

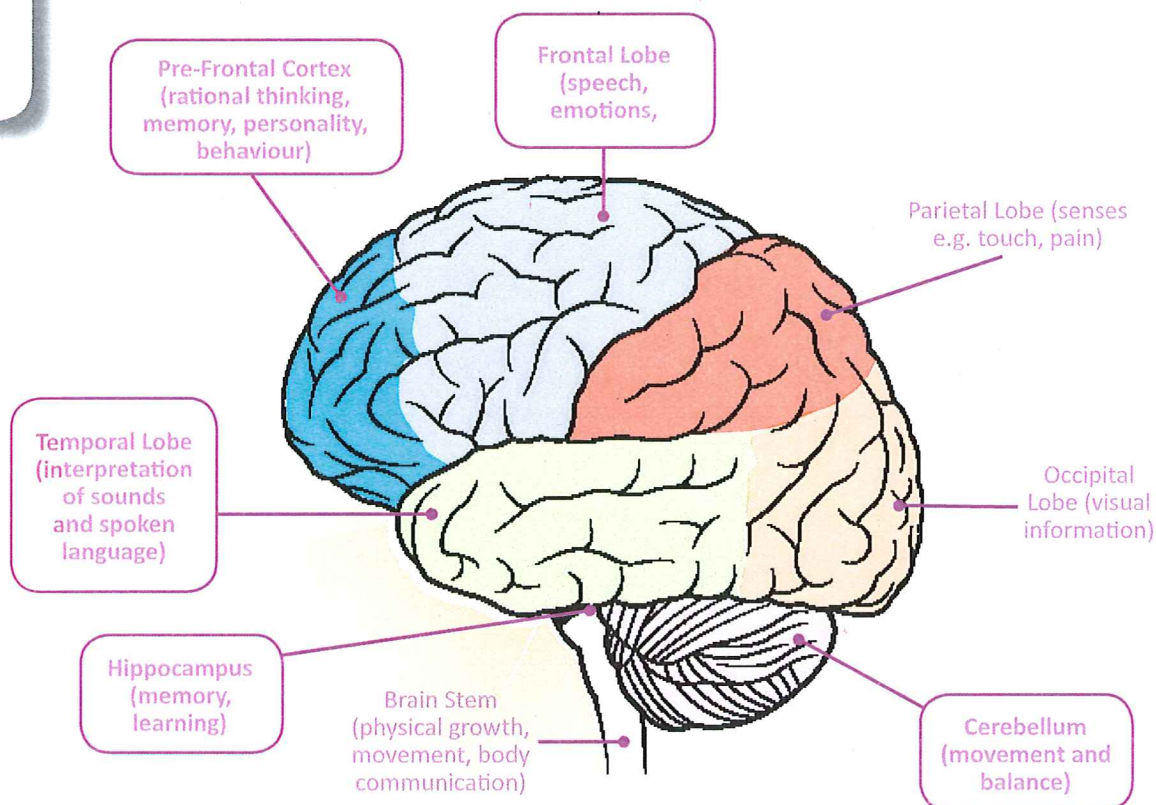
# ALCOHOL AND ADOLESCENT DEVELOPMENT

This fact sheet explains how alcohol can affect brain development during the teenage years...

## Did you know?

- Drinking in adolescence can be harmful to young people's physical development, particularly brain development. Adolescence is a critical period in a young person's development towards adulthood. What they learn during their teenage years, and how they learn it, can set the young person's path for later life. Alcohol consumption during this time can bring about learning difficulties, memory problems and other problems later in life.

## Areas of the brain and functions affected by alcohol



During adolescence the brain undergoes a lot of changes. As it is still developing, it is more sensitive to alcohol (sections affected are highlighted in boxes).

Areas of the brain that may be particularly vulnerable to alcohol's effects are the frontal and temporal lobes, pre-frontal cortex, cerebellum and hippocampus. The hippocampus, which lies deep within the cerebral hemispheres, plays an important role in learning and memory formation. Heavy drinking during adolescence can lead to reduced hippocampal volume and memory and learning difficulties.



## Key facts

The changes that occur to the brain during the teenage years make young people more vulnerable to drug dependence.

**People who first use alcohol before age 15 are five times more likely to abuse alcohol than those who first use alcohol at age 21 or older.** This increased use leads to a greater chance of alcohol-related problems in later life, including becoming dependent on alcohol (addiction).

- › Different parts of the brain develop at different rates as we grow, and depending on whether we are male or female. One example is the pre-frontal cortex, which houses the part of the brain that controls rational thinking. This part of the brain does not begin to mature until age 19 and only fully matures by around age 21 in women and age 28 in men. So damage to the pre-frontal cortex during its development can have life-long consequences for the young person's memory, personality and behaviour.
- › Drinking alcohol during the teenage years can cause permanent brain damage. Damage to the brain could be responsible for memory problems, inability to learn, problems with verbal skills, alcohol dependence and depression.
- › Alcohol can affect a teenager's social development if they start drinking at an early age. They may spend their time drinking instead of participating in sports or other recreational activities. They may turn to alcohol as a form

of coping with problems and be more open to using other substances. The learning difficulties caused by teenage drinking can result in poor school performance and an increased risk of social problems, depression, suicidal thoughts and violence.

- › Research shows that a hangover can be just as damaging to the brain as heavy drinking by reducing a person's ability to learn new information and recall memories.

## Special considerations and tips

- › For health reasons, recent research suggests that young people under 18 years of age should avoid alcohol.
- › There are both short-term and long-term risks associated with teenage drinking. Make sure you understand these, and keep yourself informed.
- › Talk to your teenager about alcohol. Explain the risks and the harms associated with drinking at a young age. Be firm, confident, clear and consistent.
- › Keep the lines of communication open, so your teenager can feel comfortable talking to you about the things that concern him or her.
- › Remember, you are not alone. Other parents of teenagers are most likely facing the same issues. Share your concerns as well as what has worked for you when dealing with teenagers and alcohol. Seek professional help if you need it.

## Further information/Where to get help

- › For further information on the short-term and long-term effects of alcohol on teenagers, go to [www.druginfo.adf.org.au](http://www.druginfo.adf.org.au).
- › To find out about the Australian Alcohol Guidelines for low-risk drinking, see [Fact Sheet 3: Standard drinks and low-risk drinking](#).
- › For tips on communicating with your teenager about alcohol, see [Fact sheet 7: Teenage drinking: Parents' communication style can make a difference](#).
- › Directline 24-hour seven day counselling referral services [1800 888 236](tel:1800888236)
- › Department of Health, Better Health Channel has a list of health services in your area, see: [www.betterhealth.vic.gov.au/bhcv2/bhcsite.nsf/pages/service\\_directory?opendocument](http://www.betterhealth.vic.gov.au/bhcv2/bhcsite.nsf/pages/service_directory?opendocument)



# ScienceNewsforStudents

BEHAVIOR BODY FUNCTIONS TOXICOLOGY

## Alcohol can rewire the teenage brain

Binge drinking may harm a teen's brain now — and forever — a mouse study suggests

BY [TARA HAELE](#) OCT 5, 2015 — 7:00 AM EST



Warning: Binge drinking can change the brain in ways that make it more difficult to have self-control and not drink later.

Sheila Dee/ Flickr (CC BY-NC-ND 2.0)

Alcohol is a drug. And every day, more than 4,750 American kids aged 15 and younger take their first full drink of this drug. That's according to the U.S. Substance Abuse and Mental Health Services Administration, or SAMHSA. And the problem is not just that this consumption is illegal. Kids who start drinking before age 15 also are five times more likely to become alcoholics or abuse alcohol than are people who wait until adulthood for their first sip. Another big problem for kids who experiment with this drug is that they are more likely than adults are to consume too much alcohol over a short period of time. This is known as *binge drinking*.

What few people realize is that binge drinking poses many risks that go well beyond getting drunk and acting irresponsibly. That's why an organization of doctors has just issued a new report laying out those risks. It appeared in the August 30 issue of *Pediatrics*.

Lorena Siqueira is a pediatrician at Florida International University and Nicklaus Children's Hospital in Miami. She studies teen alcohol use and helped write the new *Pediatrics* report. "When kids



drink, they tend to do heavy drinking," she notes. Unfortunately, she adds, "Their bodies are not ready to handle that kind of alcohol."

## Teens are most likely to binge drink

Some teens drink because they have low self-esteem or think it will make them feel happier, the new *Pediatrics* report states. Others are impulsive. They are looking for new experiences. Teens also drink when many of their friends do.

Underage drinking accounts for 11 percent of all the alcohol consumed in the United States, SAMHSA notes. More than one in five kids 12 and younger has consumed alcohol. By high school, two out of three teens has, a new study reports. The problem: Many teens don't stop at a few sips. They binge.

In adults, binge drinking means downing at least four drinks in a row, if you're a woman — five in a row if you're a man. A drink is one beer, one glass of wine or one shot of hard liquor. For adolescents, it takes less alcohol to constitute a binge. Downing just three drinks in a row is bingeing for boys 9 to 13 or for any girl under 17. Among boys 14 to 15, it's four drinks.

More adults drink alcohol than teens do. But among drinkers, teens are more likely than adults to binge, Siqueira notes. Some 28 to 60 percent of teens who drink report binge drinking, she says. Indeed, 9 out of 10 drinks downed by those under age 21 are in a binge-drinking episode, according to the U.S. Centers for Disease Control and Prevention, or CDC.

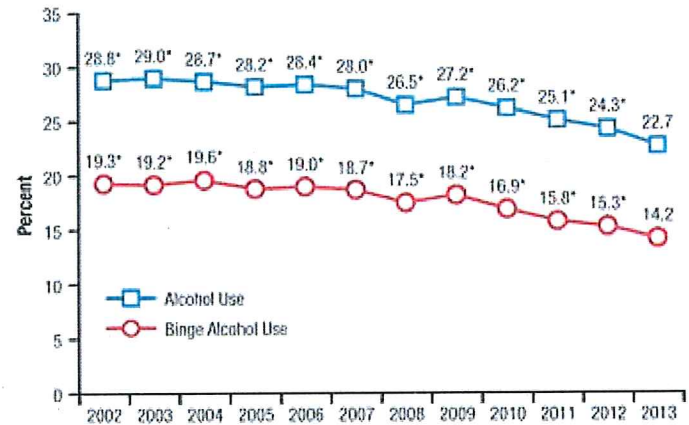
Teens often start drinking because they are curious and experimenting, Siqueira says. But they tend to drink quickly, "so they take in more than they realize," she says. Not surprisingly, they can get dangerously drunk very fast.

Plus, "the younger they start, the more likely they are to continue to drink and to drink larger amounts," Siqueira says. That occurs even though alcohol has a stronger effect in adolescents than it does in adults. The really sad outcome: Teens who binge drink are more likely to become alcoholics, she reports.

## Binge drinking is dangerous

"We live in a world where many adults and some teenagers drink alcohol," says Vivian Faden. She's a scientist at the National Institute on Alcohol Abuse and Alcoholism, or NIAAA, in Rockville, Md. "So it is normal to be curious about alcohol," she concedes. But there are good reasons why it makes sense to hold off drinking alcohol "until the teenage years are over," she says.

Binge drinking leads people to get very drunk. Normally, the liver helps remove alcohol from the blood. But when the liver cannot keep up, the alcohol then circulates through the bloodstream and brain while waiting to be removed by the liver. This is when a person becomes drunk, a condition known as *intoxication*. About half of high school seniors have been drunk at least once, according to recent research. Some 10 percent of eighth graders have too.



Just released graph shows alcohol use — and binge drinking — in the United States during the previous month by people under the legal drinking age of 21.

SAMHSA

"When you binge drink, you can get into all kinds of trouble," Siqueira says. Big trouble.

For one, auto accidents. One in every 5 teen drivers involved in fatal car crashes has alcohol in their bloodstream, according to the CDC. More than 80 percent have blood-alcohol levels above the legal limit for adults. But a teen doesn't have to be behind the wheel for alcohol to pose a grave risk. Teens can get depressed and injure themselves or hurt someone else. They might have sex when they didn't mean to. A teen might black out, forgetting what happened when he or she was drunk. Some teens drink so much that alcohol poisoning stops them from breathing.

The risks of teen drinking are so high, Siqueira says, that even a single episode may prove to be one too many.

### **Long-term effects on the brain**

People forget what happens when they are drunk because alcohol makes it harder for the brain to turn short-term memories into long-term ones. But for teens, alcohol's dangers go well beyond impairing memory. A new rodent study finds that alcohol can lead to long-term — and harmful — changes to the brain.

"We used to think that brain development was done by the time you're a teenager," Siqueira says. "Now we know that's not true." The brain keeps developing into a person's 20s and even early 30s, she explains.

In the new study, scientists gave 10 doses of alcohol to adolescent rats over 16 days. The amounts led to blood-alcohol levels that might model a binge-drinking teen. After these exposures, the rats never tasted alcohol again. Later, in adulthood, the scientists attached electrical equipment to a part of each animal's brain. Called the *hippocampus*, this region controls memory and learning.

Nerve cells in that part of the brain communicated abnormally, the scientists found. The cells also looked more immature than usual. Branches coming off of nerve cells should look like short mushrooms. Instead, here they looked long and thin. Again, this damage showed up in that part of the brain linked with learning and memory.

"For humans, this means binge drinking during adolescence may permanently change brain functioning," says the NIAAA's Faden. What's more, she adds, these changes "appear to be irreversible."

Mary-Louise Risher of Duke University in Durham, N.C., led that new rodent study. Her team published it in the June issue of *Alcoholism: Clinical and Experimental Research*.

Other research has shown that teens who drink heavily lose more white matter in their brain over time than do teens who don't, Faden says. White matter acts a bit like the brain's superhighway system. It connects areas of the brain's so-called gray matter, which processes information. The white matter allows messages to shuttle quickly, even over relatively long distances in the brain. Alcohol also can hurt a portion of gray matter in a region known as the *prefrontal cortex*, Faden says. This area is used for attention, concentration, self-control and making decisions.

Those kinds of skills work together to create what brain scientists refer to as *executive function*. Poor executive function makes it harder for individuals to control their behavior. And it makes it more difficult for them to stop doing something that know could hurt them. A person with poor executive function may be less likely to turn down the chance to drink alcohol or may get behind the wheel of a car when it would be dangerous to drive.



As alcohol makes a teen less likely to turn down alcohol, the risk of bingeing grows. This drinking can create a cycle of inappropriate behavior. Worst of all, this cycle may lead to alcoholism in some teens, Faden notes.

The bottom line, she says: When it comes to the developing adolescent brain, "There is no known safe level of binge drinking."

### Power Words

(for more about Power Words, click [here \(https://student.societyforscience.org/power-words-aid-stem-literacy\)](https://student.societyforscience.org/power-words-aid-stem-literacy))

**addiction** The uncontrolled use of a habit-forming drug or uncontrolled and unhealthy habit (such as video game playing or phone texting). It results from an illness triggered by brain changes that occur after using some drugs or engaging in some extremely pleasurable activities. People with an addiction will feel a compelling need to use a drug (which can be alcohol, the nicotine in tobacco, a prescription drug or an illegal chemical such as cocaine or heroin), even when the user knows that doing so risks severe health or legal consequences. (For instance, even though 35 million Americans try to quit smoking each year, fewer than 15 out of 100 succeed. Most begin smoking again within a week, according to the National Institute on Drug Abuse.)

**adolescence** A transitional stage of physical and psychological development that begins at the onset of puberty, typically between the ages of 11 and 13, and ends with adulthood.

**alcohol poisoning** A serious and potentially deadly condition that occurs when someone drinks a very large amount of alcohol in a short time period. The alcohol can reduce a person's body temperature. It also can slow a person's heart rate and breathing until one or both stop. Symptoms include confusion, vomiting, seizures, slow or irregular breathing, pale or blue-colored skin, low body temperature and not being able to wake up.

**binge drinking** To consume a dangerous amount of alcohol in a short period of time. At a minimum, this would be five servings by an adult within a single day, usually within a short period of time. For teens, it could take far less alcohol to constitute bingeing.

**development** (in biology) The growth of an organism from conception through adulthood, often undergoing changes in chemistry, size and sometimes even shape.

**electrode** (in brain science) Sensors that can pick up electrical activity. (in chemistry) Materials that serve as an anode or cathode, attracting negatively or positively charged particles. Or things that serve as electric conductors through which current leaves or enters something else.

**executive function** The term that includes all of the brain functions needed for self-regulation, self-control and problem-solving. Executive function requires good working memory to hold several pieces of information in the brain at once. It also includes multi-tasking, prioritizing, reasoning, focus, concentration, goal setting and controlling impulses.

**hippocampus** A seahorse-shaped region of the brain. It is thought to be the center of emotion, memory and the involuntary nervous system.

**intoxicating** An adjective to describe something that can cause a sensory high (such as alcohol or certain other drugs) — or an event or condition that can also cause an extremely pleasurable sensation. The "drug" that does this is known as an **intoxicant**.

**long-term memory** The brain's system for storing, maintaining and recalling information from the past.

**neuron or nerve cell** Any of the impulse-conducting cells that make up the brain, spinal column and nervous system. These specialized cells transmit information to other neurons in the form of electrical signals.

**prefrontal cortex** A region containing some of the brain's gray matter. Located behind the forehead, it plays a role in making decisions and other complex mental activities, in emotions and in behaviors.

**self esteem** How a person collectively views one's abilities, attractiveness and overall self-worth.

**short-term memory** (also known as primary memory) The small amount of memory held actively in the mind for a short period of time, such as the series of digits in a telephone number.

**white matter** One of the two main tissue types found in the brain and spinal cord. It consists mainly of bundles of nerve fibers.

## Readability Score:

7.0

## Further Reading

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Learn more about the risks of underage drinking from the National Institute of Health [here](http://www.niaaa.nih.gov/alcohol-health/special-populations-co-occurring-disorders/underage-drinking) (<http://www.niaaa.nih.gov/alcohol-health/special-populations-co-occurring-disorders/underage-drinking>).

**Original Journal Source:** L. Siqueira et al. "[Binge drinking](http://pediatrics.aappublications.org/content/136/3/e718) (<http://pediatrics.aappublications.org/content/136/3/e718>).  
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**Original Report Source:** L.D. Johnston et al. "Monitoring the Future: National survey results on drug use, 1975-2014: [2014 overview, key findings on adolescent drug use](http://www.monitoringthefuture.org/pubs/monographs/mtf-overview2014.pdf) (<http://www.monitoringthefuture.org/pubs/monographs/mtf-overview2014.pdf>).  
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## Preventing Drug Abuse and Excessive Alcohol Use

Preventing drug abuse and excessive alcohol use increases people's chances of living long, healthy, and productive lives. Excessive alcohol use includes binge drinking (i.e., five or more drinks during a single occasion for men, four or more drinks during a single occasion for women), underage drinking, drinking while pregnant, and alcohol impaired driving. Drug abuse includes any inappropriate use of pharmaceuticals (both prescription and over-the counter drugs) and any use of illicit drugs. Alcohol and other drug use can impede judgment and lead to harmful risk-taking behavior. Preventing drug abuse and excessive alcohol use improves quality of life, academic performance, workplace productivity, and military preparedness; reduces crime and criminal justice expenses; reduces motor vehicle crashes and fatalities; and lowers health care costs for acute and chronic conditions.

Download and print these recommendations: [Preventing Drug Abuse and Excessive Alcohol Use](#) (PDF – 238 KB)

### *Recommendations:*

1. Support state, tribal, local, and territorial implementation and enforcement of alcohol control policies.
2. Create environments that empower young people not to drink or use other drugs.
3. Identify alcohol and other drug abuse disorders early and provide brief intervention, referral and treatment.
4. Reduce inappropriate access to and use of prescription drugs.

### *What Can State, Tribal, Local and Territorial Governments Do?*

- Maintain and enforce the age 21 minimum legal drinking age (e.g., increasing the frequency of retailer compliance checks), limit alcohol outlet density, and prohibit the sale of alcohol to intoxicated persons.
- Require installation of ignition interlocks in the vehicles of those convicted of alcohol impaired driving.
- Implement or strengthen prescription drug monitoring programs.
- Facilitate controlled drug disposal programs, including policies allowing pharmacies to accept unwanted drugs.
- Implement strategies to prevent transmission of HIV, hepatitis and other infectious diseases associated with drug use.

### *What Can Businesses and Employers Do?*

- Implement policies that facilitate the provision of SBIRT or offer alcohol and substance abuse counseling through employee assistance programs.
- Include substance use disorder benefits in health coverage and encourage employees to use these services as needed.
- Implement training programs for owners, managers, and staff that build knowledge and skills related to responsible beverage service.

### *What Can Health Care Systems, Insurers, and Clinicians Do?*

- Identify and screen patients for excessive drinking using SBIRT, implement provider reminder systems for SBIRT (e.g., electronic medical record clinical reminders) and evaluate the effectiveness of alternative methods for providing SBIRT (e.g., by phone or via the internet).
- Identify, track, and prevent inappropriate patterns of prescribing and use of prescription drugs and integrate prescription drug monitoring into electronic health record systems.
- Develop and adopt evidence-based guidelines for prescribing opioids in emergency departments, including restrictions on the use of long-acting or extended-release opioids for acute pain.
- Train prescribers on safe opioid prescription practices and institute accountability mechanisms to ensure compliance. For example, the use of long-acting opioids for acute pain or in opioid-naïve patients could be minimized.

### *What Can Early Learning Centers, Schools, Colleges, and Universities Do?*

- Adopt policies and programs to decrease the use of alcohol or other drugs on campuses.
- Implement programs for reducing drug abuse and excessive alcohol use (e.g., student assistance programs, parent networking, or peer-to-peer support groups).

### *What Can Community, Non-Profit, and Faith-Based Organizations Do?*

- Support implementation and enforcement of alcohol and drug control policies.
- Educate youth and adults about the risks of drug abuse (including prescription misuse) and excessive drinking.
- Work with media outlets and retailers to reduce alcohol marketing to youth.
- Increase awareness on the proper storage and disposal of prescription medications.

***What Can Individuals and Families Do?***

- Avoid binge drinking, use of illicit drugs, or the misuse of prescription medications and, as needed, seek help from their clinician for substance abuse disorders.
- Safely store and properly dispose of prescription medications and not share prescription drugs with others.
- Avoid driving if drinking alcohol or after taking any drug (illicit, prescription, or over-the-counter) that can alter their ability to operate a motor vehicle.
- Refrain from supplying underage youth with alcohol and ensure that youth cannot access alcohol in their home.

Was this page helpful?

☐ Yes

☐ No

Next

[Form Approved OMB# 0990-0379 Exp. Date 9/30/2020](#)