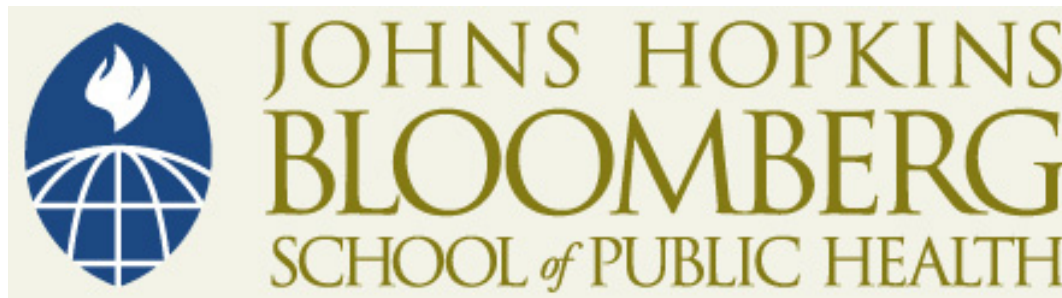


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Ratio, Rate, and Probability

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Ratio

- ◆ Value obtained by dividing one quantity by another
- ◆ Indicates the relative magnitude of a numerator and a denominator
- ◆ Ratios tend to be descriptive statistics

Ratio: Examples

- ◆ Sex ratio at birth (male births per 100 female births)
- ◆ Child-woman ratio (number of children aged 0 to 4 years divided by the number of women aged 15 to 44 years or 15 to 49 years)
- ◆ Dependency ratio (population aged under 15 or over 64 divided by the population aged 15 to 64 and multiplied by 100)

Rate

- ◆ Measure of the frequency with which an event occurs in a defined population during a given length of time
- ◆ Rates are special cases of a ratio
- ◆ Rates tend to be associated with population change

Rate

- ◆ Numerator: Count of events that occur during a period
- ◆ Denominator: Midpoint population, or person-years, or other person-time units of exposure for the same period as the numerator
 - Persons exposed to the event are included in the denominator, but others can also be included

Crude Rate

- ◆ The number of events is divided by the total population
 - Problems:
 - Denominator contains some individuals not susceptible to the event
 - Is affected by age structure of the population; makes comparison between populations difficult

Rates

- ◆ Crude birth rate

$$\frac{\text{Number of births in a specific year}}{\text{Mid - year population for same year}}$$

- ◆ Crude death rate

$$\frac{\text{Number of deaths in a specific year}}{\text{Mid - year population for same year}}$$

- ◆ Rate of natural increase

$$\text{Crude birth rate} - \text{Crude death rate}$$

Specific Rate

- ◆ *Specific rate*—The number of events is divided by some homogeneous sub-group of the total population
- ◆ *Age-specific death rate*—Deaths in a specific age group divided by the mid-point population of that age group

Probability

- ◆ In demography, indicates the likelihood that some event will (or will not) occur to some group of exposed persons during the course of some period of time
- ◆ Similar to rates except that they consider the number of people exposed to risk at the start of a time interval instead of the average number exposed (midpoint population)
- ◆ Probabilities are special cases of a ratio

Probability

- ◆ *Probability of dying between birth and age five*—Probability that a child will die between birth and exact age five
- ◆ *Probability of surviving from age 20 to age 25*—Probability that a person of exact age 20 will survive to exact age 25

Summary

- ◆ Most indices developed by demographers to describe a population are expressed in the form of ratios, rates, or probabilities
- ◆ However, the distinction between ratio, rate, and probability is not always clear-cut

Summary

◆ Infant mortality rate = $\frac{\text{Infants deaths in year } x}{\text{Live births in year } x}$

Summary

- ◆ Infant mortality rate
 - Is not a rate in the technical sense since the denominator is not in terms of mid-year population or person-years of exposure
 - Is not a probability since the numerator includes events to births not included in the denominator
 - Should thus be regarded as a ratio, though it is called a rate