Measures of Morbidity and Mortality Used in Epidemiology

LEARNING OBJECTIVES

By the end of this chapter the reader will be able to:

- define and distinguish among ratios, proportions, and rates
- explain the term population at risk
- identify and calculate commonly used rates for morbidity, mortality, and natality
- state the meanings and applications of incidence rates and prevalence
- discuss limitations of crude rates and alternative measures for crude rates
- apply direct and indirect methods to adjust rates
- explain when either direct or indirect rate adjustment should be used

*Refer to Appendix I for a Chapter 3 worksheet.

Study Questions

Instructions: Fill in the blanks with the terms below.

- attack rate
- proportional mortality ratio
- count
- rate
- incidence rate
- ratio
- proportion

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1. A ___________ refers merely to the number of cases of a disease or other health phenomenon being studied. (p. 108)
2. A ___________ is defined as “the value obtained by dividing one quantity by another.” (p. 109)
3. A ___________ is a type of ratio in which the numerator is part of the denominator. (p. 110)
4. Also a type of ratio, a ___________ differs from a proportion because the denominator involves a measure of time. (p. 111)
5. The term ___________ describes the rate of development of a disease in a group over a certain time period; this period of time is included in the denominator. (p. 118)
6. The ___________ is an alternative form of the incidence rate that is used when the nature of the disease or condition is such that a population is observed for a short time period, often as a result of a specific exposure. (p. 120)
7. The ___________ is the number of deaths within a population due to a specific disease or cause divided by the total number of deaths in the population. (p. 140)

**Calculation Problems**

8. In 2006, a total number of 2,426,264 resident deaths were registered in the United States. The estimated population in the United States as of July 1, 2006, was 299,398,484.
   a. Define the term **crude death rate** and give the formula.
   b. Calculate the crude death rate per 100,000 population.
9. As of June 30, 2009, the estimated population of Swaziland (located in southern Africa) was 1,123,913. The estimated number of deaths as of June 30, 2009, was 34,650. What is the estimated crude death rate per 1,000 population?
10. The following number of cases of norovirus were reported among employees of a long-term residential treatment facility in Oregon in 2007 (refer to Student Manual Table 3–1):

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of Respondents</th>
<th>Number Ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>43</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>99</td>
<td>39</td>
</tr>
</tbody>
</table>

*Based on 146 self-administered, anonymous questionnaires submitted by employees of wards with 10 or more cases; some employees did not answer all questions.


a. Define the term *attack rate* and give the formula.

b. Calculate the attack rates for males and females separately. What was the attack rate for all employees?

c. Among the ill respondents, calculate the proportion of male cases.

11. Student Manual Figure 3–1 indicates the prevalence of smoking at 3 months before pregnancy in selected states in the United States during the year 2005.
a. Define the term *prevalence*.

b. Give the formula for point prevalence.

c. Interpret Student Manual Figure 3–1, e.g., compare the states with the highest and lowest prevalence of smoking before pregnancy.
12. The following information was collected from the National Center for Health Statistics (NCHS) regarding the percentage of adults (aged 50 years and over) with physical limitations (refer to Student Manual Figure 3–2):

Which of the following statements is more appropriate based on the figure?

a. The prevalence of physical limitations increases with age.
b. The risk of physical limitations increases with age.

13. A total of 4,265,555 live births were registered in the United States in 2006. The estimated population of the United States on July 1, 2006, was 299,398,484.

a. Define the term *crude birth rate* and give the formula.
b. Calculate the crude birth rate per 1,000 persons in 2006.
14. The estimated population of women aged 15–44 years in the United States during 2006 is shown in Student Manual Table 3–2 below. There were 4,265,555 registered births during 2006.
   a. Define the term general fertility rate and give the formula.
   b. Calculate the general fertility rate per 1,000 women aged 15–44 years. You will need to calculate the total number of women aged 15–44 by using the data shown in the table.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–19</td>
<td>10,389,322</td>
</tr>
<tr>
<td>20–24</td>
<td>10,201,150</td>
</tr>
<tr>
<td>25–29</td>
<td>10,125,210</td>
</tr>
<tr>
<td>30–34</td>
<td>9,726,116</td>
</tr>
<tr>
<td>35–39</td>
<td>10,535,872</td>
</tr>
<tr>
<td>40–44</td>
<td>11,280,796</td>
</tr>
<tr>
<td>Total</td>
<td>?</td>
</tr>
</tbody>
</table>


15. Student Manual Table 3–3 shows the number of deaths for the five leading causes of death for the total population during 2006 in the United States (estimated population as of July 1, 2006 = 299,398,484).

<table>
<thead>
<tr>
<th>Rank Order</th>
<th>Cause of Death</th>
<th>Number</th>
<th>Proportional Mortality Ratio (%)</th>
<th>Cause-Specific Death Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diseases of heart</td>
<td>631,636</td>
<td>26.0</td>
<td>?</td>
</tr>
<tr>
<td>2</td>
<td>Malignant neoplasms</td>
<td>559,888</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>3</td>
<td>Cerebrovascular diseases</td>
<td>137,119</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>4</td>
<td>Chronic lower respiratory diseases</td>
<td>124,583</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>5</td>
<td>Accidents (unintentional injuries)</td>
<td>121,599</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>All causes</td>
<td></td>
<td>2,426,264</td>
<td></td>
<td>?</td>
</tr>
</tbody>
</table>


a. Define the term proportional mortality ratio and give the formula.
   b. Calculate the proportional mortality ratio for the second through fifth leading causes of death.
c. Define the term *cause-specific mortality rate* and give the formula.
d. Calculate the cause-specific mortality (death) rate for diseases of the heart.

16. There were a total of 28,527 registered deaths among children under 1 year of age in the United States in 2006. The estimated number of live births during 2006 was 4,265,555.
   a. Define the term *infant mortality rate* and give the formula.
   b. Calculate the infant mortality rate per 1,000 live births.