First Drink? Your Brain Will Never Forget It

Written by Yvette Brazier

Published: Monday 22 February 2016

The first time you consume alcohol, you learn something that will affect how you approach drinking thereafter, and binge drinking at an early age may encourage dangerous habits in the future, says a study published in the Journal of Neuroscience.

Neurological changes occur with the first drink of alcohol.

Young people abuse alcohol more than any other substance in the US, and American 12-20-year olds consume 11% of all alcohol nationally.

Statistics from the National Institute of Health (NIH) show that by the age of 15 years, about 35% of teens have consumed at least one alcoholic drink, rising to around 65% by the age of 18.

Although adolescents drink less frequently than adults, the practice of binge drinking means that when they do drink, they consume more. In fact, American youths consume more than 90% of their alcohol during binge-drinking sessions.

In 2014, 8.7 million young people between the ages of 12-20 years reported drinking more than "just a few sips" in the previous month.

The health and safety risks of underage drinking are enormous, and the practice poses a serious public health concern.

1. What is the most common substance that people 12-20 abuse?
2. How much alcohol do 12-20 years olds consume nationally? Why is that?

Attraction of alcohol lies in enduring cellular changes

Much of the attraction of alcohol, cocaine and other widely abused drugs lies in the perceived, euphoric "high" that they induce.

Research has associated this with activation neurons in the dopamine pathways that are related to goal-oriented and reward-based behaviors, and studies have shown that dopamine receptor D1 neurons play a key role in alcohol learning and reinforcement.

To understand more about long-lasting cell changes following the first experience with alcohol consumption, researchers from the University of California San Francisco (UCSF), led by Dr. Dorit Ron, looked into the neuronal behavior of mice.

They wanted to find out whether a single exposure to alcohol induces memory and behavioral changes that could promote future drinking.

The mice were subjected to a two-bottle drinking test for 24 hours, one bottle containing water and the other 20% alcohol. The next day, the scientists measured the neuron physiology for dopamine receptors D1 and D2 in the mice's brains.

Memory registers effects from the first exposure

In the mice that consumed alcohol, the scientists observed changes in the D1 neurons, compared with mice that only drank water.

The results indicate that the memory registers and stores the perceived benefits of alcohol from the very first time a person drinks.

Similar changes were observed after a single dose was given to mice that had not previously consumed alcohol, indicating that a first, and perhaps even a single, experience with alcohol can bring about permanent neurological changes.

The findings help to explain the neurological changes that accompany initial alcohol exposure and suggest that similar alterations underlie the reward-based learning associated with alcohol and other substance abuse.

The study also reveals pathways that could be targeted therapeutically by drugs to help patients who have problems with addiction.

3. What does the memory store the first time a person drinks?
4. What does this study show?

Alcohol Can Rewire the Teenage Brain

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

BY

TARA HAELLE

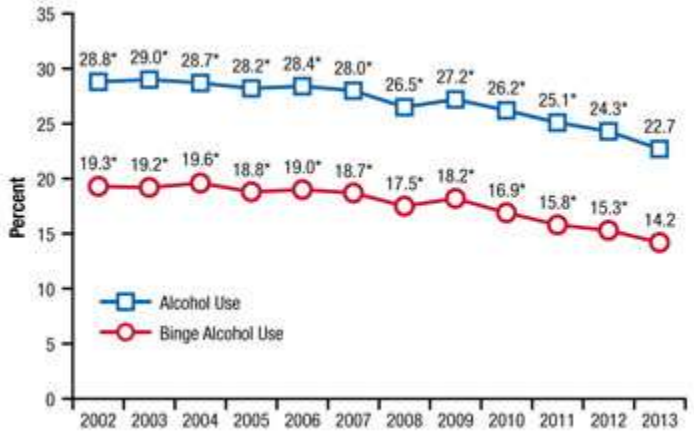
Alcohol is a drug. And every day, more than 4,750 American kids aged 15 and younger take their first full drink of this drug. That's according to the U.S. Substance Abuse and Mental Health Services Administration, or SAMHSA. And the problem is not just that this consumption is illegal. Kids who start 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.



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

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 binging 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.

"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 binging 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."

1. Which group of people are most likely to binge drink?
2. Explain what happens to the body systems during binge drinking?
3. What happens to the teenage brain for someone who drinks?

Half of Teen, Young Adult Car Crash Deaths Involve Pot or Alcohol

by Stephanie Pappas, Live Science Contributor

Half of the teen and young adult drivers who die in car crashes are under the influence of either pot, alcohol, or both, suggests a new study done in states where toxicology screening for accident victims is routine.

What's more, the increasing legalization and availability of marijuana does not seem likely to push alcohol use aside, the researchers said. The crash victims in the study who were over age 21 (and of legal drinking age) were more likely than younger victims to have used both marijuana and alcohol prior to their crash.

"Given the rapid changes currently underway in marijuana availability and permissibility in the U.S., understanding the effects of drug control policies on substance use behavior and adverse health outcomes, such as fatal motor vehicle crashes, has never been more important," study researcher Katherine Keyes, of Columbia University's Mailman School of Public Health, said in a statement.

Under the Influence

Car crashes are the leading cause of death of 18- to 25-year-olds in the U.S., and driving under the influence is a major cause of accidents. Not every state conducts routine toxicology tests on car crash victims right after the accident, but those that do have come up with alarming results. For example, a 2012 study in the journal Addiction found that 57.3 percent of the drivers in this age group who died were on some kind of mind-altering substance, usually alcohol. [The History of 8 Hallucinogens]

For Keyes and her colleagues pulled data on 16- to 25-year-olds from the Fatality Analysis Reporting System (FARS), a federal database of fatal crashes. They focused on California, Connecticut, Hawaii, Illinois, New Hampshire, New Jersey, Rhode Island, Washington and West Virginia, because each of these states tests at least 85 percent of its fatal car crash victims for drugs and alcohol within an hour of the accident.

The researchers found that half (50.3 percent) of the young drivers who died were drunk or high at the time of their fatal crashes, the researchers found. In total, 36.8 percent tested positive for alcohol alone, while 5.9 percent tested positive for marijuana alone and 7.6 percent had been using both.

1. What substances are the primary ones that factor into teen driving fatalities?

Mixing alcohol and marijuana

Next, the researchers wanted to know whether at-risk youth were using pot and alcohol as substitutes for one another; if so, the results might suggest specific policy changes. For example, they wrote in the open-access journal Injury Epidemiology, a large coalition of university presidents recently recommended lowering the legal drinking age to 18 in the hopes that access to alcohol would make other illegal drugs less appealing to 18- to 21-year-olds. That policy would only work, though, if young people tend to drop one drug in favor of another, rather than just double up.

Looking at the 16- to 25-year-old age range enabled the researchers to see how drug use changed in accident fatalities at the 21-year mark — the turning point when alcohol becomes legal. They found that at age 21, the likelihood of finding alcohol alone in the crash victims' systems went up 14 percent. At the same time, the likelihood of finding pot alone went down 24 percent.

But there was a catch: In victims over age 21, the chances of finding both alcohol and marijuana in the victims was 22 percent higher than in those under age 21. Ultimately, the researchers concluded, the availability of alcohol has little effect on young people's use of marijuana.

2. Does availability of alcohol impact peoples use of marijuana?

It's possible that young people who tend to use only one substance do switch from marijuana to alcohol at age 21, they wrote. But for others, who tend use more than one substance, the legality of alcohol seemed to actually increase the use of marijuana, as well.

"Taken together, we found no significant substitution effect between alcohol," study researcher Guohua Li, director of Columbia University's Center for Injury Epidemiology and Prevention, said in a statement.

"Rather, increased availability seems to increase the prevalence of concurrent use of alcohol and marijuana."

3. Should drivers' education make more of a focus on alcohol use and its impact on driving? Why or why not?

Teen Drivers: Get the Facts

Motor vehicle crashes are the leading cause of death for U.S. teens.[1] Fortunately, teen motor vehicle crashes are preventable, and proven strategies can improve the safety of young drivers on the road.

How big is the problem?

In 2011, about 2,650 teens in the United States aged 16–19 were killed and almost 292,000 were treated in emergency departments for injuries suffered in motor-vehicle crashes.[1] That means that seven teens ages 16 to 19 died every day from motor vehicle injuries.

1. How many teens die daily from motor vehicle crashes/injuries? How many would die each year?

Young people ages 15-24 represent only 14% of the U.S. population. However, they account for 30% ($19 billion) of the total costs of motor vehicle injuries among males and 28% ($7 billion) of the total costs of motor vehicle injuries among females.[3]

2. After reading the paragraph above, do you believe this properly explains why car insurance for teenagers is more expensive than it is for other drivers? Why?

Who is most at risk?

The risk of motor vehicle crashes is higher among 16- to 19-year-olds than among any other age group. In fact, per mile driven, teen drivers ages 16 to 19 are nearly three times more likely than drivers aged 20 and older to be in a fatal crash.[2]

Among teen drivers, those at especially high risk for motor vehicle crashes are:

- Males: In 2011, the motor vehicle death rate for male drivers and passengers ages 16 to 19 was almost two times that of their female counterparts.[1]
- Teens driving with teen passengers: The presence of teen passengers increases the crash risk of unsupervised teen drivers. This risk increases with the number of teen passengers.[4]
- Newly licensed teens: Crash risk is particularly high during the first months of licensure.[5,6]

What factors put teen drivers at risk?

- Teens are more likely than older drivers to underestimate dangerous situations or not be able to recognize hazardous situations.[7]
- Teens are more likely than older drivers to speed and allow shorter headways (the distance from the front of one vehicle to the front of the next). The presence of male teenage passengers increases the likelihood of this risky driving behavior.[8]
- Among male drivers between 15 and 20 years of age who were involved in fatal crashes in 2012, 37% were speeding at the time of the crash[9] and 25% had been drinking.[10]
- Compared with other age groups, teens have the lowest rate of seat belt use. In 2013, only 55% of high school students reported they always wear seat belts when riding with someone else.[11]
- At all levels of blood alcohol concentration (BAC), the risk of involvement in a motor vehicle crash is greater for teens than for older drivers.[12]
- In 2012, 23% of drivers aged 15 to 20 involved in fatal motor vehicle crashes were drinking.[10]
    - In a national survey conducted in 2013, 22% of teens reported that, within the previous month, they had ridden with a driver who had been drinking alcohol. Among students who drove, 10% reported having driven after drinking alcohol within the same one-month period.[13]
    - In 2012, 71% of drivers aged 15 to 20 were killed in motor vehicle crashes after drinking and driving were not wearing a seat belt.[10]
    - In 2012, 49% of teen deaths from motor vehicle crashes occurred between 3 p.m. and midnight and 53% occurred on Friday, Saturday, or Sunday.[2]

3. Based on the points above, pick out the three that most stood out to you and explain why they stand out?

How can deaths and injuries resulting from crashes involving teen drivers be prevented?

There are proven methods to helping teens become safer drivers.

Seat Belts

Of the teens (aged 13-19) who died in passenger vehicle crashes in 2012 approximately 55% were not wearing a seat belt at the time of the crash.[14]Research shows that seat belts reduce serious crash-related injuries and deaths by about half. [15]

4. How often in a crash with fatalities, are teens not wearing a seatbelt?

Not Drinking & Driving

Enforcing minimum legal drinking age laws and zero blood-alcohol tolerance laws for drivers under age 21 are recommended.

Graduated Licensing Systems (GDL)

Driving is a complex skill, one that must be practiced to be learned well. Teenagers' lack of driving experience, together with risk-taking behavior, puts them at heightened risk for crashes. The need for skill-building and driving supervision for new drivers is the basis for graduated driver licensing systems, which exist in all US states and Washington, DC. Graduated driver licensing puts restrictions on new drivers; these are systematically lifted as the driver gains experience. Research suggests that the most comprehensive graduated drivers licensing (GDL) programs are associated with reductions of 38% and 40% in fatal and injury crashes, respectively, among 16-year-old drivers.[16] When parents know their state's GDL laws, they can help enforce the laws and, in effect, help keep their teen drivers safe.

Eight Danger Zones

Make sure your young driver is aware of the leading causes of teen crashes:

- Driver inexperience
- Driving with teen passengers
- Nighttime driving
- Not using seat belts
- Distracted driving
- Drowsy driving
- Reckless driving
- Impaired driving

Learn what research has shown parents can do to keep teen driver safe from each of these risks.

5. What are the 8 causes of teen crashes?