Cancer Risk Computation

Grades

8-10

Subjects

Math and Health

Duration

30 minutes

Materials

Cancer risk handout and worksheet

Objective

Students will be able to think critically about the many factors that influence health effects.

Students will be able to confirm/refute cause and effect health claims using basic calculations.

Set

Ask students about any claims they have heard about the health benefits or health risks of various products and/or substances. Listen to some volunteers. Ask if they have ever seen or heard any figures to back these claims. Inform the class that they will be participating in a lesson designed to help them think more critically about health benefit/risk claims.

Instructional Input

Hand out the Calculating Cancer Risk scenario and worksheet. Go over the scenario with the students. Assist students with calculations as necessary.

Evaluation

Have students hand in the worksheet, or grade it in class. Go over the calculations and the answers to the follow up questions with the students. The key is included with this lesson plan.

Closure

Challenge the students to identify claims or news stories similar to the cellular phone scenario. See if the class can prove or disprove the claim or opinion.

Calculating Cancer Risk

NAME_____

Scientists often have a hard time stating that a chemical or product is 100% safe or 100% harmful to human health. A certain amount of uncertainty is always present when attempting to identify potential health effects of chemicals, products, or human behavior. Sometimes, our own opinions shape our perception about health risks. Other times we rely on newspaper stories to help us form our perception of risk. Other times we rely on facts and figures to provide us with the information we need to make a decision about accepting or rejecting a potential health risk. Sometimes, facts, figures, and public opinion are used to change regulations regarding chemicals, products, or human behaviors. If good science is not used to analyze the data, incorrect links can be made between health effects and their potential causes. The following example illustrates the need to exercise caution when relying on news stories or numbers when trying to identify the cause of a health effect.

A local newspaper reporter noted the rate of reported brain cancers in his home state seemed to be increasing at a dramatic rate. While searching for a potential cause, the reporter came across stories implicating the use of cellular phones with increased risk of brain cancer. The argument was made that the electromagnetic waves produced when using cellular phones, which are held against the head, could be responsible for additional cases of brain cancer. Intrigued by these stories, the reporter researched population information and reported cancer rates over a 20 year period. The reporter found that in 1980 there were 1,800,000 people in the state with zero (0) cellular phone users. In 2000, there were 2,000,000 people residing in the state, 300,000 of whom used cellular phones. In 1980 there were 1,800 reported cases of brain cancer in the reporter's state. The number of reported cases of brain cancer jumped to 4,000 in twenty years. It appeared to the reporter that in those 20 years, the number of brain cancer cases more than doubled. It seemed reasonable to the reporter that the increase must at least in part be due to cellular phone use.

Armed with facts and figures, the reporter wrote an article about the health risk of using cellular phones. The article was submitted to the newspaper's editor for review. The editor realized that such an article could have major impacts on public perception of cellular phones. The editor decided to look into the matter a bit further by mathematically analyzing the reporter's information. The reporter's information was organized into the following table. You have been asked by the editor to prove or

disprove the reporter's claim that cellular phone use is causing additional brain cancer cases in your state.

	1980	**2000**
Population	1,800,000	2,000,000
Reported Brain Cancer Cases	1,800	4,000
Cell Phone Users	0	300,000

Using the information provided in the table, answer the following questions.

1. What was the risk of a person developing brain cancer in 1980? (hint: # of cases / population)

_____ _____ _____
decimal value percent # per 1,000

2. What was the risk of a person developing brain cancer in 2000?

_____ _____ _____
decimal value percent # per 1,000

3. A person's risk of developing brain cancer in 2000 was _____ times as high as it was in 1980.

4. Given the risk for developing brain cancer in 2000, how many cases of brain cancer would you expect to see among those people who use cellular phones? (hint: # cell phone users **x** cancer risk rate)

5. After checking with your state's Cancer Data Registry, you find out that there were 250 cases of reported brain cancers among cellular phone users. How does this compare with the number of brain cancer cases you would expect to see in this group?

6. Based on your answers to questions #4 and #5, would you allow the reporter to print their story? Why or why not?

7. Upon further research, you discover that life expectancy increased by ten years from 1980 to 2000. What impact could increased life expectancy have on the increase of reported brain cancer cases from 1980 to 2000? Explain your answer.

8. Through further research, you discover that access to health care and the availability of effective cancer treatment programs has increased. What impact would these two items have on the increase of reported brain cancer cases from 1980 to 2000? Explain your answer.

9. Prior to 1982, your state did not have a system in place to report cancer cases. In 1982, the state created a Cancer Data Registry. The registry records information about all diagnosed cancer cases in the state. What impact would the creation of a Cancer Data Registry have on the number of reported cancer cases between 1980 and 2000? Explain your answer.

10. What have you learned about taking reported information at face value?

KEY

	1980	2000
Population	1,800,000	2,000,000
Reported Brain Cancer Cases	1,800	4,000
Cell Phone Users	0	300,000

Using the information provided in the table, answer the following questions.

1. What was the risk of a person developing brain cancer in 1980? (hint: # of cases / population)

_____0.001_____ _____0.1%_____ _____1_____
decimal value percent # per 1,000

2. What was the risk of a person developing brain cancer in 2000?

_____0.002_____ _____0.2%_____ _____2_____
decimal value percent # per 1,000

3. A person's risk of developing brain cancer in 2000 was _2_ times as high as it was in 1980.

4. Given the risk for developing brain cancer in 2000, how many cases of brain cancer would you expect to see among those people who use cellular phones?

   600=[(300000/1000)X2] or (300000 x 0.002)

5. After checking with your state's Cancer Data Registry, you find out that there were 250 cases of reported brain cancers among cellular phone users. How does this compare with the number of brain cancer cases you would expect to see in this group?

   350 fewer cases

6. Based on your answers to questions #4 and #5, would you allow the reporter to print their story? Why or why not?

   No, the results of the numerical analysis do not match the reporter's conclusion. Since there were fewer observed cancers among cell phone users than expected based on the population's cancer rate, you can not reasonably assume that cell phones cause brain cancer

7. Upon further research, you discover that life expectancy increased by ten years from 1980 to 2000. What impact could increased life expectancy have on the increase of reported brain cancer cases from 1980 to 2000? Explain your answer.

   If the state's population is increasing and living 10 years longer than in the past, there are more people alive at any given time which creates more potential cases of cancer.

8. Through further research, you discover that access to health care and the availability of effective cancer treatment programs has increased. What impact would these two items have on the increase of reported brain cancer cases from 1980 to 2000? Explain your answer.

   Better health care and treatment programs could prolong the life of cancer patients, causing more cases to remain alive longer than they would have in 1980. Combine this with the effect of a larger population and greater longevity and the number of expected cancer cases increases. Also, cases in 1980 may not have been diagnosed if diseased people were not able to access health care.

9. Prior to 1982, your state did not have a system in place to report cancer cases. In 1982, the state created a Cancer Data Registry. The registry records information about all diagnosed cancer cases in the state. What impact would the creation of a Cancer Data Registry have on the number of reported cancer cases between 1980 and 2000? Explain your answer.

   Cases prior to 1982 may have been underreported. In reality, there may have been many more than 1800 cases in 1980. Some cases may have gone unreported. By instituting a registry, the chances that an individual case of cancer will be adequately reported dramatically increases.

10. What have you learned about taking reported information at face value?

    Expect a variety of answers here.