Mortality Frequency Measures

Mortality Rates

A **mortality rate** is a measure of the frequency of occurrence of death in a defined population during a specified interval. For a defined population, over a specified period of time,

$$\textit{Mortality rate} = \frac{\textit{deaths occurring during a given time period}}{\textit{size of the population among which the deaths occurred}} \times 10^n$$

When mortality rates are based on vital statistics (e.g., counts of death certificates), the denominator most commonly used is the size of the population at the middle of the time period. In the United States, values of 1,000 and 100,000 are both used for 10^n for most types of mortality rates. Table 2.8 summarizes the formulas of frequently used mortality measures.

Table 2.8
Frequently used measures of mortality

Measure	Numerator (x)	Denominator (y)	Expressed per Number at Risk (10^n)
Crude Death Rate	total number of deaths reported during a given time interval	estimated mid-interval population	1,000 or 100,000
Cause-Specific Death Rate	# deaths assigned to a specific cause duing a given time interval	estimated mid-interval population	100,000
Proportional Mortality	# deaths assigned to a specifc cause during a given time interval	total number of deaths from all causes during the same interval	100 or 1,000
Death-to-Case Ratio	# deaths assigned to a specific disease during a given time interval	# new cases of that disease reported during the same time interval	100
Neonatal Mortality Rate	# deaths under 28 days of age during a given time interval	# live births during the same time interval	1,000
Postneonatal Mortality Rate	# deaths from 28 days to, but not including, 1 year of age, during a given time interval	# live births during the same time interval	1,000
Infant Mortality Rate	# deaths under 1 year of age during a given time interval	# live births reported during the same time interval	1,000
Maternal Mortality Rate	# deaths assigned to pregnancy-related causes durirg a given time interval	# live births during the same time interval	100,000

Example

A total of 2,123,323 deaths were recorded in the United States in 1987. The mid-year population was estimated to be 243,401,000. HIV-related mortality and population data by age for all residents and for black males are shown in Table 2.9. We will use these data to calculate the following four mortality rates:

a. Crude mortality rate

b. HIV-(cause)-specific mortality rate for the entire population

c. HIV-specific mortality among 35- to 44-year-olds

d. HIV-specific mortality among 35- to 44-year-old black males

a. Crude mortality rate

$$= \frac{\text{number of deaths in the U.S.}}{\text{total population}} \times 100{,}000$$

$$= \frac{2{,}123{,}323}{243{,}401{,}000} \times 100{,}000$$

= 872.4 deaths per 100,000 population

TABLE 2.9
HIV mortality and estimated population by age group overall and for black males, United States, 1987

	All Races, all ages		Black Males	
Age Group (years)	HIV Deaths	Population (x 1,000)	HIV Deaths	Population (x 1,000)
0–4	191	18,252	47	1,393
5–14	47	34,146	7	2,697
15–24	492	38,252	145	2,740
25–34	5,026	43,315	1,326	2,549
35–44	4,794	34,305	1,212	1,663
45–54	1,838	23,276	395	1,117
≥55	1,077	51,855	168	1,945
Unknown	3		1	
Total	**13,468**	**243,401**	**3,301**	**14,104**

Source: 10

b. HIV (cause)-specific mortality rate for the entire population

$$= \frac{\text{number of HIV deaths}}{\text{population}} \times 10^n$$

$$= \frac{13{,}468}{243{,}401{,}000} \times 100{,}000$$

= 5.5 HIV-related deaths per 100,000 population

c. HIV-related mortality rate among 35- to 44-year-olds (cause-specific and age-specific mortality rate)

$$= \frac{\text{Number of HIV deaths in 35- to 44-year-olds}}{\text{Population of 35 to 44-year-olds}} \times 10^n$$

$$= \frac{4,794}{34,305,000} \times 100,000$$

= 14.0 HIV-related deaths per 100,000 35- to 44-year-olds

d. HIV-related mortality rate among 35- to 44-year-old black males (cause-, age-, race-, and sex-specific mortality rate)

$$= \frac{\text{Number of HIV deaths in 35- to 44-year-old black males}}{\text{Population of 35- to 44-year-old black males}} \times 10^n$$

$$= \frac{1,212}{1,663,000} \times 100,000$$

= 72.9 HIV-related deaths per 100,000 35- to 44-year-old black males

Morbidity Frequency Measures

To describe the presence of disease in a population, or the probability (risk) of its occurrence, we use one of the morbidity frequency measures. In public health terms, disease includes illness, injury, or disability. Table 2.4 shows several morbidity measures. All of these can be further elaborated into specific measures for age, race, sex, or some other characteristic of a particular population being described. We will describe how you calculate each of the morbidity measures and when you would use it. Table 2.5 shows a summary of the formulas for frequently used morbidity measures.

Table 2.5
Frequently used measures of morbidity

Measure	Numerator (x)	Denominator (y)	Expressed per Number at Risk (10^n)
Incidence Rate	# new cases of a specified disease reported during a given time interval	average population during time interval	varies: 10^n where n = 2,3,4,5,6
Attack Rate	# new cases of a specified disease reported during an epidemic period	population at start of the epidemic period	varies: 10^n where n = 2,3,4,5,6
Secondary Attack Rate	# new cases of a specified disease among contacts of known cases	size of contact population at risk	varies: 10^n where n = 2,3,4,5,6
Point Prevalence	# current cases, new and old, of a specified disease at a given point in time	estimated population at the same point in time	varies: 10^n where n = 2,3,4,5,6
Period Prevalence	# current cases, new and old, of a specified disease identified over a given time interval	estimated population at mid-interval	varies: 10^n where n = 2,3,4,5,6

Incidence Rates

Incidence rates are the most common way of measuring and comparing the frequency of disease in populations. We use incidence rates instead of raw numbers for comparing disease occurrence in different populations because rates adjust for differences in population sizes. The incidence rate expresses the probability or risk of illness in a population over a period of time.

Since incidence is a measure of risk, when one population has a higher incidence of disease than another, we say that the first population is at a higher risk