BioEd℠

TEACHER'S GUIDE

SCIENTIFIC DECISION-MAKING

DECISIONS AND RISK

 ISBN: 978-1-888997-84-2

Baylor College of Medicine

NANCY P. MORENO, PHD, RONALD L. MCNEEL, DRPH,
BARBARA Z. THARP, MS, GREGORY L. VOGT, EDD, AND JAMES P. DENK, MA

About the Project

Baylor College of Medicine

CENTER FOR EDUCATIONAL OUTREACH

The Scientific Decision-making curricular unit, produced as part of the project entitled AHRQ's Ischemic Heart Disease Products Translated for High School Populations, was funded by a grant (R18HS019248) from the Agency for Healthcare Research and Quality (AHRQ).
The project's goal is to develop—and evaluate the effectiveness of—high school-level teaching materials focusing on evidence-based decision-making using examples related to cardiovascular health.

Activities described in this book are intended for middle or high school students under direct supervision of adults. The authors, Baylor College of Medicine and AHRQ cannot be held responsible for any accidents or injures that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text. The opinions, findings and conclusions expressed in this publication are solely those of the authors and do not necessarily reflect the views of BCM or the sponsoring agency.

ISBN: 978-1-888997-84-2

BioEd℠

BioEd℠ Teacher Resources from the Center for Educational Outreach at Baylor College of Medicine.

Authors: Nancy P. Moreno, PhD, Ronald L. McNeel, DrPH, Barbara Z. Tharp, MS, Gregory L. Vogt, EdD, and James P. Denk, MA
Editor: James P. Denk, MA
Designer: Martha S. Young, BFA

Acknowledgments

This project at Baylor College of Medicine has benefited from the vision and expertise of scientists and educators in a wide range of specialties. Our heartfelt appreciation goes William A. Thomson, PhD, Professor and Director of the Center for Educational Outreach, and C. Michael Fordis, MD, Senior Associate Dean and Director of the Center for Collaborative and Interactive Technologies at Baylor College of Medicine, who have lent their support and expertise to the project.

We are especially grateful to the many classroom teachers in the Houston area who participated in the field tests of these materials and provided invaluable feedback.

All persons depicted in photographs throughout this guide are models and their images are used strictly for illustrative purposes only. The images are not intended to represent the model, nor any person living or deceased.

Contact

Center for Educational Outreach, Baylor College of Medicine
One Baylor Plaza, BCM411, Houston, Texas 77030
713-798-8200 • 800-798-8244
edoutreach@bcm.edu | www.bioedonline.org | www.bcm.edu

1

Setup: 15 minutes | **Class:** One 45-minute class period

Decisions and Risk

Overview

- Students practice evidence-based decision-making by examining a simple choice: whether or not to consume a soft drink. They revisit their decisions after calculating the amount of sugar in a typical single-serving bottle.
- Students estimate and rank the risks of dying from a variety of causes, and then compare their estimates to actual data. Students discover that heart disease is a leading cause of death in the United States.

Nutrition Facts

Serving Size 20 fl oz
Servings Per Container 1

Amount Per Serving	% DV*
Calories 240	
Total Fat 0g	**0%**
Sodium 75 mg	**3%**
Total Carbohydrate 65g	**22%**
Sugars 65g	
Protein 0g	

Not a significant source of calories from fat, saturated fat, trans fat, cholesterol, dietary fiber vitamin A, vitamin C, calcium and iron.

* Percent Daily Values (DV) are based on a 2,000 calorie diet.

Typical nutrition facts label for a 20-fluid-ounce bottle of cola.

Personal choices are part of everyday life. Whether choosing what to wear in the morning, what to have for lunch, or which college to attend, our days are filled with decisions. Do we approach decision-making in a systematic and organized way? Perhaps not often enough, particularly when making decisions that affect our health, or that of our family members. A 2009 study concluded that more than one million people die needlessly each year due to decisions they have made. Why do we make poor choices, such as smoking, eating lots of high-sugar foods, or drinking too much alcohol? Peer pressure, resistance to change and misperceptions about risk all contribute to choices with potentially bad outcomes.

A choice that involves risk implies possible negative consequences. While we cannot avoid all risk (the Chinese symbol for risk even combines two characters, corresponding to "danger" and "opportunity"), solid decision-making requires the ability to assess risk and apply evidence appropriately. Consider the possible outcomes of a driver speeding to work or school in the morning. If all goes as planned, the motorist arrives on time to begin his or her day. But other more negative outcomes, such as being ticketed for speeding or having an accident, also are possible. Behavior that involves risk always can have a negative outcome. Fortunately, we can learn to make better choices, particularly those related to our health.

This lesson poses a simple choice: should students drink a sugar-sweetened beverage, or not? Studies show that people who regularly eat or drink products with added sugar tend to consume more calories than people who consume fewer of these items. Research also links sweetened beverages to weight gain. Cutting back on added sugars, especially from sweetened beverages such as regular soda and fruit-flavored drinks, can help to maintain a healthy weight and reduce the risks for several diseases.[1]

Materials

Teacher

- Pad of sticky notes (one note per student)
- 16- or 20-oz bottle of soft drink, any flavor (not sugar-free or diet)

Per Team of Students

- Plastic teaspoon
- 16-oz clear plastic cup
- 30 single-serving sugar packets
- Empty soft drink can or single-serving bottle (not sugar-free or diet, groups may have bottles from different sizes and kinds of drinks)
- Access to a calculator or computer
- Sheet of 8.5 in. x 11 in. paper
- Tape or glue stick
- Copy of "Sweetened Soft Drinks" page (one per group or student)
- Copy of "Selected Causes of Death" page (to save time in class, you may cut the sheet into strips for students ahead of time)

- Pair of scissors (only if students will be cutting statements into strips)
- Copy of "Lifetime Risk of Dying from Different Causes" page

Setup

Place all supplies in a central location for distribution and return. Students should work in teams of four.

Procedure

Part One: Informed Choices

1. Tell students they will explore human body systems and learn how to use evidence to make better decisions for themselves, or maybe other people. They will place themselves in the roles of scientists, healthcare providers and even persons with common health problems. Ask, *Would you choose to have diabetes? How about cancer or heart disease?* Follow by asking, *Do we deliberately choose or decide on bad things for our lives?* Allow a few minutes for students to think about and discuss these questions.
2. Follow by saying, *Let's focus on a simple decision.* Show students a standard 16- or 20-ounce soft drink bottle. Ask for a show of hands in response to the question, *Would you decide to drink this beverage?* Create a T-chart on the board with one side labeled "yes" and the other side labeled "no." Give every student a sticky note and have each write one reason either for ("yes") or against ("no") consuming the soft drink. Have a few students collect and post the notes on the chart. Tally the notes "for" and "against," and announce whether or not the majority of students would drink the bottle of soda.
3. As a class, identify and discuss the most common reasons for or against consuming the soft drink. Ask, *Do any of these reasons change your thinking?*
4. Tell students that they are going to gather more information about the soft drink. Divide the class into teams of four students, and have each team pick up the following supplies: one clear plastic cup, 30 sugar packets, one empty soft drink container, and at least one copy of the "Sweetened Soft Drinks" page.
5. Have each team follow the instructions on the "Sweetened Soft Drinks" page, and estimate the number of teaspoons of sugar in a 16- or 20-ounce soft drink (same size as shown to the class earlier). Tell them to be realistic, and explain that each sugar packet contains approximately one teaspoon of sugar. Direct teams to count out (but not open) the number of sugar packets they predict for the soft drink, and place the packets in their plastic cups.
6. Have teams compare the amounts of sugar estimated by the different groups.
7. On the board, write the grams of sugar in the drink you brought to class (a 16-ounce bottle typically has 54 grams of sugar; a 20-ounce bottle has 65 grams). Have each team use the formula below to calculate the number of teaspoons of sugar in the soft drink.

   Number of teaspoons of sugar = total grams / four grams of sugar per teaspoon
8. Have teams report and discuss their calculations. A 16-ounce drink with 54 grams of sugar would have 13.5 teaspoons of sugar; a 20-ounce drink with 65 grams of sugar would have 16.25 teaspoons.
9. Ask, *How many Calories do you think are in the soft drink?* Direct teams to complete the sheet and report their results to the rest of the class.
10. Have students put the sugar packets back into the cup and return all supplies to the central station.
11. Ask students if they were surprised by the amount of sugar or Calories in the soft drink.

Adolescents and Risk

Adolescents choose to engage in risky behaviors at a much higher rate than adults. Recent research shows that adolescents typically underestimate risks when the outcomes are ambiguous—in other words, the likelihood of a good or bad outcome is not known. This behavior probably is related to a need, typical of all young organisms, to explore and learn about the world. However, adolescents' attitudes toward risk change when the probabilities of alternative outcomes are known. In situations where risks are clearly stated, adolescents are more likely to avoid risky behaviors at about the same level as adults. These findings reinforce the importance of helping young people learn to use information to make better choices for their own health and well-being, and that of their families.

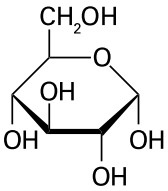
Tymula A, et al., 2012, PNAS 109:42, 17135–17140.

Discuss the role of carbohydrates in living organisms. Carbohydrates store energy in the form of chemical bonds. This energy becomes available when our bodies process the food we eat. When we eat too many Calories, the excess energy can be stored as fat.

12. Ask, *Given what you now know about the sugar content in this soft drink, would you choose to consume it?* Have students raise their hands or move their sticky notes to the appropriate side on the T-chart. Ask, *Have you ever had a "Big Gulp"? Did you know that a 32-ounce soft drink has about 27 teaspoons of sugar and 432 Calories?*
13. Ask, *Might you make different decisions about soft drinks in the future, based on what you just learned? Why or why not?* Lead a class discussion about the importance of using accurate information to make decisions. Mention that most decisions require us to choose between multiple options, which can lead to different outcomes (positive or negative).

Sugar Stores Energy

Carbohydrates store energy and serve as an organism's building materials. Carbohydrate molecules usually contain the elements carbon (C), hydrogen (H) and oxygen (O) in the molar ratio 1:2:1. Simple sugars, the smallest carbohydrate molecules, may contain as few as three carbon atoms. Sugars that are important for energy storage have six carbons. Glucose (a form of sugar), which exists as a ring structure in solution, is shown here to the right.



Fructose, another six-carbon sugar, combines with glucose to form sucrose (common table sugar). When linked in chains of hundreds of molecules, simple sugars form long molecules, known as polysaccharides (including starch in plants and glycogen in animals).

Part Two: Risk

1. Ask, *Do you think some decisions are riskier than others? What is "risk," anyway?* [Risk involves behaviors or actions that have possible adverse outcomes.] Explain that one way to quantify risk is to state it as likelihood that something will occur. In fact, scientists are able to estimate the risk of many kinds of events by studying how frequently they have happened in the past.
2. Provide a "Selected Causes of Death" sheet to each student team. Teams should read all of the statements, and use the scissors to cut the statements into strips (unless you have pre-cut the sheets).
3. Have teams discuss and predict how likely it is for each event to occur, and then arrange the statements from highest risk (top) to lowest risk (bottom). Provide tape and a separate sheet of paper on which students can secure their strips.
4. Discuss students' predictions briefly, asking which causes of death they ranked as being the highest and lowest risks. Allow groups to share some of their predictions and explain the reasoning behind their choices.
5. Distribute a copy of the "Lifetime Risk of Dying from Different Causes," sheet to each group, or project the sheet in front of the class. Tell students that the sheet shows estimates of the lifetime risk of dying from a variety of causes, based on the United States population. (In this activity, "lifetime risk" is the likelihood that an average person will die from the disease or type of accident indicated.)[2]
6. Lead a class discussion in which students compare their predictions to the actual statistics. Students will discover that two leading causes of death in the United States (heart disease and stroke) involve the cardiovascular system.

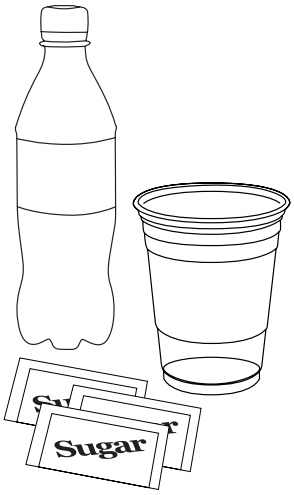
Extensions or Homework

- Have each student record (1) the kind and size of each sweetened drink (soft drinks, sweet tea, juice drinks, etc.) that he or she consumes in a 24-hour period, and (2) use label information or online calorie counters to estimate the total amount of sugar and calories in those drinks.
- The FDA recently began taking steps to reduce or eliminate the use of artificial trans fats in foods, because they increase the risk for heart disease. Lead a class discussion, or have students write essays about the pros and cons of taking similar action to limit the amount of sugar that manufacturers add to foods. ■

1 National Heart, Lung and Blood Institute (www.nhlbi.nih.gov).
2. National Safety Council. 2012. Lifetime odds of death for selected causes, in *Injury Facts 2012 Edition*, pages 41–43.

Sweetened Soft Drinks

Your group will need: one clear plastic cup, 30 sugar packets, one empty soft drink bottle and a calculator.



INSTRUCTIONS

1. Within your group, estimate how many teaspoons of sugar you believe are in the soft drink shown by your teacher.

   Estimate:_____ teaspoons

2. Each sugar packet contains approximately one teaspoon of sugar. Count out the number of packets that represents the number of teaspoons of sugar your team predicted. *Do not open the packets.* Place the unopened packets in the plastic cup.

3. Appoint one member to report your team's estimate to the rest of the class.

4. Your teacher will tell you the total number of grams of sugar in the drink. Write that number below.

   _____ grams

5. A packet or teaspoon contains approximately four grams of sugar. Use this information to calculate the number of teaspoons of sugar in the soft drink.

   Number of teaspoons of sugar = total grams / four grams of sugar per teaspoon

   Answer:_____ teaspoons of sugar in the soft drink

6. Since one gram of sugar has four Calories, how many Calories are in the soft drink?

   Answer:_____ Calories in the soft drink

7. Calculate the difference between your team's original estimate and the actual number of teaspoons of sugar in the soft drink.

   Difference =_____ teaspoons

8. Using the Nutrition Facts label on your group's soft drink container, repeat step 5 to calculate the number of teaspoons of sugar that would be that drink. Remember, one teaspoon of sugar weighs four grams.

   Answer:_____ teaspoons of sugar in the team's soft drink container

9. Repeat step 6 to calculate the number of Calories that would be in your team's drink. Keep in mind that one gram of sugar has four Calories [kcal].

   Answer:_____ Calories in the team's soft drink container

Selected Causes of Death

What are the lifetime risks of dying from the causes below? Cut out each statement (if your teacher has not already done so) and arrange the statements in order of likelihood from the most risk (top) to least risk (bottom). Secure the strips with tape to a piece of paper.

Accident while riding a bicycle

Victim of a cataclysmic storm (hurricane, tornado, etc.)

Accidental/unintended poisoning by alcohol, drugs, other chemicals

Accident involving fireworks or firecrackers

Being killed during an earthquake

Heart disease, heart failure or heart attack

Exposure to hornets, wasps or bees

Intentional self-harm

Being killed by a flood

Any kind of cancer

Bitten or attacked by dog

Struck by lightning

Accident while walking (pedestrian)

Accidental shooting

Stroke

Legal execution

Exposure to excessive natural heat

Accidental drowning

Accident while riding in a car (driver or passenger)

Falls

Intentional shooting (shot by someone with a firearm)

Any kind of motor vehicle accident

Lifetime Risk of Dying from Different Causes

Lifetime Risk	Cause of Death
1 in 6	Heart disease, heart failure or heart attack
1 in 7	Any kind of cancer
1 in 29	Stroke
1 in 98	Any kind of motor vehicle accident
1 in 109	Intentional self-harm
1 in 127	Accidental/unintended poisoning by alcohol, drugs or other chemicals
1 in 163	Falls
1 in 321	Intentional shooting (shot by someone with a firearm)
1 in 368	Accident while riding in a car (driver or passenger)
1 in 701	Accident while walking (pedestrian)
1 in 1,103	Accidental drowning
1 in 4,381	Accident while riding a bicycle
1 in 6,609	Accidental shooting
1 in 13,217	Exposure to excessive natural heat
1 in 29,196	Victim of a cataclysmic storm (hurricane, tornado, etc.)
1 in 79,842	Exposure to hornets, wasps or bees
1 in 97,807	Being killed during an earthquake
1 in 111,779	Legal execution
1 in 143,906	Struck by lightning
1 in 144,899	Bitten or attacked by dog
1 in 558,896	Being killed by a flood
1 in 652,046	Accident involving fireworks or firecrackers