Overview

Students will estimate risks associated with different events and compare their estimates to the real probabilities.

Drugs, Risks and the Nervous System

People perceive risks differently, depending on the nature of the risk and their individual experiences. Risk perceptions are strongly influenced by issues of choice and control; risks often seem “riskier” to people if they have not voluntarily chosen to bear them. Conversely, people are more willing to accept or ignore risks that they choose voluntarily, especially if the immediate benefit seems to outweigh the potential for negative outcomes much later in time. In the case of chemical substances that affect the brain, the risks can be very high indeed.

It is important to note that most people begin to use brain-altering chemicals voluntarily. Over time, however, the brain and body may adapt to the effects of a chemical. This can create a new “normal” state, adjusted to the presence of the introduced substance. This adaptation may lead to a physical dependence on the substance, such that the individual requires the chemical to function normally.

For example, more than 80 percent of the current US population chooses to consume the stimulant caffeine in coffee and/or cola drinks because of its taste and/or perceived enhancement of mental and physical performance. Eventually, most caffeine consumers develop a dependence on its stimulating effects and experience mild withdrawal symptoms, such as sleepiness and headaches, when they do not have caffeine. Other chemicals have more dramatic effects on the brain and body, affecting the brain’s natural reward centers, which are responsible for generating feelings of pleasure or well-being. However, feelings of euphoria, comfort or pleasure often decrease or disappear after the first few uses of the substance.

Drugs that act on areas of the brain related to sensations of pleasure are sometimes used inappropriately by people. Unfortunately, continued drug use actually changes the way the brain works. In some cases, it can cause permanent changes in the structure and function of the brain. This is the biological basis of addiction.

Many mind-altering chemicals abused by children and adults in the US lead to permanent changes in the brain that lead to addiction, and also may cause damage to other parts of the body. Marijuana use can alter memory regions of the brain and affect coordination and the senses in

Concepts

- Perception of risk is affected by issues of personal choice and control.
- Many chemicals influence the function of the nervous system.
- Health risks associated with tobacco, alcohol and other drugs of abuse are often underestimated.

Science & Math Skills

Predicting, sorting and classifying, comparing, sequencing, inferring and understanding probability

Time

Preparation: 10 minutes
Class: 45 minutes

Adolescents and Risky Behavior

Adolescents commonly take more risks than younger children and adults do, but not because they are attracted to danger. Rather, adolescents are simply more willing than other age groups to accept risks when consequences are unknown. A recent study showed that when risks are precisely stated, adolescents avoid them as much—if not more—than adults do.
the short term. Heroin changes the way nerve cells in the brain receive and process messages. Inhalants, which are taken up by fatty tissue in the body, damage or destroy the fat-containing myelin sheath on nerve cell axons and disrupt nervous system communications, sometimes permanently. LSD can contribute to the development of chronic mental disorders. Alcohol, which depresses physical and mental abilities, damages many tissues throughout the body, including the liver and the brain. Alcohol also is a major contributing factor to automobile accidents because it affects coordination and judgment. Nicotine, a stimulant in tobacco, is a very addictive substance that can damage the circulatory system. However, the greatest health risk from smoking comes from other compounds in cigarette and cigar smoke that are linked to development of lung and other cancers.

**MATERIALS**

**Per Group of Students** (See Setup)  
- Roll of clear tape, 0.5 in.

**Per Student**  
- Pair of scissors

**SETUP**

Make photocopies of the student pages (one set for each per student). Begin with a class discussion, followed by students working in groups of four to complete the activity.

**PROCEDURE**

1. Begin with a class discussion of the previous activity in which students simulated the effects of chemicals on neuron signaling. Ask, *What are examples of substances that change the way the brain works or how a person feels?* Give students time to think of some of the most common examples, such as alcohol, coffee and soft drinks with caffeine, cigarettes (nicotine), marijuana, inhalants (“sniffing” glue, paint or aerosols), etc.

2. Follow by asking, *Do you think people evaluate possible health risks when they take a substance that affects the brain? Why or why not? Do you think they should?*

3. Tell students that one way to quantify risk is to state it as a probability that something will occur. For example, when students rolled a die in Activity 4, they had a one in six chance of rolling a “two” on any given toss because the die has six sides. Explain that by studying how frequently events have happened in the past, scientists and statisticians have been able to calculate the risk of many different types of occurrences.

4. Give each group of students a copy of the “What Are the Odds?” page and have them read all of the statements. Have students cut the statements into strips (so that they can be rearranged easily). Next,
have students discuss within their groups how likely it is that each event will occur.

5. Students should rank the events numerically, from most likely to occur to least likely. The number “1” should be given to the most likely event. Have students place the strips in order of likelihood from most risk (top) to least risk (bottom). You may want to provide tape and a separate sheet on which students can arrange and secure their strips.

   **Note.** Tell students that some items have the same odds.

6. Discuss students’ predictions briefly by asking which events they placed at the tops and bottoms of their lists. Let each group share some of its predictions and the reasoning behind the choices. Allow student groups to rethink or revise their predictions based on the discussion.

7. Distribute a copy of “The Risks Are Real” page to each group and ask students to compare their predictions to the actual risk calculations.

8. Conclude by discussing the actual risks as compared to students’ predictions. Ask guiding questions such as, *Which ranking surprised you the most? Which were you able to predict most accurately? Do you think you or any of your friends might be ignoring long-term risks because you are making choices based on short-term benefits?*

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**ABUSE OR ADDICTION?**

There is a difference between drug abuse and drug addiction. Drug abuse involves any illicit use of a substance, including nonmedical use of prescription drugs. Drug addiction is a chronic, relapsing disease characterized by compulsive drug seeking and use despite harmful consequences, as well as neurochemical and molecular changes in the brain.

People abuse drugs for many reasons. Sometimes, it is because drugs produce feelings of pleasure, or because they remove feelings of stress and emotional pain.

Over time, the body can become “used” to a drug, causing severe withdrawal symptoms when the substance is removed. People who are physically dependent on a drug continue to use it to avoid the pain of withdrawal, not because they derive any pleasure from the experience.

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**HISTORICAL AND CULTURAL DRUG USE**

Anthropologists have uncovered ancient uses of mind-altering substances for medicinal and ritualistic purposes in cultures around the world.

The use of the substances in ritualistic practices was strictly controlled by community leaders and involved plant-based medicines that were less refined and often less potent than many of the drugs used today.
WHAT ARE THE ODDS?

Read the statements below. Cut the statements into strips and place the events in order from most likely (top) to least likely to occur (bottom). Rank the statements numerically, assigning “1” to the most likely event. Keep in mind that some items are equally likely, so they will share the same number.

- Being born left-handed
- Living to the age of 116 years
- Being killed by a shark
- Picking all 5 winning numbers in a lottery (total of 49 numbers)
- Quitting smoking successfully without any help
- Becoming addicted to caffeine if you regularly drink caffeinated coffee, tea or soft drinks (such as cola)
- Being electrocuted
- Becoming a professional basketball player if you play basketball in high school
- Becoming addicted to nicotine if you smoke cigarettes
- Being involved in an alcohol-related car accident
- Having poor driving skills after smoking one marijuana cigarette
- Being killed by falling out of bed
- Permanently damaging the myelin sheath on nerve cells in the brain by “sniffing” paint or glue
- Dying from influenza (the flu)
- Being pressured by a friend to smoke or use alcohol
- Having a fatal accident while playing sports
- Becoming dependent on crack or cocaine, if injected
- Dying of a smoking-related illness if you start smoking as a teenager
**The Risks Are Real**

These are the real odds for the events you ranked, from most likely to occur to least likely. Compare the odds to your rankings. Surprised?

<table>
<thead>
<tr>
<th>Event</th>
<th>Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Having poor driving skills after smoking one marijuana cigarette</td>
<td>1 in 1</td>
</tr>
<tr>
<td>2. Becoming addicted to caffeine if you regularly drink caffeinated coffee, tea or soft drinks (such as cola)</td>
<td>1 in 1.25</td>
</tr>
<tr>
<td>3. Becoming addicted to nicotine if you smoke cigarettes</td>
<td>1 in 2</td>
</tr>
<tr>
<td>4. Permanently damaging the myelin sheath on nerve cells in the brain by “sniffing” paint or glue</td>
<td>1 in 2</td>
</tr>
<tr>
<td>4. Being pressured by a friend to smoke or use alcohol</td>
<td>1 in 3</td>
</tr>
<tr>
<td>4. Being involved in an alcohol-related car accident</td>
<td>1 in 3</td>
</tr>
<tr>
<td>4. Dying of a smoking-related illness if you start smoking as a teenager</td>
<td>1 in 3</td>
</tr>
<tr>
<td>5. Becoming dependent on crack or cocaine, if injected</td>
<td>1 in 4</td>
</tr>
<tr>
<td>6. Being born left-handed</td>
<td>1 in 10</td>
</tr>
<tr>
<td>7. Quitting smoking successfully without any help</td>
<td>1 in 10</td>
</tr>
<tr>
<td>8. Dying from influenza (the flu)</td>
<td>1 in 5,000</td>
</tr>
<tr>
<td>9. Becoming a professional basketball player if you play basketball in high school</td>
<td>1 in 10,000</td>
</tr>
<tr>
<td>10. Having a fatal accident while playing sports</td>
<td>1 in 25,000</td>
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<tr>
<td>11. Being electrocuted</td>
<td>1 in 350,000</td>
</tr>
<tr>
<td>12. Picking all 5 winning numbers in a lottery (total of 49 numbers)</td>
<td>1 in 1,953,393</td>
</tr>
<tr>
<td>13. Being killed by falling out of bed</td>
<td>1 in 2 million</td>
</tr>
<tr>
<td>14. Being killed by a shark</td>
<td>1 in 300 million</td>
</tr>
<tr>
<td>15. Living to the age of 116 years</td>
<td>1 in 2 billion</td>
</tr>
</tbody>
</table>

Compiled from public domain statistics made available by the National Institutes of Health, Center for Substance Abuse Prevention, National Clearing House for Alcohol and Drug Information, American Cancer Society, CareerQuest and Dartmouth University.