type of proportion. In epidemiology, however, we often shorten the terms for these measures in a way that makes it sound as though they are completely different. When we call a measure a **ratio**, we usually mean a nonproportional ratio; when we call a measure a **proportion**, we usually mean a proportional ratio that doesn't measure an event over time, and when we use the term **rate**, we frequently refer to a proportional ratio that does measure an event in a population over time.

Uses of Ratios, Proportions, and Rates

In public health, we use ratios and proportions to characterize populations by age, sex, race, exposures, and other variables. In the example of the EMS cases we characterized the population by sex. In Exercise 2.1 you will be asked to characterize a series of cases by selected variables.

We also use ratios, proportions, and, most important rates to describe three aspects of the human condition: morbidity (disease), mortality (death) and natality (birth). Table 2.4 shows some of the specific ratios, proportions, and rates we use for each of these classes of events.

TABLE 2.4
Frequency measures by type of event described

Condition	Ratios	Proportions	Rates
Morbidity (Disease)	Risk ratio (Relative risk) Rate ratio Odds ratio	Attributable proportion Point prevalence	Incidence rate Attack rate Secondary attack rate Person-time rate Period prevalence
Mortality (Death)	Death-to-case ratio Maternal mortality rate Proportionate mortality ratio Postneonatal mortality rate	Proportionate mortality Case-fatality rate	Crude mortality rate Cause-specific mortality rate Age-specific mortality rate Sex-specific mortality rate Race-specific mortality rate Age-adjusted mortality rate Neonatal mortality rate Infant mortality rate Years of potential life lost rate
Natality (Birth)		Low birth weight ratio	Crude birth rate Crude fertility rate Crude rate of natural increase

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