

Likelihood of Cancer

Suggested Grade Levels: 9 and up

Possible Subject Area(s): Social Studies, Health, and Science

Math Skills: reading and interpreting pie charts; calculating and understanding percentages and proportions

Overview: Students will be presented with two pie charts, one showing the leading cause of death in the United States for people ages 10-24 and one for people ages 25 and older (pie chart data for 33 individual states are also available on line). Students will examine the national data and answer a series of questions designed to help them understand and compare the two charts. Then they will be presented with cancer incident data for two different age groups to compare with the pie chart data and to investigate the likelihood of developing different types of cancer at different ages (other datasets can be generated using the DEVCAN database of cancer data available on line).

Student Activities: Likelihood of Cancer

- A. What do you think is the leading cause of death for people between the ages of 10 and 24 years old in the United States?

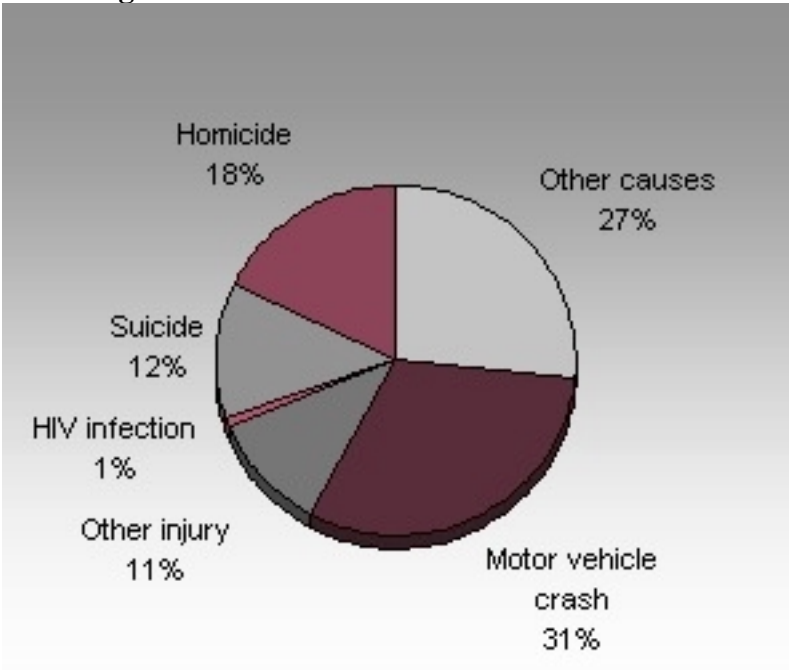
What do you think is the leading cause of death for people over the age of 25 years old in the United States?

Do you think the likelihood of getting cancer increases, decreases or stays the same, as a person gets older?

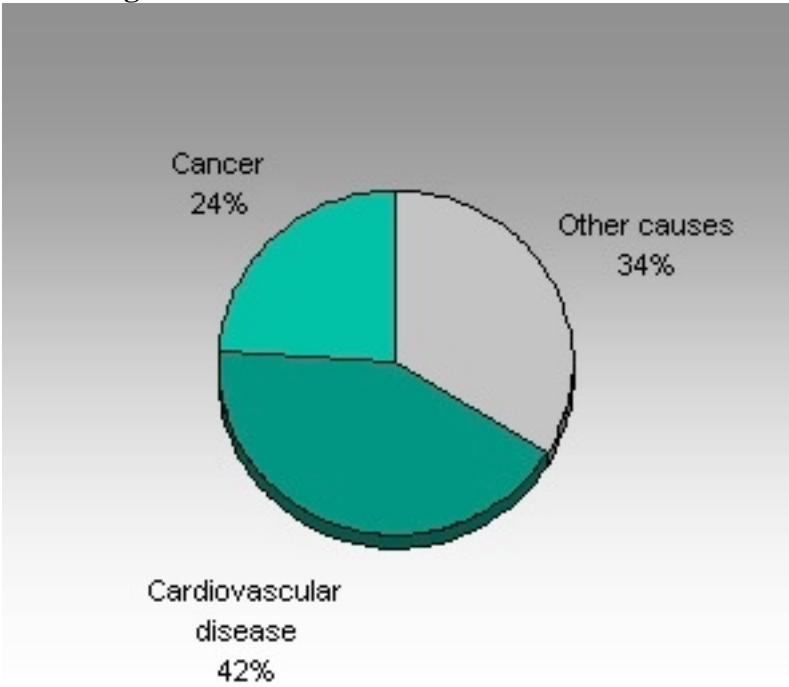
- B. The following pie charts show data on the causes of death for people between the ages of 10 and 24 years in the United States and for people over the age of 25 years. Use these charts to check your answers to the first two questions in part A and to answer the questions that follow:

<http://www.cdc.gov/nccdphp/dash/yrbs/pies99/index.htm>

**Leading Causes of Death in the United States, 1999
Youth Ages 10-24**



**Leading Causes of Death in the United States, 1999
Adults Ages 25 and Older**



1. What percentage of people between the ages of 10 and 24 years old died of suicide in the United States in 1999?
2. Do the percentages for the first pie chart add up to 100%?
3. What piece of information do you need to calculate the number of people between the ages of 10 and 24 who died in motor vehicle crashes in 1999?
4. What are some of the causes of death that would be included in the “Other causes” section of the chart?
5. Below are data from Nevada (data from 33 states are available online). Explain how it can be true that Nevada has a higher percentage, but a lower total number deaths from motor vehicle crashes, than the United States.

Cause of Death	Percentage
Motor vehicle crash	37%
Other causes	23%
Homicide	18%
Suicide	15%
Other injury	7%

6. What percentage of adults over the age of 25 years died from cancer in the United States in 1999?
 7. What are some of the causes of death that would be included in the “Other causes” section of the chart?
 8. Why is it important to consider age and gender when evaluating death statistics?
 9. If you compare the second pie chart to the first, do the data suggest that older Americans are better drivers than younger Americans? Why or why not?
 10. If you compare the second pie chart to the first, do the data suggest that older Americans are more likely to die of cancer than younger Americans? Why or why not?
 11. Does this pie chart suggest that a 25-year-old person has a 24% chance of dying of cancer in 1999? Why or why not?
- C. Now we will examine a different dataset to investigate the likelihood of developing different types of cancer at different ages.

<http://www.srab.cancer.gov/devcan/canques.html>

The above web site (i.e., DEVCAN) uses real incident and mortality data to calculate incident and mortality rates of cancer based on age and gender. Below are data generated using the DEVCAN database on the percentage of people estimated to develop certain types of cancer (lung, breast, melanoma, and all cancers combined, which includes many other individual types besides these three) between the ages of 20 and 25 years compared to the percentage of people estimated to develop these cancers between the ages of 60 and 65 years.

	20-25 year olds				60-65 year olds			
	All cancer	Lung cancer	Breast cancer	Melanoma	All cancer	Lung cancer	Breast cancer	Melanoma
Men	0.15%	0%	0%	0.01%	7.17%	1.10%	0.02%	0.36%
Women	0.19%	0%	0.01%	0.03%	5.48%	0.74%	2.20%	0.20%
Both	0.17%	0%	0%	0.02%	6.30%	0.91%	1.13%	0.28%

Answer the following questions to test your understanding of the table above and how it relates to the two pie charts that we examined earlier.

1. Is melanoma, a serious form of skin cancer, more likely to occur in men or women between the ages of 20 and 25 years old? What about between the ages of 60 and 65 years old?
2. Which of the three specific types of cancers listed in the table has the greatest increase in occurrence between the two age groups? Which type increases the most in men?
3. Why is it important to consider age and gender when evaluating the probability of developing cancer?
4. Do you think the probability of dying of these specific cancers is greater or less than the probability of developing the cancers (you can use the database to check your answer)?

Information for the Teacher

Part A can be presented to the whole class and discussed in order to reach a class consensus regarding the answers.

Part B can be done individually or by groups of students and the answers should be discussed and clarified before moving on to the next section. A science course could include student research to define and investigate specific causes of death, such as:

1. What is an HIV infection and how is HIV related to AIDS? How is HIV transferred between people?
 - a. HIV is a virus that causes AIDS
 - b. HIV can be transferred between people via bodily fluids

2. What is cancer? Are all cancers caused in the same way? What are two major risk factors that contribute to a person's likelihood of developing cancer?
 - a. Cancer is the excessive growth and/or distribution of certain cells
 - b. There are many different types of cancer and many different factors contribute to the development of cancer
 - c. Genetic predisposition (i.e., family history) and exposure to certain environmental conditions (e.g., UV radiation) are two major risk factors for the development of particular cancers

3. What is cardiovascular disease? What are two of the factors believed to contribute to this disease?
 - a. Disease of the heart and/or vascular (blood vessel) systems, which is usually characterized by a build-up of deposits within the vessels
 - b. A diet high in fat and lack of exercise are two factors believed to contribute to the development of cardiovascular disease

Part C data were generated using the DEVCAN website. The specifics about this website are as follows, however, students do not need to understand the details to be able to complete the exercise. The website can be used to investigate the likelihood of developing and/or dying from any or all types of cancer at any 5 year age interval and is relatively user-friendly.

The DEVCAN website uses incident and mortality data to calculate incident and mortality rates of cancer using population estimates from census data. The cancer incident and mortality data come from the Surveillance, Epidemiology, and End Results (SEER) Program conducted by the National Cancer Institute. The calculated rates are converted to probabilities using an exponential model and the probabilities are applied to a hypothetical population of ten million live births. For each five-year time interval, this system estimates the number in this population dying of other causes, the number of new cancer cases, the number alive and cancer free at the beginning of the interval, and the lifetime probability of developing cancer. There are two databases from which these

estimates can be obtained. SEER 9 registries are from Atlanta, Connecticut, Detroit, Hawaii, Iowa, New Mexico, San Francisco-Oakland, Seattle-Puget Sound, and Utah. SEER 12 registries consist of SEER 9 plus Los Angeles, San Jose-Monterey, and the Alaska Native Tumor Registry.

Answers to Problems and Questions

A. Questions posed for discussion. Students will discover the answers in parts B and C.

B. Answers to the first two questions from section A based on the pie charts:

The leading cause of death for people between the ages of 10 and 24 years old in the United States is motor vehicle accidents.

The leading cause of death for people over the age of 25 years old in the United States is cardiovascular disease.

Follow-up questions:

1. The percentage of people between the ages of 10 and 24 years old died of suicide in the United States in 1999? 12%
2. Do the percentages for the first pie chart add up to 100%? Yes
3. What piece of information do you need to calculate the number of people between the ages of 10 and 24 who died in motor vehicle crashes in 1999? Total number of deaths between the ages of 10-24 years old in the United States in 1999
4. What are some of the causes of death that would be included in the “Other causes” section of the chart? Cancer and other illnesses
5. Below are data from Nevada (data from 33 states are available online). Explain how it can be true that Nevada has a higher percentage, but a lower total number of crashes, than the United States. A state has fewer deaths than the whole country, but the percentage of motor vehicle crash deaths may be higher in a state if a larger fraction of that smaller number results from auto crashes.
6. What percentage of adults over the age of 25 years old died from cancer in the United States in 1999? 24%
7. What are some of the causes of death that would be included in the “Other causes” section of the chart? Auto crashes, homicide
8. Why is it important to consider age and gender when evaluating death statistics? Because certain causes are more likely in certain people. Heart disease usually develops in older people; breast cancer is more common in women.

9. If you compare the two pie charts, do the data suggest that older Americans are better drivers than younger Americans? Why or why not? No, without knowing the total number of car crash deaths in each age group compared to the total number of drivers in each age group, we cannot make this comparison.
10. If you compare the two pie charts, do the data suggest that older Americans are more likely to die of cancer than younger Americans? Why or why not? It does suggest it, because the percentage of younger Americans dying from cancer would be included in the 27% “other causes” category in the first pie chart, and is presumably lower than 24%. However, without knowing the total number of deaths and the total number of people in each of these categories, we do not know for certain.
11. Does this pie chart suggest that a 25-year-old person has a 24% chance of dying of cancer in 1999? Why or why not? No, the chart shows that 24% of all people over the age of 25 who died in 1999 died of cancer.

C. Answer to questions:

1. Is melanoma, a serious form of skin cancer, more likely to occur in men or women between the ages of 20 and 25 years old? What about between the ages of 60 and 65 years old? It is more prevalent in younger women, but more prevalent in older men.
2. Which of the three specific types of cancers listed in the table have the greatest increase in occurrence between the two age groups? Which type increases the most in men? Breast cancer increases the most overall. Lung cancer increases the most in men.
3. Why is it important to consider age when evaluating the probability of developing cancer? The probabilities change dramatically with age.
4. Do you think the probability of dying of these specific cancers is greater or less than the probability of developing the cancers (you can use the database to check your answer)? The probability of dying of cancer is less than the probability of developing cancer, because to die from it you must develop it first and then die from it. The probability of both of those events happening is lower than the probability of one event (i.e., developing cancer).

References and Resources

National Cancer Institute

<http://www.seer.cancer.gov>

Probability of Developing or Dying from Cancer

<http://www.srab.cancer.gov/devcan/canques.html>

Centers for Disease Control and Prevention

<http://www.cdc.gov>

Leading Causes of Mortality by State

<http://www.cdc.gov/nccdphp/dash/yrbs/pies99/index.htm>