Activity 7 You Bet Your Life!

Objectives

- Understand concept of probability
- Conduct trials and observe outcomes
- Use a mathematical model to approximate a real-life situation
- Understand applications of probability in real-life situations

Materials	paper, pencils, calculators
Time	45 minutes
Math Idea	Events in real life are not solely determined by chance; nor are all outcomes equally probable. Even so, probability can be used as a basis for evaluating risks and making real-life choices.

Prior Understanding

Students should know how to convert among fractions, decimals, and percents.

Introduction

Use the following information as an introduction. Then have students do the activity.

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- *The American Cancer Society estimates that each year more than 430,000 people in the U.S. die as a result of smoking.*
- *Smoking accounts for nearly 90% of deaths from lung cancer.*
- *The risks of dying from lung cancer are 23 times greater for male smokers and 13 times greater for female smokers than for non-smokers.*
- *In the U.S., more than 70% of adults who smoke began smoking before age 18.*

Would you bet your life by smoking?

Discussion

Students' opinions will vary. The model used assumes that each student will get, at most, one disease, which is a simplified and conservative estimate of risk for smokers. It is important for students to understand that there are varying probabilities for contracting different diseases, and that some diseases are more likely to be contracted than others. It is up to them to evaluate the risks.

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Exercise 1

Ask students to name other diseases related to smoking. Make a list on the chalkboard. Ask students whether they think every smoker will develop at least one of these diseases.

Divide the class into small groups (4 or 5 students each). Give each group a pair of dice. Have each group designate one student to be the record-keeper. Give a copy BLM 7 to each record-keeper. Explain that that each member of each group will take a turn rolling the dice. Each student in the group will roll the dice one time while the record-keeper enters the outcome and its corresponding disease in each row of the table. As the record-keeper records the outcomes, he or she should inform the dice-roller whether he or she will "contract a disease" and, if so, which one.

When all the groups have finished, make a class tally on the chalkboard. You can use a chart like the one shown to summarize the results.

Discuss the results and have students evaluate the risks.

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Disease	Group Total	Group Total ÷ Total Number of Students	Percent of Class "With Disease"
H	2	2/20	10%
CL	3	3/20	15%
CM	1	1/20	5%
ST			
EM			
LC			
BR			
HD			
UL			
WR			
CT			

Discussion

Smoking-related diseases include cancer of the larynx, pharynx, mouth, lips, tongue, esophagus, bladder, kidney, stomach, pancreas, and colon; cardiovascular disease including stroke, heart attack, pe-

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ripheral vascular disease, aneurysm, and atherosclerosis; pulmonary illnesses such as pneumonia, emphysema, and bronchitis; reproductive problems such as stillbirth, low birth weight, and reduction of fertility; other effects such as cataracts, gum disease, ulcers, wrinkles, hypertension, and delayed healing. Diseases from each of the categories are represented in the key for BLM 7.

Students should realize that some smokers will get one of these diseases, some will get more than one of these diseases, and some smokers will get none. Students may have heard stories about people who smoked, drank, and "had a good time" all their lives and are still healthy and happy at age 100. As it is rare to hear of an adolescent with lung cancer, an adolescent who is currently healthy tends to think long-term health consequences are too far off in the future to be real or threatening. It is true that there are individuals who engage in behaviors that have a high **probability** of leading to disease, but who "beat the odds." The examples used here are for simulation purposes. The actual incidences of these diseases are influenced by many factors.

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Activity 7 You Bet Your Life! Teacher Support

Vocabulary

probability a number from 0 to 1 that expresses the likelihood that a given event (or set of outcomes) will occur

Ongoing Assessment

In the model, why do you think lung cancer corresponded to a total of 7, while healthy corresponded to a total of 2? *(The probability of contracting lung cancer is higher than the probability of contracting any of the other diseases; the probability of staying healthy is very small. When rolling two dice, there is only one way to roll a sum of two for a probability of 1/36 or 2.6%; there are six ways to roll a sum of seven for a probability of 6/36 or 16.7%. This way the assignments better reflect the real-life situation.)*

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Added Practice 7 You Bet Your Life!

Name _____ **Date** _____

Suppose that recently you have been diagnosed with a minor physical ailment. You are considering having your doctor treat your condition with a medical procedure, but you are not sure how safe this procedure is. To determine whether the chance of treatment is worth the risk of complications, you make an appointment to speak with your doctor about it. “Don't worry," your doctor tells you, "this procedure is 99% safe." You mention that you had heard that there can be complications with this procedure, and you tell that to your doctor. "Complications are a possibility," your doctor replies, "but the risk is only one-in-a-million." You ask your doctor how often patients in the hospital where he works have had problems with the procedure. "Oh, it usually goes quite well," he answers. What is the problem with your doctor's assessment of this procedure's risk?

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Answer Key Added Practice 7 You Bet Your Life!

Your doctor has reported three significantly different levels of risk. The first time, the doctor says that the procedure is 99% safe, meaning 99 times out of 100 there would be no complications. This is the same as saying 1 person out of 100 or 10,000 out of a million persons *will* have complications. The second time, the doctor says that the procedure has a one-in-a-million risk, which means that 1 person out of a million will have complications—that makes your chances of risk-free procedure a lot better than the 10,000 out of a million risk he reported the first time. The third time, the doctor says that the procedure usually goes well, which does not give you any specific data on which to base your decision. At the least, you can assume "usually" means that the procedure goes well more often than it does not go well—in other words, that it goes well at least 51% of the time and goes badly at most 49% of the time. At this level of risk, as many as 490,000 people out of a million will have complications. Clearly, this doctor does not understand probability—he does not know whether 1, 10,000 or 490,000 people out of a million will have problems with this procedure.

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Blackline Master 7 You Bet Your Life!

Name _____ **Date** _____

Use the table and the key below to record the results for your group.

Student	Dice Total	Disease Letter Code
#1		
#2		
#3		
#4		
#5		

Key

Dice Total	Disease	Letter Code
2	Healthy (no disease)	H
3	Cancer of the lips	CL
4	Cancer of the mouth	CM
5	Stroke	ST
6	Emphysema	EM
7	Lung cancer	LC
8	Bronchitis	BR
9	Heart disease	HD
10	Ulcers	UL
11	Wrinkles	WR
12	Cancer of the tongue	CT

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