

How Alcohol Damages a Teen's Developing Brain, Part 2

Summary

This lesson helps students understand how alcohol damages the brain, as well as identify the risks of binge drinking, alcohol poisoning, and alcoholism.

Main Core Tie

Health Education I (7-8)

[Strand 4: SUBSTANCE ABUSE PREVENTION \(SAP\) Standard HI.SAP.4:](#)

Materials

- [Handouts and posters:](#)

"The Brain's Pleasure-Reward System," "Alcohol Hijacks Our Brain's Pleasure-Reward System," "Teen Alcohol Use Can 'Wire' The Brain for Early Addiction," "Alcohol Poisoning: A Real Risk" ["Pledge Cards"](#)

- [Worksheet:](#)

"Alcohol Damages Our Brain's Pleasure-Reward System"

Materials: Two clay-dough models shaped to look like a brain (see recipe at end) -- one left out to dry hard for a few days, the other kept soft in an airtight bag; small ball or wad of paper.

Intended Learning Outcomes

Students will understand how alcohol damages the brain and diminishes the sense of ordinary pleasure.

Students will identify the risks of binge drinking and alcohol poisoning and alcoholism.

Students will make a decision to stay alcohol-free.

Instructional Procedures

Lesson at a Glance

Review lesson 18, "How Alcohol Damages a Teen's Developing Brain, Part 1."

Complete worksheet: "Alcohol Damages Our Brain's Pleasure-Reward System."

Discuss various concepts regarding the central nervous system and the brain's reward system.

Play "Pass the Brain Message."

New Vocabulary

pleasure receptors

dopamine

Introduction (Setting Focus)

Review lesson 18, How Alcohol Damages a Teen's Developing Brain, using the following prompts and ideas:

What is the "best birthday present ever"? (brain)

How does the brain act as the world's most powerful computer? (It governs everything we think, see, hear, feel and do.)

How much of the brain's "software" is fully wired and how much remains to be wired through learning and experiences? (40% of our neurons are wired at birth; the other 60% are waiting to be wired by our learning and experience.)

Display poster "Peaks of Plasticity" from lesson 18. What is brain plasticity? (Plasticity refers to the brain's ability to change and reformat its internal structure as we learn new things.)

Display poster "Myelin Sheath: Brain Insulation" from lesson 18. How do our brain neurons

communicate and become wired?

The dendrites of a neuron receive a message and forward it to the soma.

The soma sends an electrical signal down the axon to the axon terminals.

The electrical impulse triggers the axon terminals to release a chemical neurotransmitter, which flows across the synapse.

The chemical message is picked up by the neighboring dendrite receptors.

When a message is successfully sent and received, a "neural connection" is made.

Every time we have new experiences or learn something new, our neurons form new connections among themselves.

If we repeat a thought or action several times, the neuron begins sending a larger amount of neurotransmitter across the synapse, and the neighboring neuron makes more dendrite receptors to receive the increased neurotransmitter. The neural connection then becomes stronger until it becomes a dominant pathway.

The axon eventually becomes coated with a fatty, waxy coating called a "myelin sheath" that protects brain wiring.

When does the brain finish "wiring"? (The brain becomes fully wired with its myelin sheath in place about age 24.)

What two brain areas are most seriously harmed by underage drinking? (prefrontal cortex and hippocampus)

Display and discuss the poster, "Alcohol Damages the Adolescent Brain" from lesson 18.

Complete the brain clay activity:

Show students the soft, fresh clay-dough brain, explaining that you just made it. Toss it to a student and have him/her describe what the clay-dough is like. (soft, pliable, easy to shape)

Show students the dried clay-dough "brain" you made last week. Toss this to a student as well, and have him/her describe what this clay-dough is like. (hard, set, not easily shaped)

Discuss that both these clay-brains are made from the exact same material and they are different because one has been in the air longer than the other.

Which clay brain is more susceptible to damage? (the new, soft brain)

How could we compare these two clay brains to an adult and adolescent brain?

How does a brain continue to develop? (It makes more neural connections when we have new learning and experiences.)

What is the term we use to describe the ability of the brain to change its internal structure as it wires itself with new neural connections? (brain plasticity)

What things harm the formation of neural connections? (alcohol, drugs, inhalants)

Discuss that alcohol, drugs, and inhalants all negatively affect brain wiring. Some drugs, like "meth" (also called "crank" or "speed"), and all inhalants, are made from such toxic chemicals that they can cause large-scale brain cell destruction and make you stupid. All illegal drugs and inhalants should be absolutely avoided. Of all addictive drugs, alcohol is most pervasive because it affects so many different areas of the brain at the same time.

Students will learn how alcohol hijacks the brain's pleasure-reward system and can create early addiction in underage drinkers.

Students complete the "Alcohol Damages Our Brain's Pleasure-Reward System" worksheet during the course of the discussion.

Body (Strategies/Activities)

Display and discuss poster, "The Brain's Pleasure-Reward System".

Our brain is created to reward positive actions that contribute to the survival and well being

of the human race with feelings of pleasure, so that we value and want to repeat those actions.

Feelings of pleasure can range from an intense emotional high, to a sense of happy satisfaction for doing something good. Our feelings of pleasure are generated and stored in our brain. We remember the feelings of pleasure because of a brain chemical called "dopamine."

Dopamine is a neurotransmitter which is stored in the axon terminals. When an electrical charge comes down the axon, the dopamine is secreted from the axon terminals and flows across the synapse, where it is picked up by the dendrite receptors of a neighboring neuron. As it makes a neural connection, it creates a pleasure sensation; and your brain then connects the pleasure-feeling you experienced to the thing you enjoyed.

With a partner, students list six things people can do, see, experience or feel that create a feeling of pleasure within them. Share a few ideas with the class. (Examples: eating a hamburger, dunking a basketball, holding hands or kissing someone you like, doing a kind deed)

Discuss how these activities bring us pleasure. (The reason you start to feel pleasure just looking at a juicy hamburger when you are hungry, or seeing your girl- or boyfriend coming down the hall, is because your eyes send signals to the brain that something good is about to happen, and the dopamine starts flowing across a pre-made neural connection. You've wired your brain to remember the feeling; and you want to repeat the action that brought the pleasure.)

Discuss the poster, "Alcohol Hijacks Our Brain's Pleasure-Reward System."

Alcohol affects the way our brain experiences pleasure by invading and manipulating the brain's neural pleasure connections. Alcohol pretends to be a neurotransmitter and tricks our brain into generating pleasure-reward feelings from a harmful chemical instead of a real experience.

However, while the alcohol is creating a feeling of pleasure, it is also damaging the brain's neural wiring for pleasure. After a while, you need more and more alcohol to give you the same amount of pleasure. This leads to addiction, meaning that your craving for the feeling you get from alcohol will become so strong that you'll risk serious consequences, or neglect important things, to get it. What is worse, your ability to sense ordinary pleasure from real things and experiences will be diminished. After a while, yummy food, real accomplishments, special moments -- even true love -- may leave you feeling flat.

What are people like who seem to have experienced a deteriorating sense of pleasure through excess alcohol use? What is it like for them and those who live with them? (They spend their spare time drinking instead of doing things they used to enjoy.)

Read and discuss the true story of Carlos.

Carlos loved playing soccer, and he was good. But then he started hanging around with friends who drank. After a while, he began drinking as well. Then he began to drink with them every weekend, and the drinking activities became more and more important to him. Pretty soon Carlos began to lose interest in soccer. One weekend he didn't even show up for a key game. When his teammates confronted him, he blew them off, saying, "Hey, it's just not fun for me anymore."

What might have been happening to the neural wiring in Carlos' brain that caused him to value drinking with his new friends over playing soccer with his team?

Discuss the illogic of drinking using the following prompts:

Why do young people drink? (to feel pleasure)

What are they really doing to themselves? (damaging their pleasure center)

Why is damaging your pleasure center one of the D.U.M.B-est things you can do? (The

short-term pleasure-buzz of alcohol is never worth the life-long diminishing of our ability to sense real pleasure, nor the risk of becoming an alcoholic.)

What did the American Medical Association say that D.U.M.B. stood for? (Drinking Underage Maims the Brain)

Let's not be D.U.M.B.

Discuss the poster, "Teen Alcohol Use Can Wire the Brain for Addiction" using the following prompts and ideas:

In addition to damaging the good judgment, the memory center, and the pleasure center of our brain, drinking alcohol under the age of 21 can also program the brain to become addicted to alcohol.

Research shows that if people begin drinking alcohol at age 15, they have a 40 percent chance of becoming an alcoholic.

If people wait until age 21 to drink, they have less than a 7 percent chance of becoming an alcoholic.

In 2004 there were 16 million alcoholics in the United States, and 4 million of them were teens.

What problems do alcoholics often have? (get angry, lose jobs, neglect family)

Alcohol has permanently changed an alcoholic's brain wiring, making them crave alcohol.

This negatively affects who they become and not only harms their quality of life, but also causes great emotional distress to those with whom they live.

It is important to know that there is no cure for alcoholism -- the pleasure center of an alcoholic's brain is permanently altered. Alcoholism can be "treated" through counseling and support groups like Alcoholics Anonymous to help a person get off alcohol, but the person must then abstain completely from alcohol for the rest of his or her life.

Why is society as a whole harmed when people become alcoholics? (Alcoholics often drive drunk and get in accidents, injuring or killing others. This takes police and court resources, and causes insurance rates to go up. They often abuse spouses or children when intoxicated, lose their jobs, become depressed or develop mental illnesses, and they or their families may end up on welfare.)

Some people are genetically predisposed to alcoholism, and may become alcoholics even if they begin drinking after age 21. Research shows that their brains often produce less serotonin, a neurotransmitter that makes a person feel calm and happy. Their pleasure centers also have an increased sensitivity to the pleasure alcohol provides -- making them feel the pleasure alcohol provides much more intensely. They thus become more easily wired for addiction.

How do you know if you are genetically predisposed to alcoholism? (If a person has a family member who has a drinking problem, then he or she likely has a genetic predisposition to alcoholism and, to be safe, should probably not drink.)

About 60 percent of the U.S. population doesn't drink at all. Some make the choice not to drink for health reasons; others, for religious reasons, or because they don't like the taste.

Their children may not know if they are predisposed for alcoholism or not, because no one drinks in their family. They should be especially careful to avoid underage drinking.

What is the only sure way to stay safe from alcoholism? (stay alcohol-free)

Discuss the poster "Alcohol Poisoning: A Real Risk" using the following prompts and ideas:

There is another huge danger with underage drinking. Because the adolescent brain is not fully formed, in many cases it has not yet developed the "shut-off" switch that adults have developed, which makes a person get sleepy or pass out from too much alcohol, and thus stop excessive drinking. As a result, most teens can drink more alcohol before passing out than adults.

Some participate in "binge drinking," which is defined as 5 or more drinks at a sitting. Because teens lack the shut-off switch, they can consume dangerous amounts of alcohol in a short period of time, which can result in alcohol poisoning or death.

How can you protect yourself or a friend from alcohol poisoning? (Never drink before age 21, and then if you choose to drink never have more than one or two drinks a day.)

What should a person do if he or she has a friend who passes out from drinking and starts to turn blue around the mouth? (The friend should be taken to a hospital emergency room immediately. If left untreated, he or she could die.)

Discuss the "Light Switch Object Lesson" using the following prompts and ideas:

Turn a light switch off and on.

Most brain cells have a "go" switch that tells the soma in the neuron to fire off an electrical impulse, passing on information necessary for memory formation.

Excess alcohol turns off this "go" switch, preventing cells from firing and new memories from being stored. When we get drunk, it is like turning off a light switch in our brain, causing brain activity to slow down. The brain tries to compensate by increasing the activity of neurons. This causes over-stimulation of brain neurons, and the intoxicated person develops a "hangover" effect: headaches, nausea, etc.

Many of the over-stimulated cells break down and die in their own membranes. The effects on an adult brain from getting drunk diminish after about 24 hours and the brain resumes more normal activity.

In a teen brain, the negative effects of getting drunk can continue to linger in the brain for several days, affecting the "go" switch and interrupting neural brain development during this time.

Why do teens who get drunk every weekend hinder their ability to lay down memories, becoming less smart? (The brain of a teen doesn't get over the effect of getting drunk for several days -- preventing the brain from effectively laying down new information and making needed neural connections during this period of time.)

Teens who drink often engage in risky or dangerous behavior because the areas of their brain that governs good judgment and coordination are shut down by the alcohol.

Many states, including Utah, have "Not A Drop" laws. That means that it is against the law for anyone under the age of 21 to have any alcohol in their body; and those who are found violating this law can be arrested and charged with a misdemeanor.

Why do you think it is against the law for people under age 21 to drink alcohol?

Why is it also illegal for an adult to provide alcohol for teens? (It harms teens' developing brains, which can later cause them to do poorly in school, and do society harm.)

Adults can be fined or go to jail for providing alcohol for those under age 21.

Closure (Wrap-Up and Extension)

Review the ideas of lessons 18 and 19 with the following prompts and ideas:

When is a brain most susceptible to damage -- especially alcohol damage? (before age 21 -- during times of peak plasticity)

What are some of the most impressive things you have learned about alcohol and brain damage from these lessons?

What will you do differently because of this new knowledge?

Complete the "Pledge Card" signing activity.

After considering the damaging effects of alcohol on the developing brain, how many of you would like to make a serious commitment to stay alcohol-free until at least age 21?

Interested students complete and sign the pledge cards.

Students take home their completed worksheets from lessons 19 and 20 and teach a parent, family member, or friend (1) how the brain becomes wired, (2) what two areas need to be wired

during adolescence, (3) and how alcohol harms a teen brain.

Read and discuss the following letter written by a teen that appeared in a newspaper advice column, "Help Me Harlan." Ask class members how they would have answered the letter. Then read how "Harlan" answered. Discuss his advice.

"Dear Harlan: I'm 17 years old, and I live in a small town. I've been drinking heavily for the past six months. At first, it would only be on the weekends, but now I find myself drinking more and more on weekdays. For the majority of the time, I'm by myself. Granted, alcoholism is a major problem in my family... but six months -- I'm not sure I am an alcoholic. I'm confused if I'm drinking because of the crap going on in my life (parents, grades, lady friends, etc.) or if it's because I can't go without it. Alcoholics Anonymous is not an option. Some of my friends go and if they saw me there it would spread like wildfire. Is there any way of getting help without talking to parents or friends? Signed: "Secretly Drinking"

"Dear Drinking: If addiction were a highway, you're driving 110 mph on a winding mountain road during a freezing rainstorm on a motorcycle and not wearing a helmet. Drinking to escape, drinking alone and a history of alcoholism are all signs of major trouble ahead. You're only a few exits from "Ruined-my-life-ville" (population: 1). Before turning away from family and friends, realize that they know this problem best and would be the last people to judge you. If attending an AA meeting isn't an option check out [Al-Ateen](#). It is like AA, but it's for relatives and friends of alcoholics. It's an easy way to get information and not get labeled. Beyond Al-Ateen there's Smart Recovery (www.smartrecovery.org), which has online meetings. Also, check out the Alcoholics Anonymous Web site (<https://www.aa.org>) or contact the AA general service office at 1-212-870-3400 to inquire about meetings. Please, put the breaks on what you know is a serious problem -- exit immediately, and get the help you need." (©Harlan Cohen 2004; Dist. By King Features Syndicate Inc.)

Play "Pass the Brain Message."

Before beginning this activity, arrange with two students to toss the ball back and forth instead of letting it go around the circle.

The class makes a set of neural connections that will require everyone to stand up and form a huge circle all around the room. Each student makes a brain neuron (see lesson 1) with his or her hand and arm. This time we will pretend that ____ (student's name) is visiting his/her cousin _____ (student's name) in the country and they decide to climb a fence and cross a field to go swimming in the river. They don't realize that an ill-tempered bull was just put in the field. Halfway across the field they notice the bull come running toward them. They have less than a minute to run the rest of the distance to safety.

In this circle, we need to get a neural message (a ball) sent from the eyes to the brain, and then to the feet telling them to run. If we can get this message-ball all the way around this giant neuro-connection, everyone gets a treat. Start the ball around. As it is going around the room, add the following: "I forgot to mention that these kids had found some beer and decided to have a few drinks before they went swimming. How is that going to affect their brain's ability to send and receive messages?" (At this point the two designated students toss the ball instead of passing it.) When time ends have students take their seats.

How did alcohol affect these kids' brain connections? (harmed them)

What were the consequences? (couldn't run away from danger)

What could the consequences be in real life? (make poor decisions, etc.)

Extensions

Additional Resources

Clay Dough Recipe: Mix together:

1 cup flour

1/2 cup salt

2 teaspoons cream of tartar

1 cup water

Heat 1 tablespoon of oil in pan. Add flour mixture; cook for three minutes, stirring constantly until it forms a ball. Dump clay-dough onto an oiled countertop. Knead until soft. Store in plastic.

Media worth watching

"Brain Scans" video (Human Relations Media: 1-800-431-2050 or <http://www.hrmvideo.com>)

"Don't Drain Your Brain -- How Alcohol Damages Your Brain" (Human Relations Media, 1-800-431-2050 or www.hrmvideo.com).

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