible risks and increase substance use among adolescents.

Conclusion

Brain development and environmental factors interact together by affecting how individuals respond to substance exposure and increasing the risk of addiction. The time period of adolescence allows for vulnerable changes in the brain, which can reinforce future drug use along with long-term changes within brain function. Because of the vulnerability during adolescence, reducing early substance use may decrease the risk of developing long-term dependency or addiction. To continue understanding vulnerability within the time period of adolescence relating to the development of addiction, continued research is essential.

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