



National Institute on Alcohol
Abuse and Alcoholism

Alcohol and the Adolescent Brain



As adolescents mature, they undergo complex developmental changes, especially in their brains. The widespread changes in the organization and functioning of the brain—which continue into a person’s mid-20s—bring about the cognitive, emotional, and social skills necessary for adolescents to survive and thrive. The nature of these rapid changes may also increase the adolescent brain’s vulnerability to alcohol exposure.

Patterns of Adolescent Drinking

People often begin to drink alcohol and use other substances during adolescence. And although adolescents tend to drink alcohol less often than adults, they tend to drink more when they do drink. See [Facts and Statistics on Underage Drinking](#) for more information.

Relationship Among Adolescent Risk-Taking, Brain Plasticity, and Drinking

Adolescents are motivated to explore and take risks. These learning experiences, complemented by the adolescent brain’s increased ability to readily change in response to experiences (also known as *brain plasticity*), are key to developing the skills and knowledge to become independent. Although this increase in brain plasticity and risk-taking can provide incredible opportunities for learning and personal growth, it also makes adolescents more vulnerable to both the short-term and long-term negative effects of alcohol.¹

For example, a sizable body of research links the early initiation of alcohol use to unsafe alcohol-related behaviors.¹ In general, [underage drinking](#) can lead adolescents to make poor decisions and engage in potentially harmful behavior (e.g., drinking and driving, unsafe sexual behavior, and other substance use) that can result in a range of negative consequences, such as injuries, sexual assaults, and even death.

Drinking Levels Defined

Binge Drinking: The National Institute on Alcohol Abuse and Alcoholism (NIAAA) defines binge drinking as a pattern of drinking alcohol that brings blood alcohol concentration (BAC) to 0.08%—or 0.08 grams of alcohol per deciliter—or higher. For a typical adult, this pattern corresponds to consuming five or more drinks (male), or four or more drinks (female), in about two hours. However, research shows that fewer drinks in the same time frame are necessary to reach the same BAC in adolescents (compared to adults): only three drinks for adolescent females and three to five drinks for adolescent males, depending on their age and size.⁸ In the United States, a "standard drink" is defined as any beverage containing 0.6 fl oz or 14 grams of pure alcohol.

Heavy Drinking: NIAAA defines heavy drinking for men as five or more drinks on any day or 15 or more in a week and for women four or more drinks a day or eight or more per week.

Research suggests that the patterns in adolescent brain development may increase the likelihood of adolescents engaging in unsafe behaviors such as alcohol use.¹ For example, the systems of the brain that respond to rewards and stressors are very active in adolescence.

Meanwhile, the areas of the brain involved in planning and decision-making (the prefrontal cortex) are the last areas to mature, typically at least into the mid-20s.²

Scientists have found that alcohol causes less sedation (sleepiness) and smaller impairments in balance and muscle coordination in adolescent rodents than adult rodents.¹ If this research holds true for humans, it could put adolescents at even greater risk of harm from alcohol by allowing them to continue drinking and reach higher blood alcohol levels despite impairments in decision-making and impulse control.

Link Between Childhood Trauma and Later Alcohol Misuse

Research suggests that youth who have experienced childhood trauma may have disrupted growth in brain regions, and patterns of connections between brain regions, that may make them more likely to engage in binge drinking during adolescence.^{8,13}

Immediate Effects of Alcohol on the Brain and Behavior

In adults, drinking alcohol impairs decision-making and impulse control, and can lead to a range of negative consequences. For adolescents, drinking alcohol can make it even more difficult to control impulses and make healthy choices. In both adolescents and adults, drinking also compromises the ability to sense danger by disrupting the function of a brain region called the amygdala. Alcohol often produces rewarding feelings such as euphoria or pleasure that trick the brain into thinking the decision to drink alcohol was a positive one and that motivate drinking again in the future.

If a person drinks enough, particularly if they do so quickly, alcohol can produce a blackout. Alcohol-induced blackouts are gaps in a person's memory for events that occurred while they were intoxicated. These gaps happen because alcohol temporarily blocks the transfer of memories from short-term to long-term storage—a process known as memory consolidation—in a brain area called the hippocampus.

Alcohol-related blackouts are quite common among adolescents. In one study, one in five older adolescents who ever drank alcohol reported an alcohol-induced blackout in the previous six months.³

Even a small amount of alcohol can cause subtle memory impairment while a person is drinking. The more alcohol a person consumes, the more significant the memory impairment.⁴

Longer-Term Effects of Alcohol on the Brain and Behavior

In some people, a history of adolescent alcohol use could increase a person's likelihood of developing alcohol use disorder and is associated with mental health disorders such as anxiety and depression during adolescence and later in life.^{5,6,7}

More and more research suggests that drinking alcohol in adolescence may have significant effects on brain function. The earlier people start drinking alcohol, the more likely they are to experience a measurable impact on cognitive functions, memory, and school performance over time—perhaps even into adulthood.^{8,9}

Alcohol misuse during adolescence—generally measured by a history of binge drinking or alcohol use disorder diagnosis—has been linked to changes within and between brain regions.¹⁰ For example, researchers have found reductions in the size of the frontal lobe (involved in planning and decision-making), hippocampus (involved in learning and memory), amygdala (involved in fear-sensing), and corpus callosum (involved in the communication between the two sides of the brain).^{8,11} Researchers have also found that heavy drinking changes the normal developmental patterns in the connections between and within brain regions, and weakens connections between brain areas that regulate emotional and cognitive functioning.^{2,11}

The good news is that the special ability of the brain to change with experience during adolescence seems to also lend itself to recovery from some alcohol-induced changes.²

What Can We Do?

The more we know about how alcohol affects the adolescent brain, the more we can inform the conversations about alcohol that we have with teens.

Parents and teachers play a major role in the way adolescents think about alcohol. Research demonstrates, for example, that children whose parents allow them to drink are more likely to quickly transition from their first drink to unhealthy patterns of drinking such as binge drinking.¹²

Through regular conversations about alcohol and by parents being a positive role model with their own drinking, parents can shape kids' attitudes about alcohol and set them up to make healthy choices.

For more information on alcohol and the brain, visit the [Alcohol and the Brain topic page](#).

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