Rates and Proportions

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Proportions

Proportions are used to describe situations with two possible outcomes. For example newborn babies are classified shortly after birth as males or females. There are approximately 105 male births for every 100 female births, a sex ratio at birth of 105. The *proportion* male is therefore 105/205 = 0.512 or 51.2%.

Proportions are often interpreted as estimates of probabilities. We could say that the probability that a newborn baby is male is 0.512.

> To calculate a proportion you divide the number of units who possess the attribute of interest by the total number of units under observation. Proportions (and probabilities) are always between zero and one.

Rates

Rates are used to describe the frequency of occurrence of events over time. For example your heart rate is the number of times your heart beats per minute. Women aged 15-44 in the U.S. have births at a rate of 62.5 births per 1000 woman-years of exposure. Note the key role played by time in both examples.

> To calculate a rate you divide the number of events observed in a period of time by a measure of exposure based on the number of units under observations and the time each one was at risk. Rates cannot be negative but they can exceed one.

For annual rates exposure is often estimated as the mid-year population. Some events terminate exposure but others don't. (Think of births and deaths.)

Usage

Rates and probabilities can be confusing because usage is not consistent. Some authors use the two terms interchangeably and many use "rate" to describe proportions. For example the contraceptive prevalence "rate" is just the proportion of women currently using contraception. There is no time interval involved. At least in this case there is no risk of confusion. The most egregious example is the "infant mortality rate", which is an estimate of the probability that a child will die before reaching its first birthday. This causes confusion because, as we shall see, we can also calculate a rate. We will return to this issue when we compute life tables.