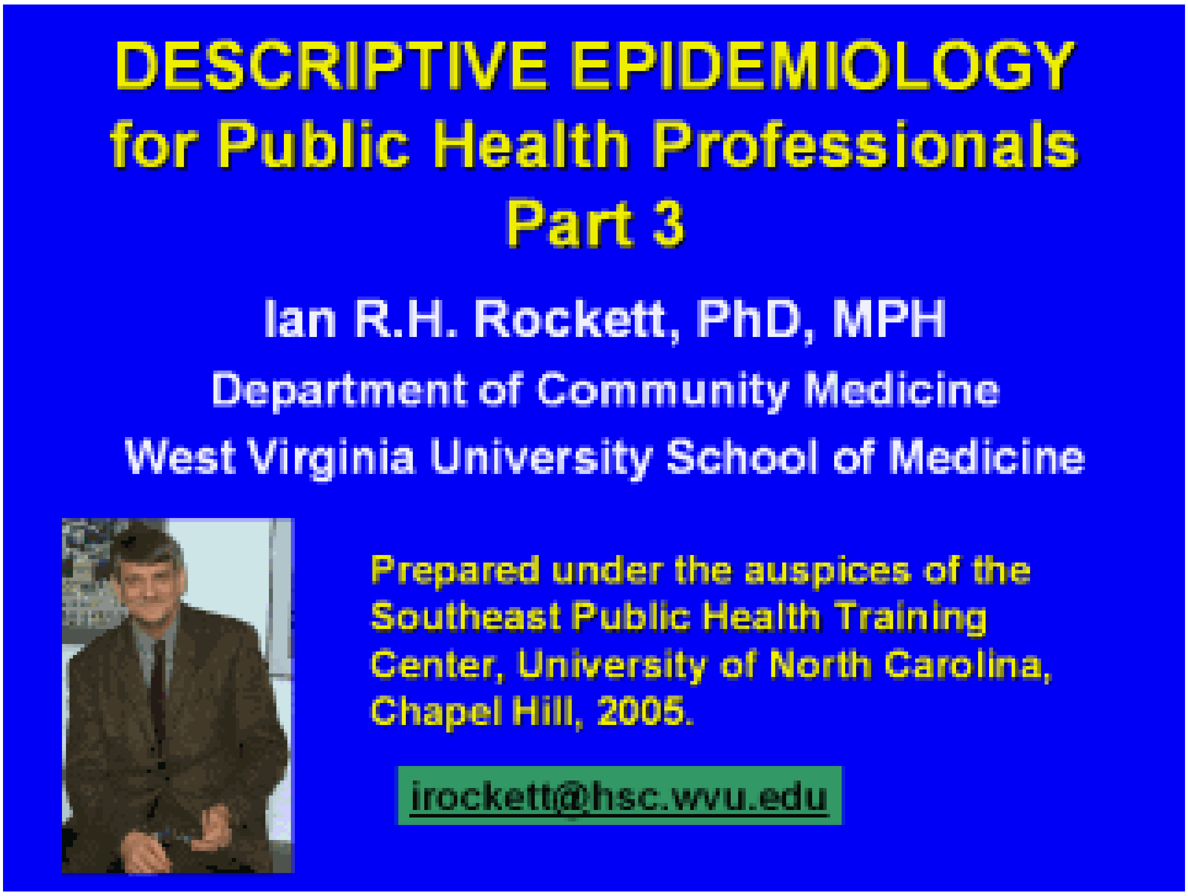
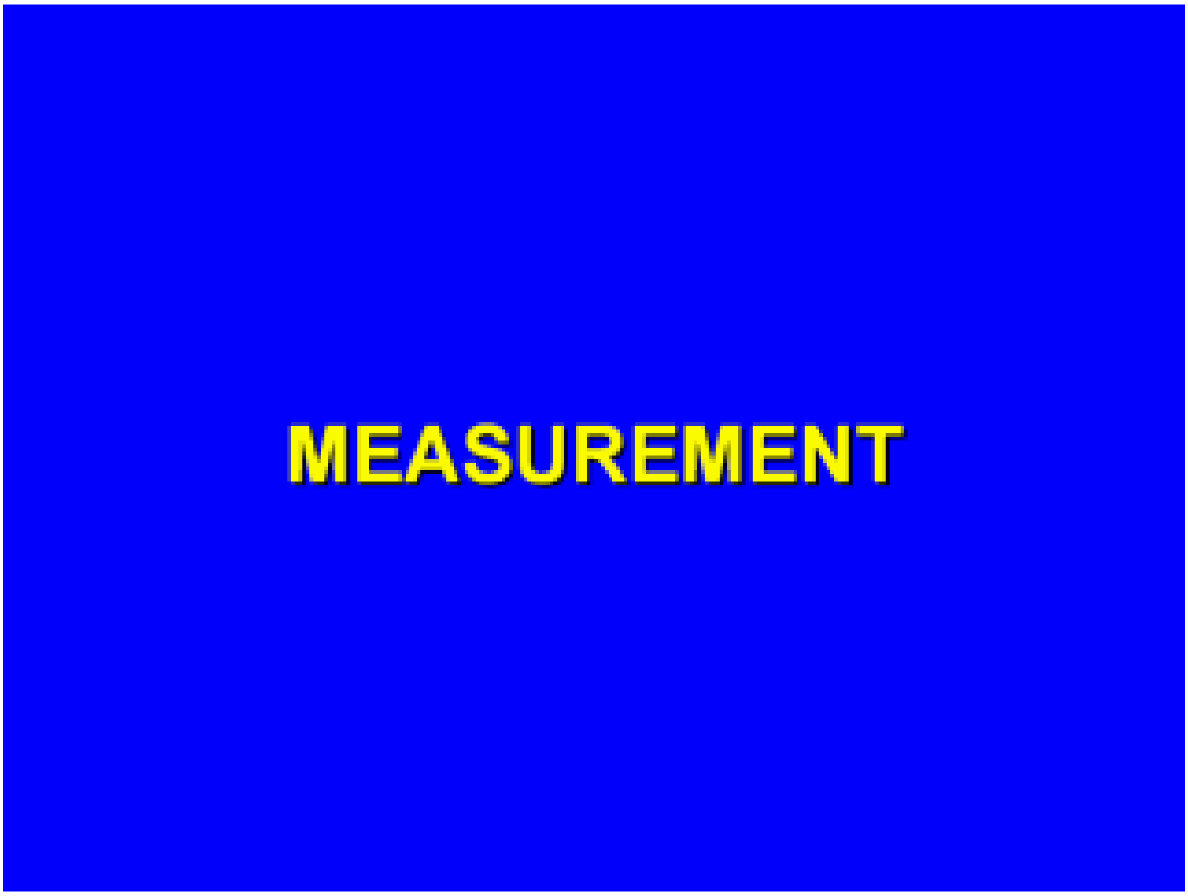
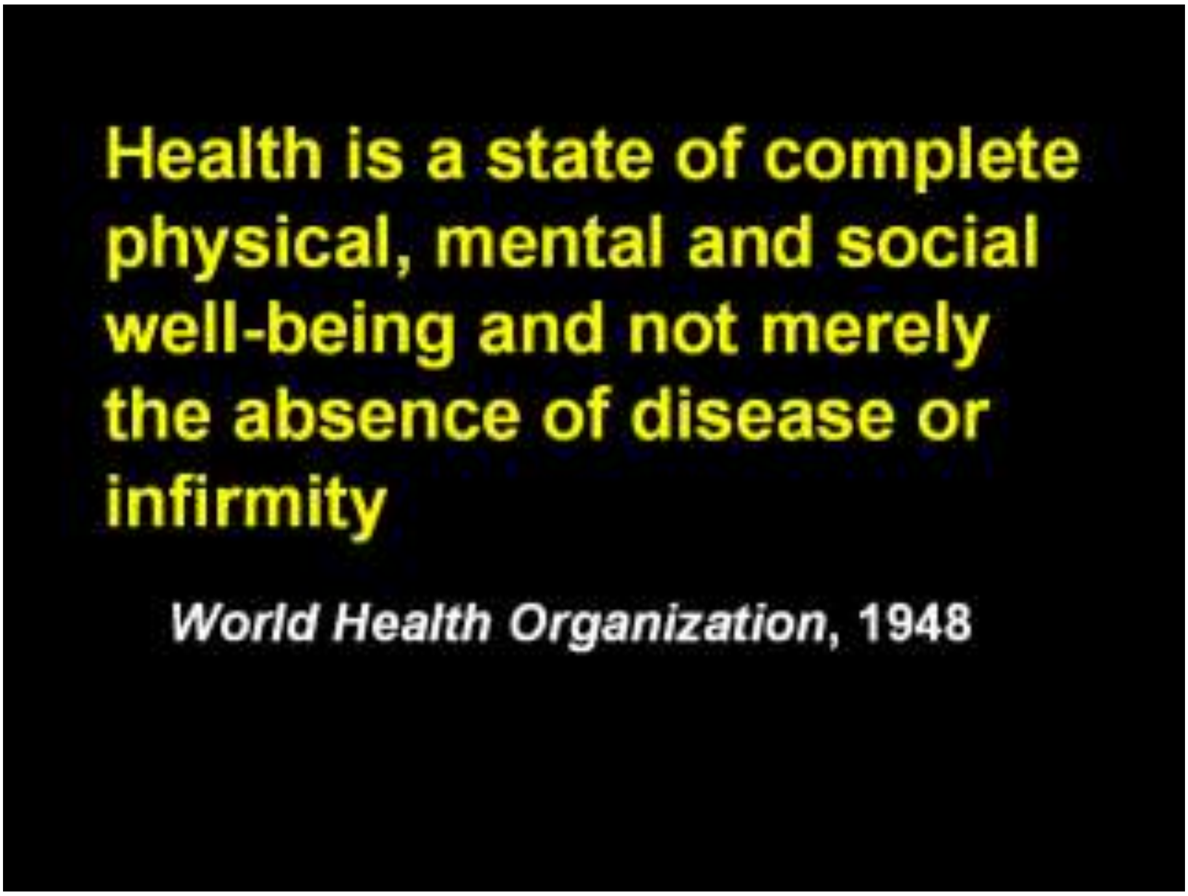


Did you see **the Part I** and **the Part II** of this lecture?

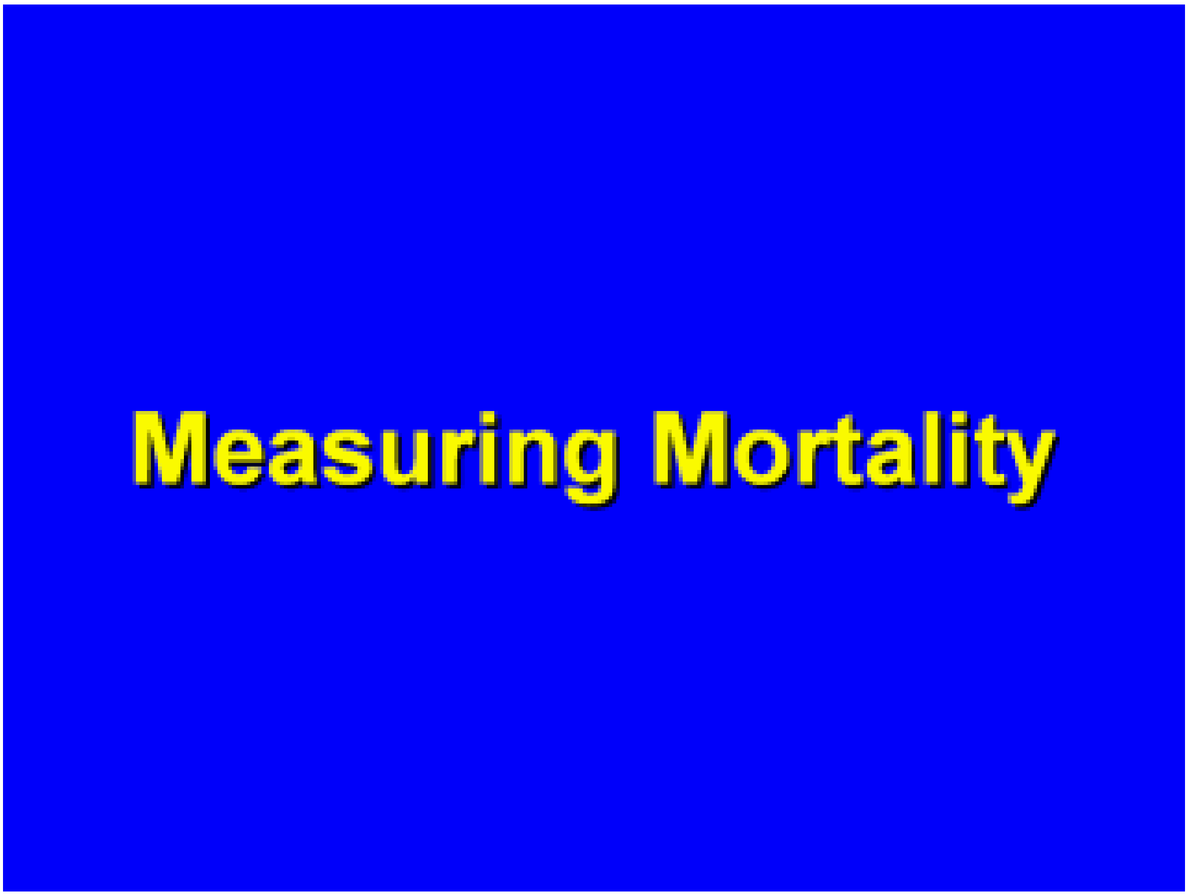


Central to epidemiology is measurement, the contribution that Major Greenwood credited to John Graunt.

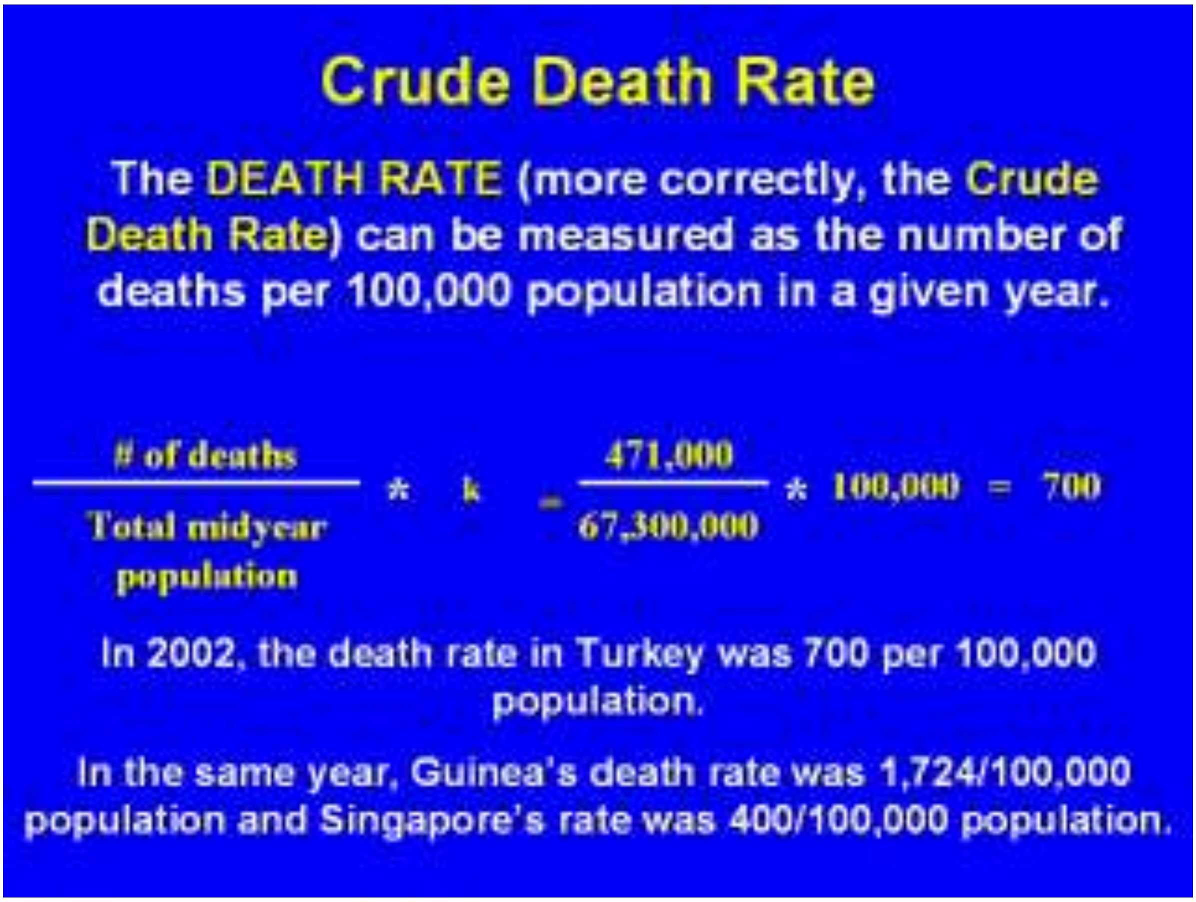


The 1948 World Health Organization definition of health is an ideal, and historically has been problematic to measure. For that reason, measurement has targeted ill-health rather than health. However, newer generations of health measures, such as healthy life expectancy, referred to near the end of the module, are beginning to correct the large imbalance in the orientation of epidemiologic measurement.

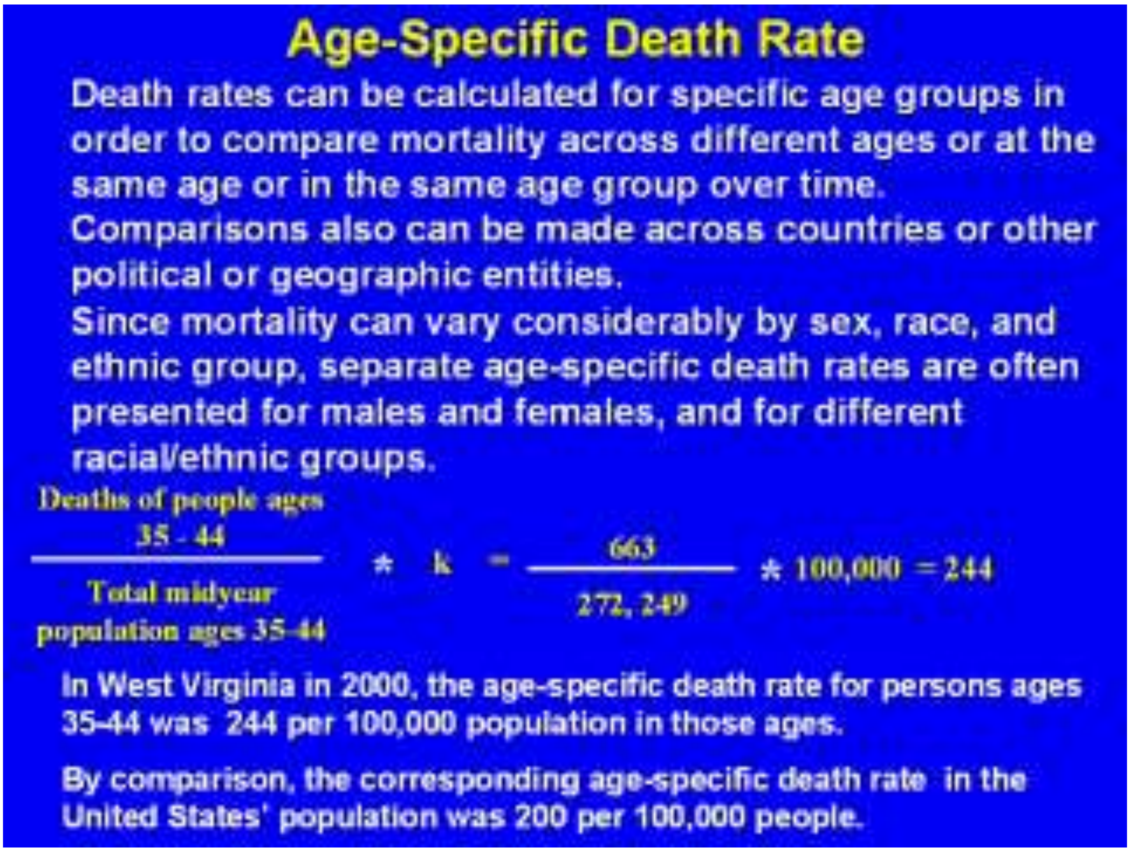

Purposes of Health-related Measurement
Disease and Injury Prevention
Health Promotion
Health Services Planning and Intervention Design
Evaluation

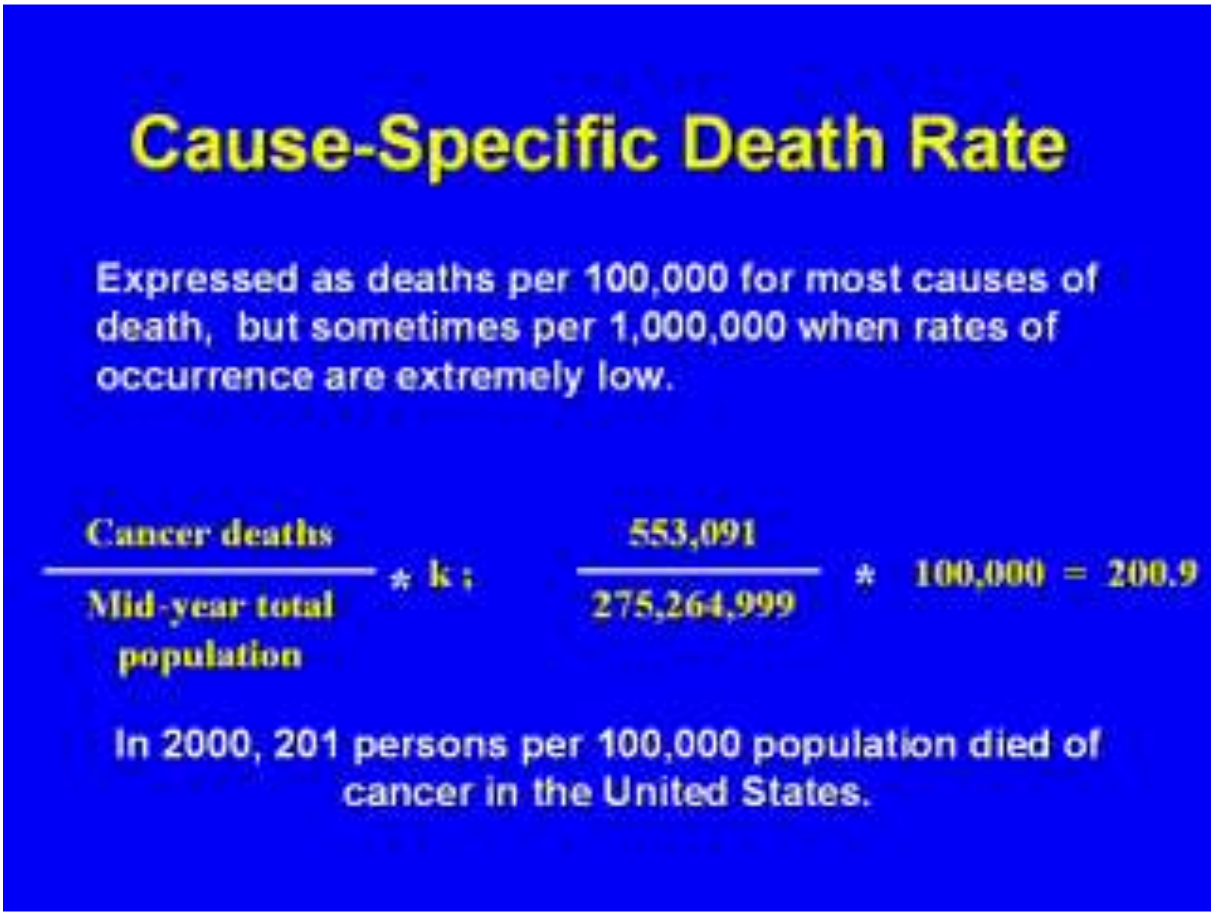


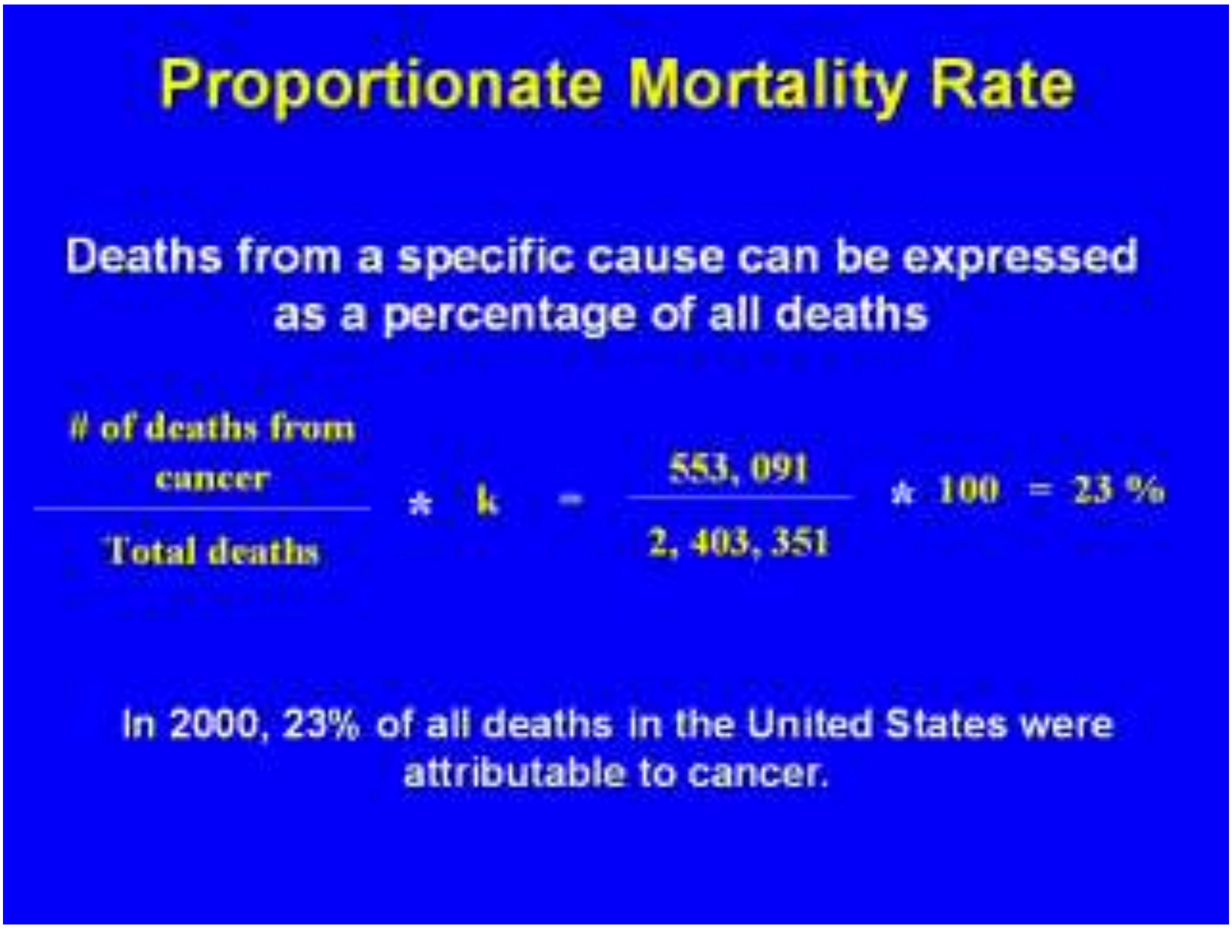
The next five slides provide formulae and examples of well known mortality measures. They derive from the fourth international edition of the Population Handbook published by the Population Reference Bureau.

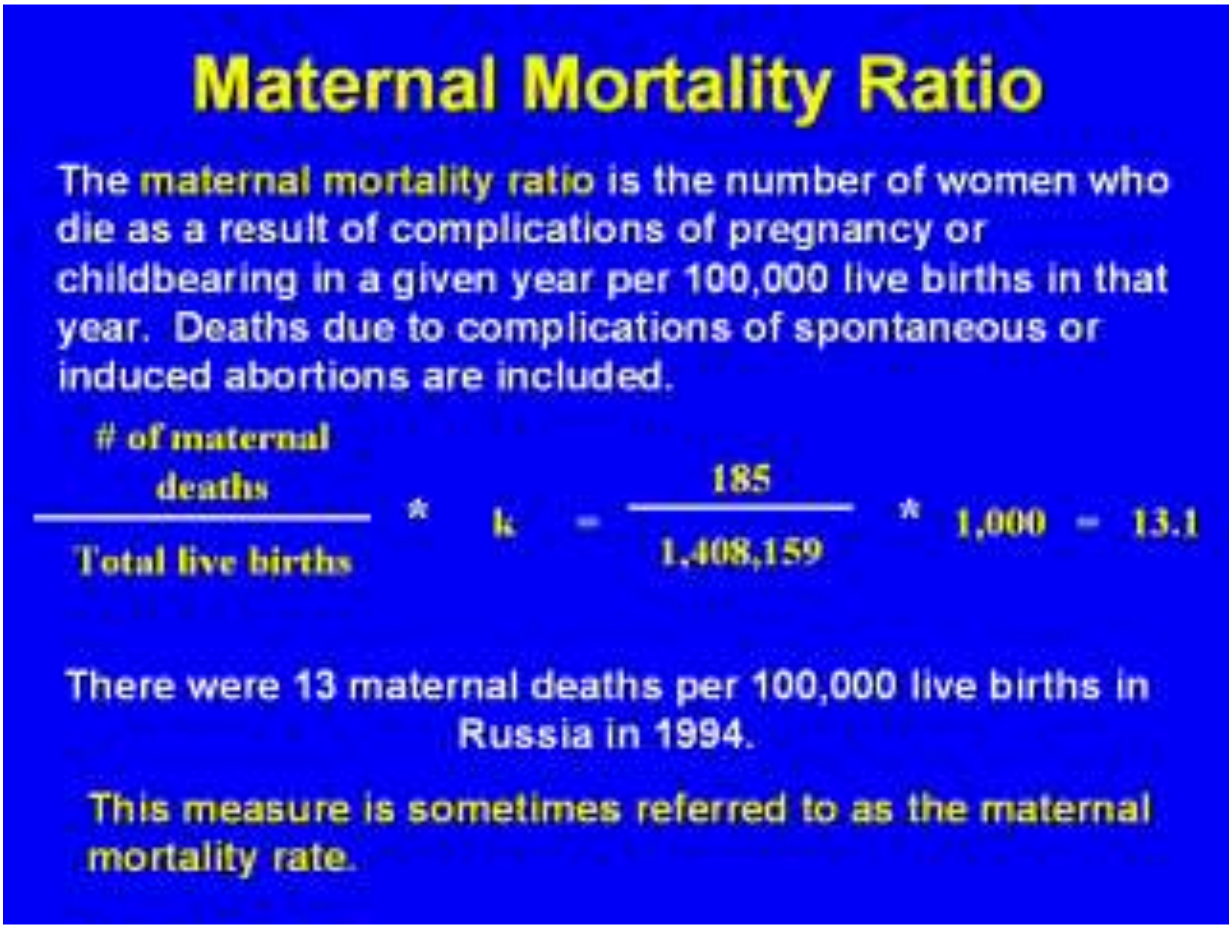


Where the population serves as the denominator for annualized mortality or morbidity rates, the midyear population serves as the best approximation of the population-at-risk for the event represented in the rate numerator, such as death by any cause. This makes allowance for changes in population due to births, deaths, or migration that occur over the year for which the measurement applies.


Age-Specific Death Rate
Death rates can be calculated for specific age groups in order to compare mortality across different ages or at the same age or in the same age group over time.
Comparisons also can be made across countries or other political or geographic entities.
Since mortality can vary considerably by sex, race, and ethnic group, separate age-specific death rates are often presented for males and females, and for different racial/ethnic groups.
Deaths of people ages 35 - 44
Total midyear population ages 35-44
* k = 663 / 272, 249 * 100,000 = 244
In West Virginia in 2000, the age-specific death rate for persons ages 35-44 was 244 per 100,000 population in those ages.
By comparison, the corresponding age-specific death rate in the United States' population was 200 per 100,000 people.


Cause-Specific Death Rate
Expressed as deaths per 100,000 for most causes of death, but sometimes per 1,000,000 when rates of occurrence are extremely low.
Cancer deaths
Mid-year total population
* k ;
553,091
275,264,999
* 100,000 = 200.9
In 2000, 201 persons per 100,000 population died of cancer in the United States.

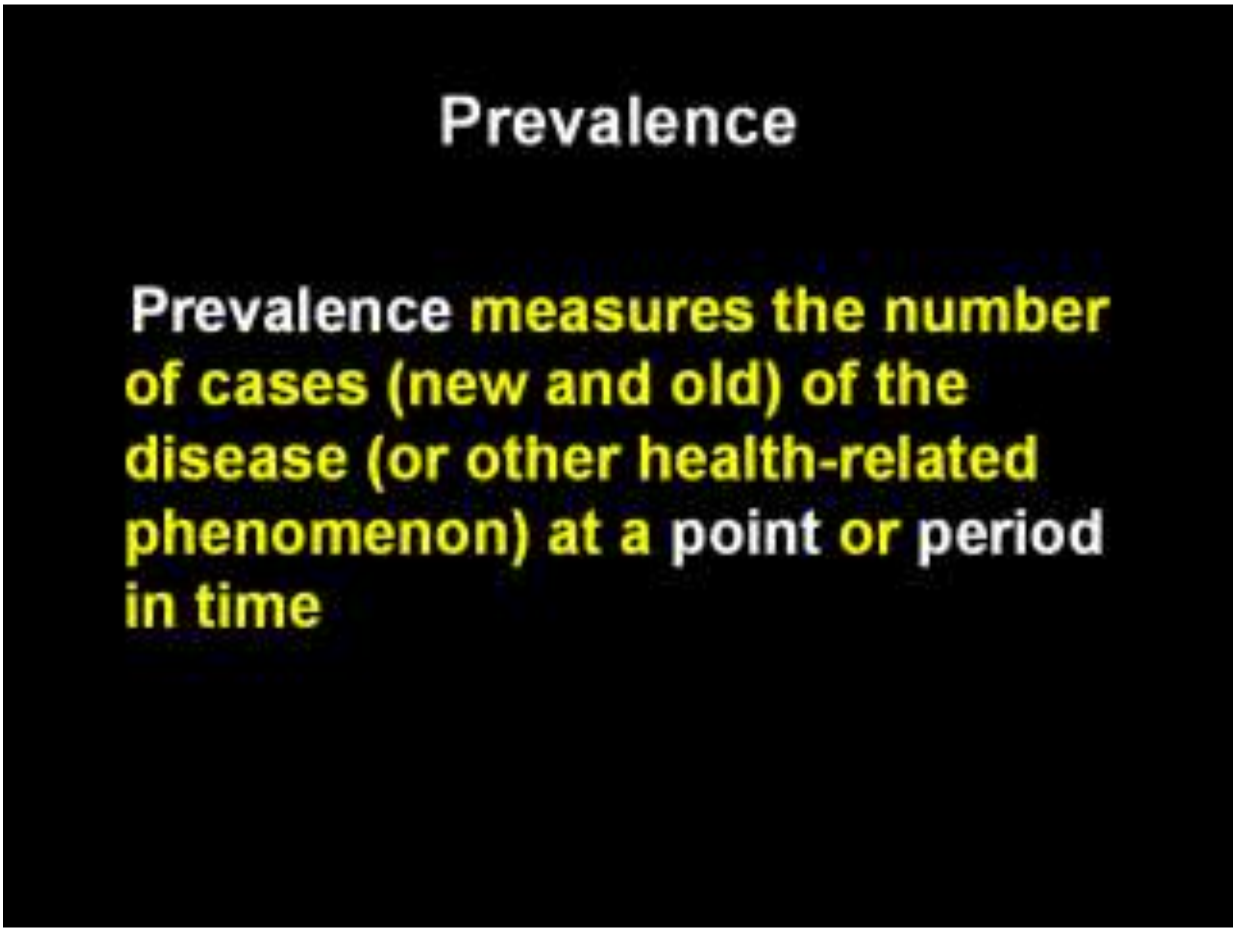

Proportionate Mortality Rate
Deaths from a specific cause can be expressed as a percentage of all deaths
# of deaths from cancer
Total deaths
* k =
553, 091
2, 403, 351
* 100 = 23 %
In 2000, 23% of all deaths in the United States were attributable to cancer.

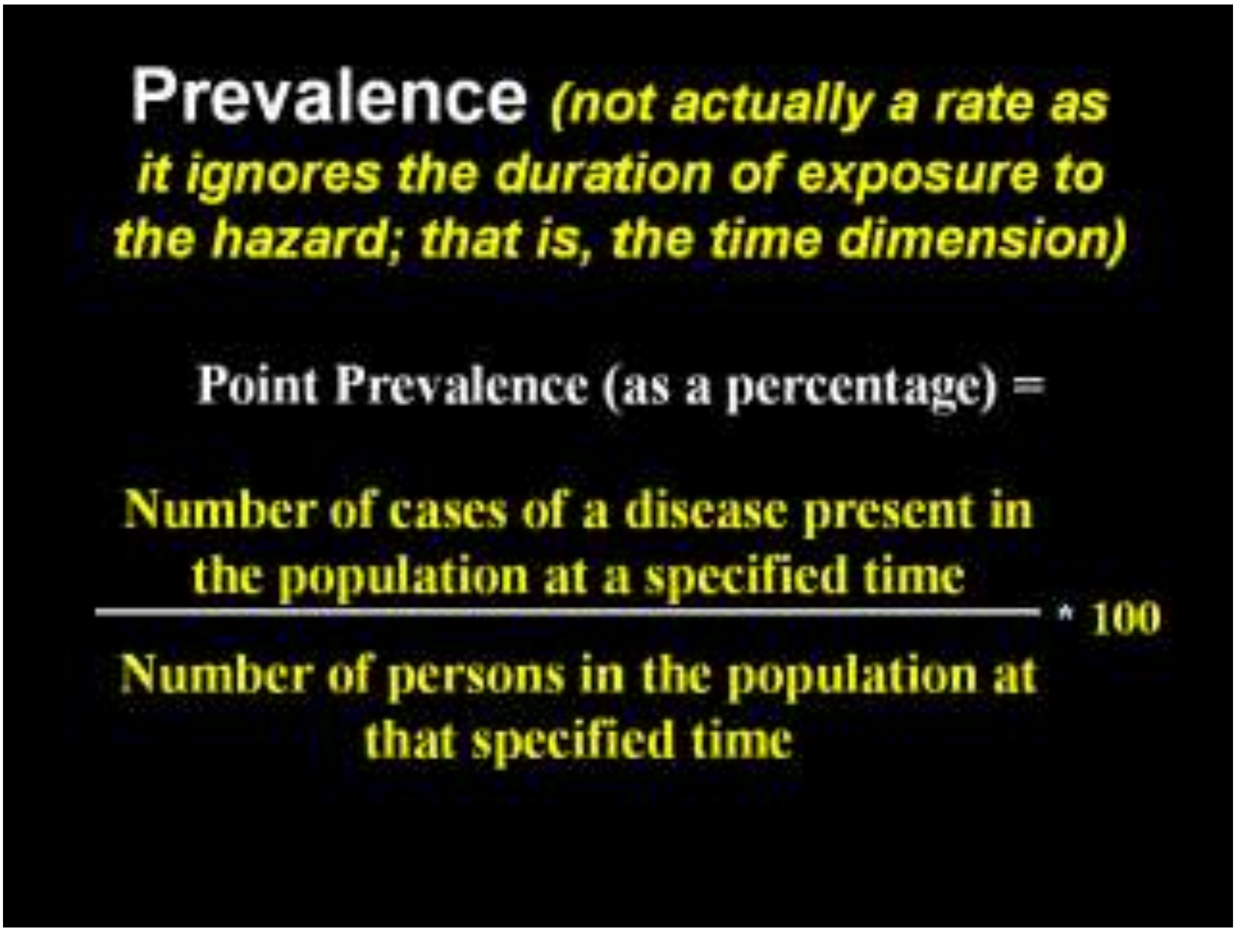


A valid maternal mortality rate would divide the number of maternal deaths by the population-at-risk; the number of pregnant women in the population. This information is typically unknown and inaccessible.

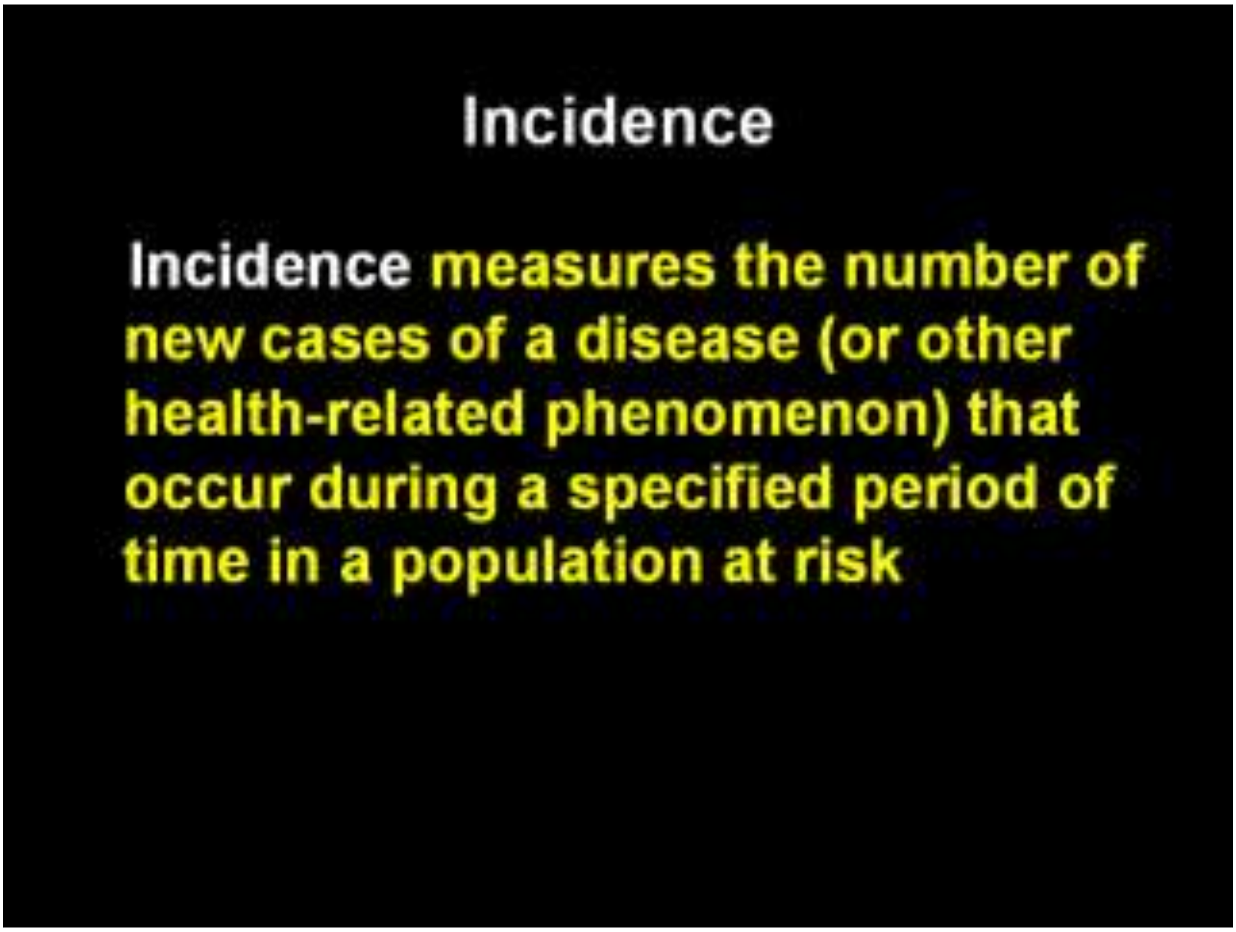
The Dictionary of Epidemiology (4^{th} edition), edited by John Last, defines morbidity as “any departure, subjective or objective, from a state of physiological or psychological well-being.” Thus, this definition allows for self-reported ill-health as well as classification supported by a physician’s diagnosis.

Prevalence and Incidence form the core of epidemiologic measurement

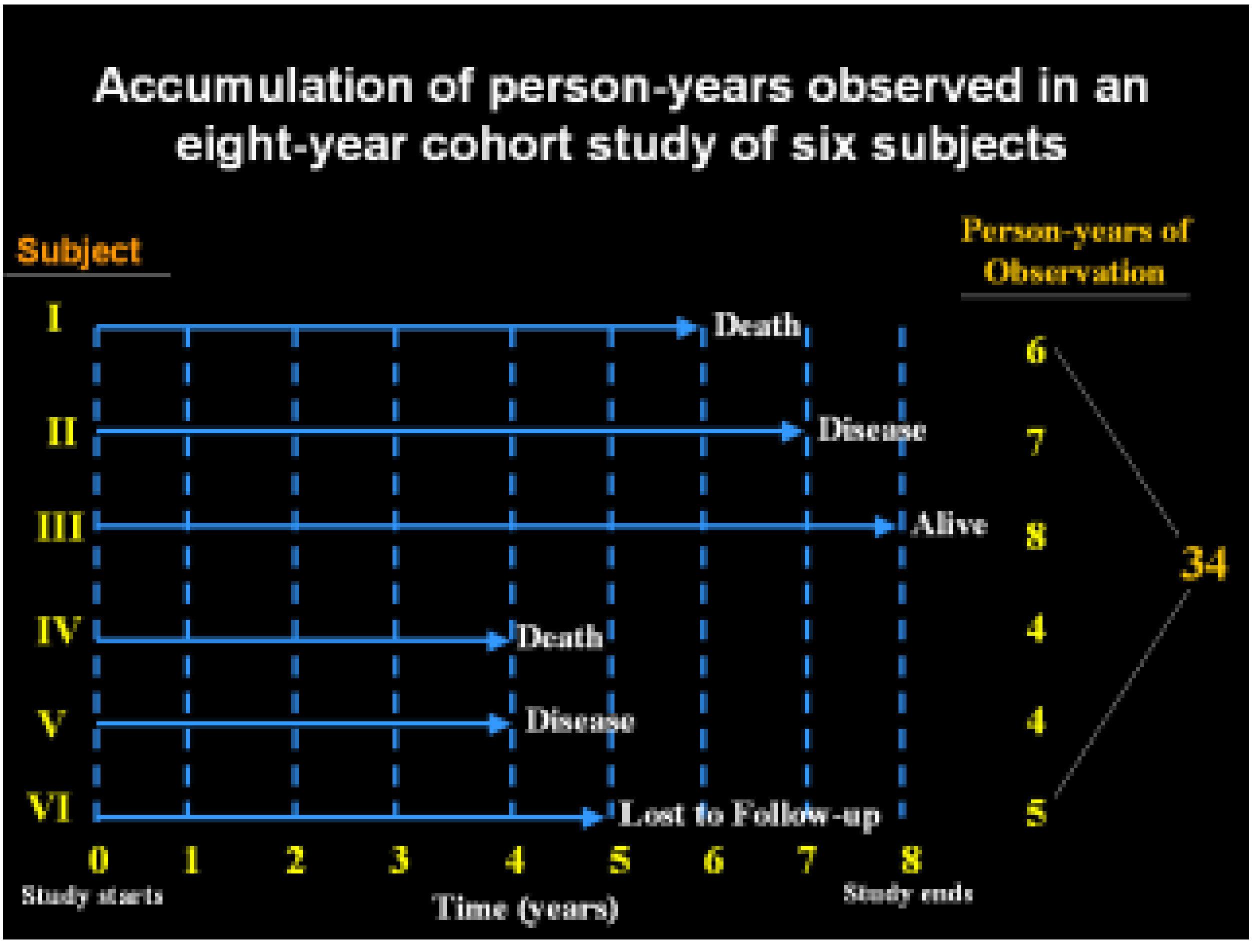

Prevalence
Prevalence measures the number of cases (new and old) of the disease (or other health-related phenomenon) at a point or period in time



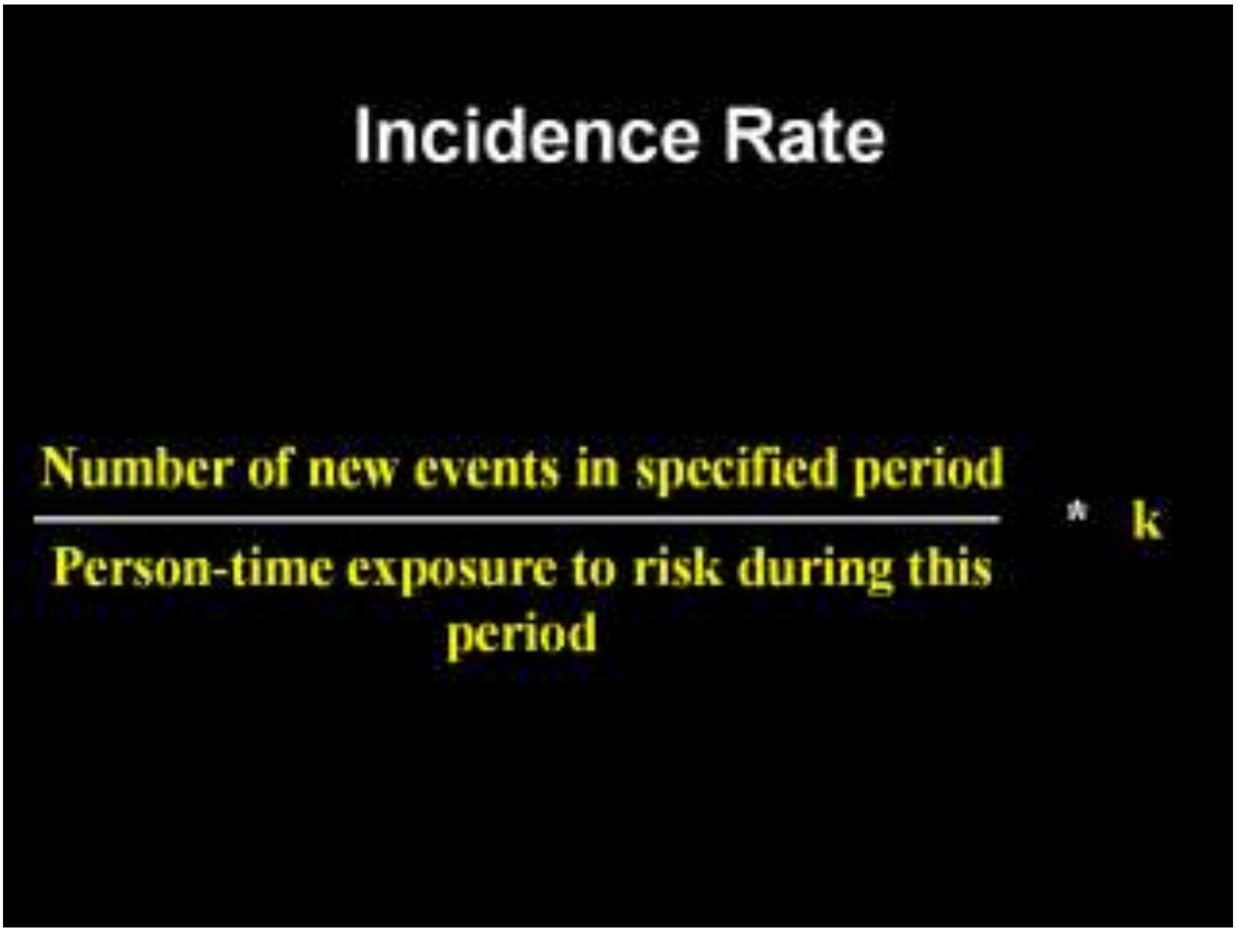
If prevalence is measured for a period of time, say three months, rather than at a point in time, the population denominator should represent the average population during that period. Care needs to be taken in selecting or estimating the denominator for any epidemiologic measure to avoid overestimation or underestimation of rates or proportions, and to make sure that events are correctly matched to a population-at-risk.



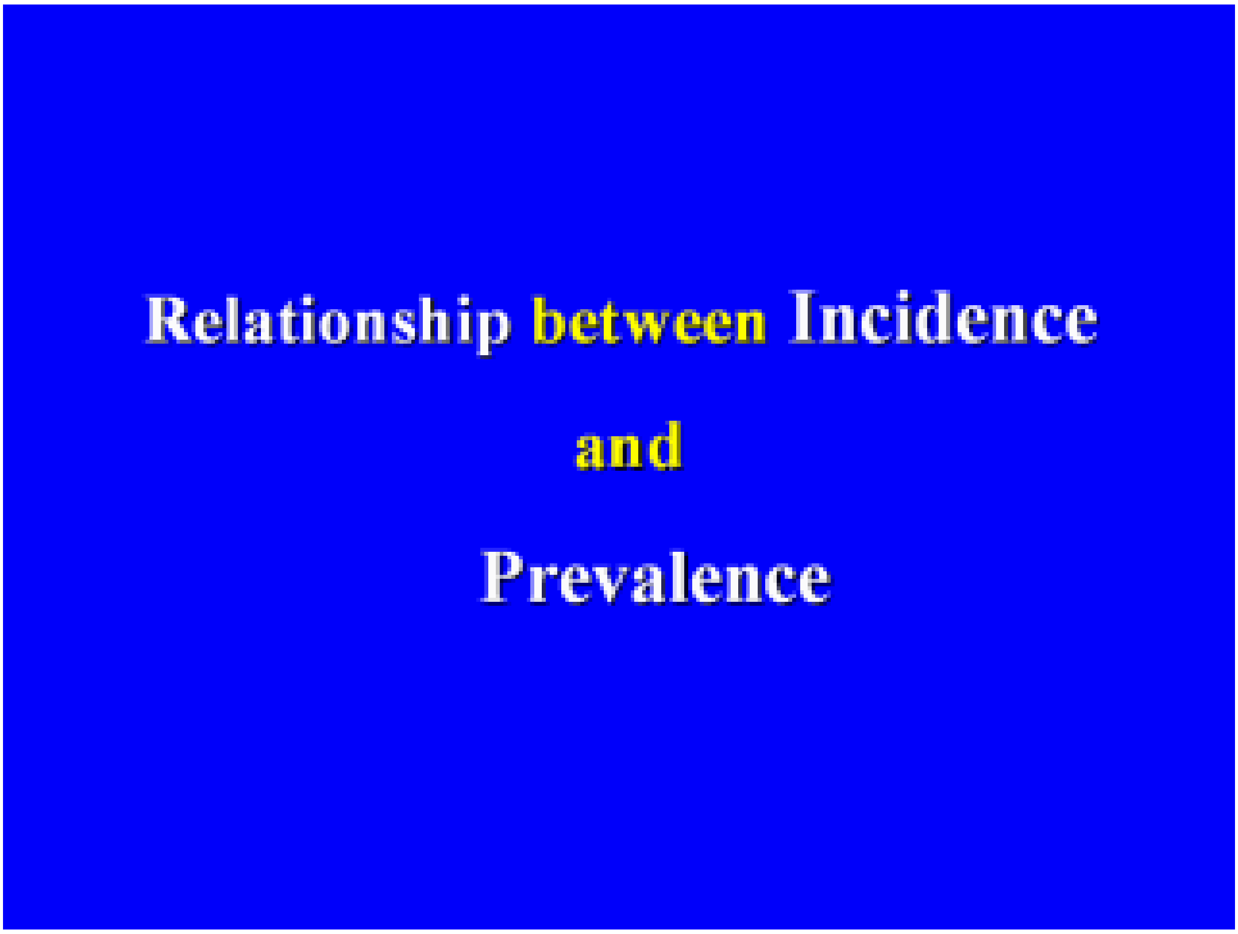
The specified period of time pertaining to the population-at-risk for the health related phenomenon in question is referred to as person-time-at-risk. This is the time study subjects, as a group, are exposed to the risk under investigation.



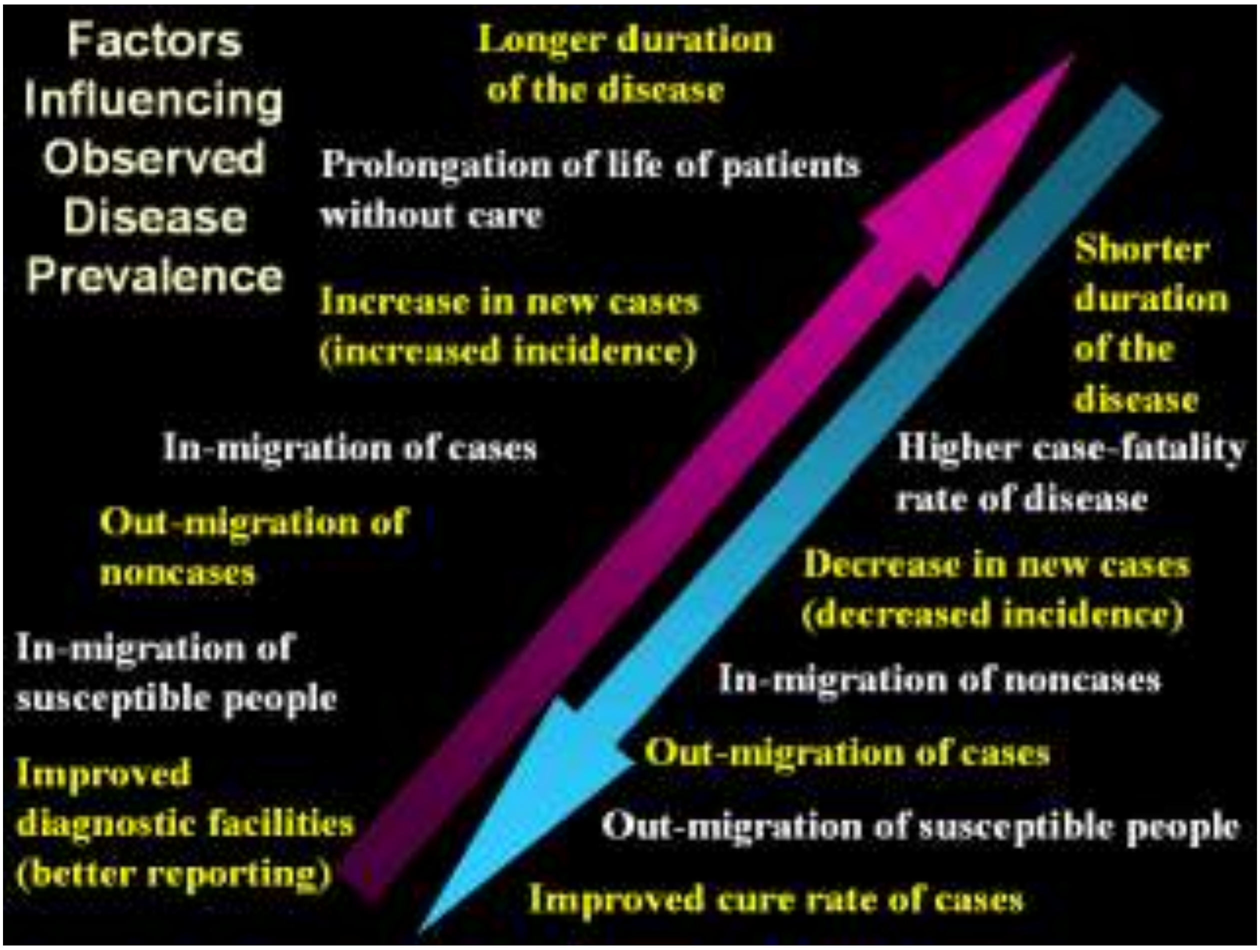
This diagram illustrates how person-time-at-risk is calculated for a cohort of subjects, where the cohort is the group of individuals who share a common putative risk exposure like work in a coal mine or tobacco smoking.



The incidence rate is commonly expressed as the number of cases of disease or injury per 100,000 person-years of exposure to the risk or putative hazard under investigation. With very rare conditions the rate may be expressed per million person-years to avoid the awkwardness of decimals.


Relationship between Incidence
and
Prevalence

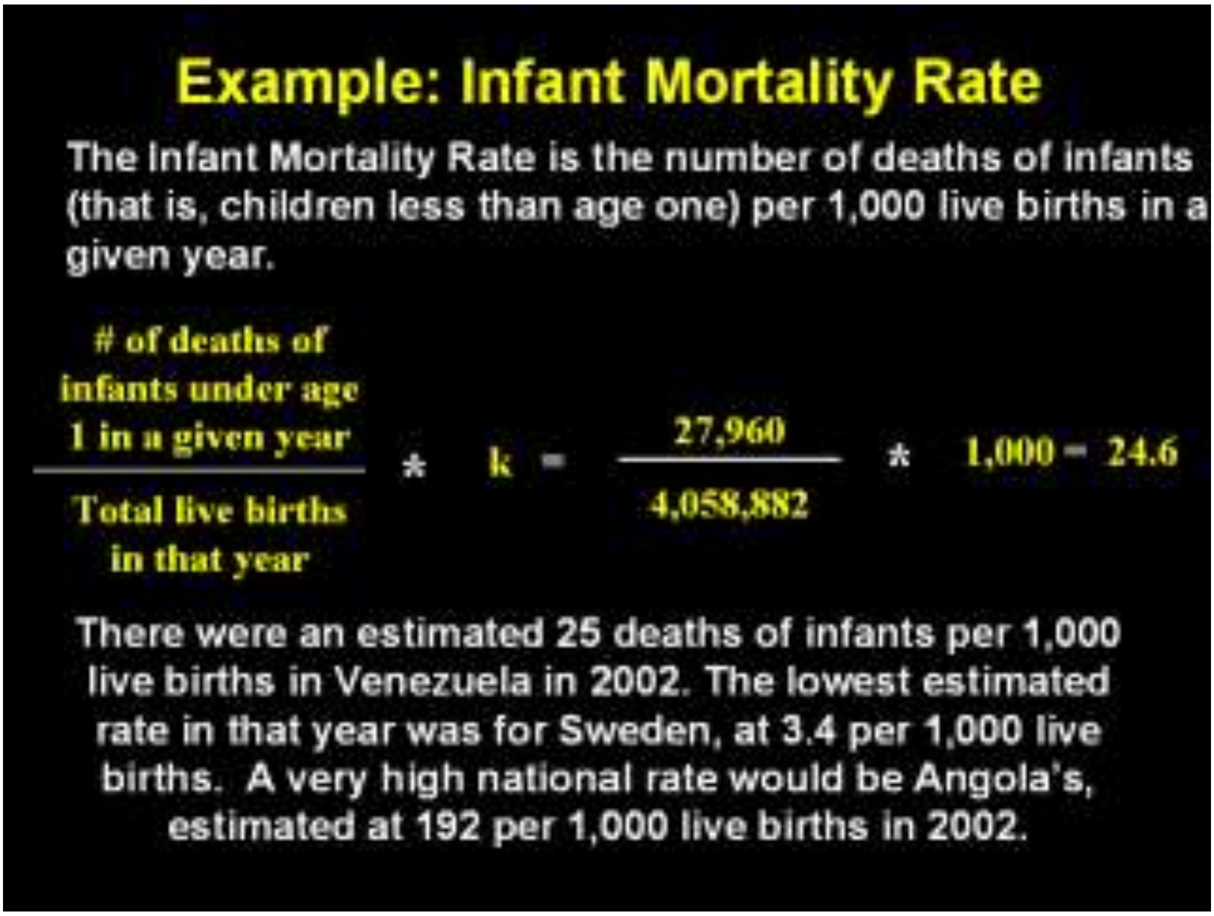
A waterfall metaphor can be helpful in illustrating the concepts of incidence and prevalence. Commencing at the top of the falls, we see the new cases flowing into the prevalence pool below. The water flowing out of this pool reflects the individuals who die, recover, or migrate out of that population for which the prevalence is measured.



This diagram shows factors that alternatively can increase or decrease the magnitude of the observed prevalence of a disease. This diagram is a modified version of one published in the teachers' guide to *Basic Epidemiology*, a textbook published under the sponsorship of the World Health Organization.


Mortality
meets
Morbidity

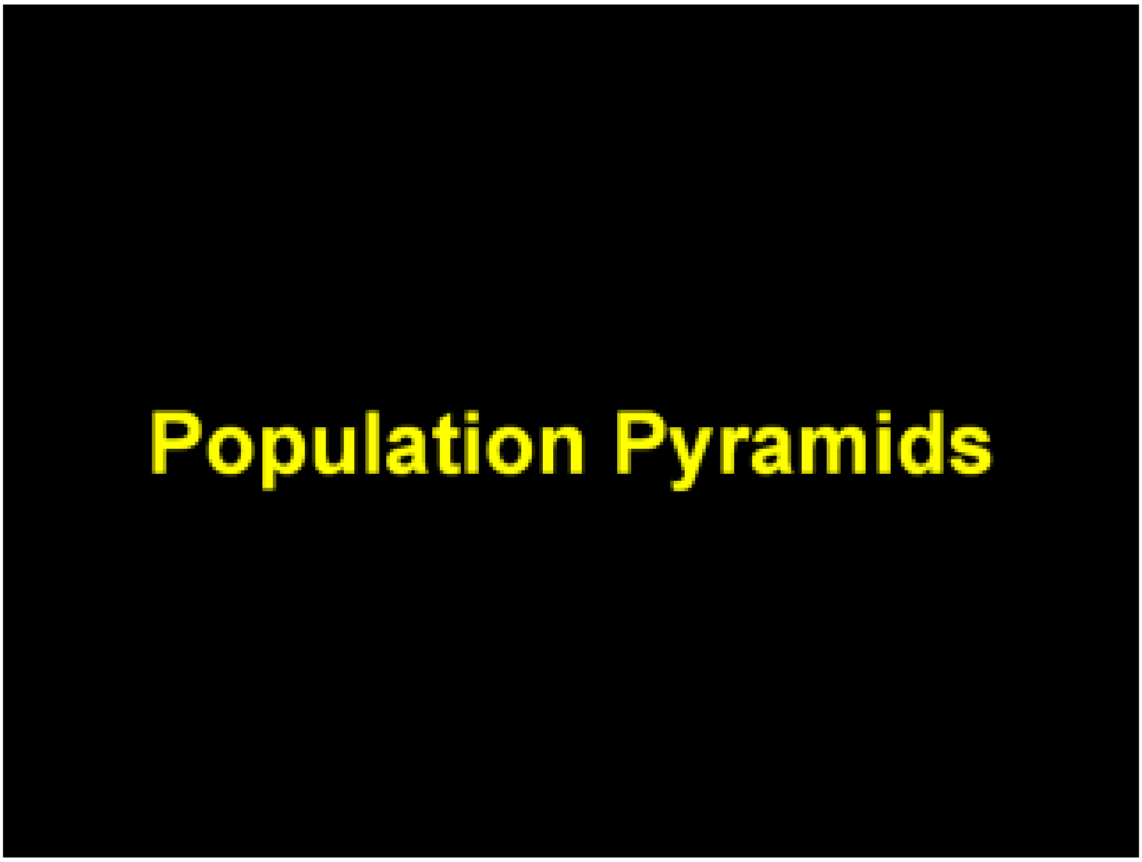
An important question concerns the proportion of cases of a particular disease which end in death. Epidemiologists label this proportion the case-fatality rate.



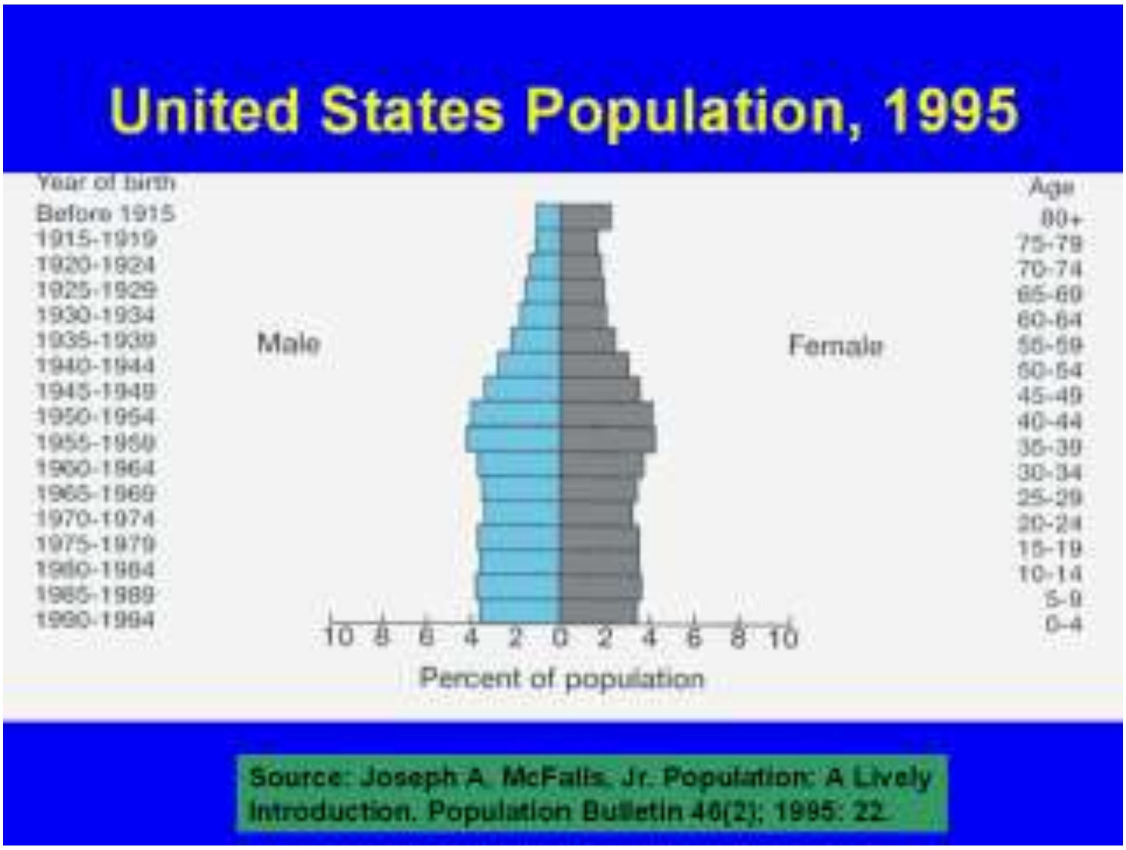
A special example of the case-fatality rate is the Infant Mortality Rate. The decision to use the live births as the rate denominator instead of the 0-1 population stems from the fact that this population historically was poorly enumerated in the census. Babies were too easy to overlook in the count.

Comparison of these national crude death rates reveals differences that are not intuitive. Assuming that the rates are accurate, and actually this is a solid assumption, then how is it that the rates displayed are higher in the two more developed countries, the United States and The Netherlands, than in the two less developed countries, Algeria and Mexico?

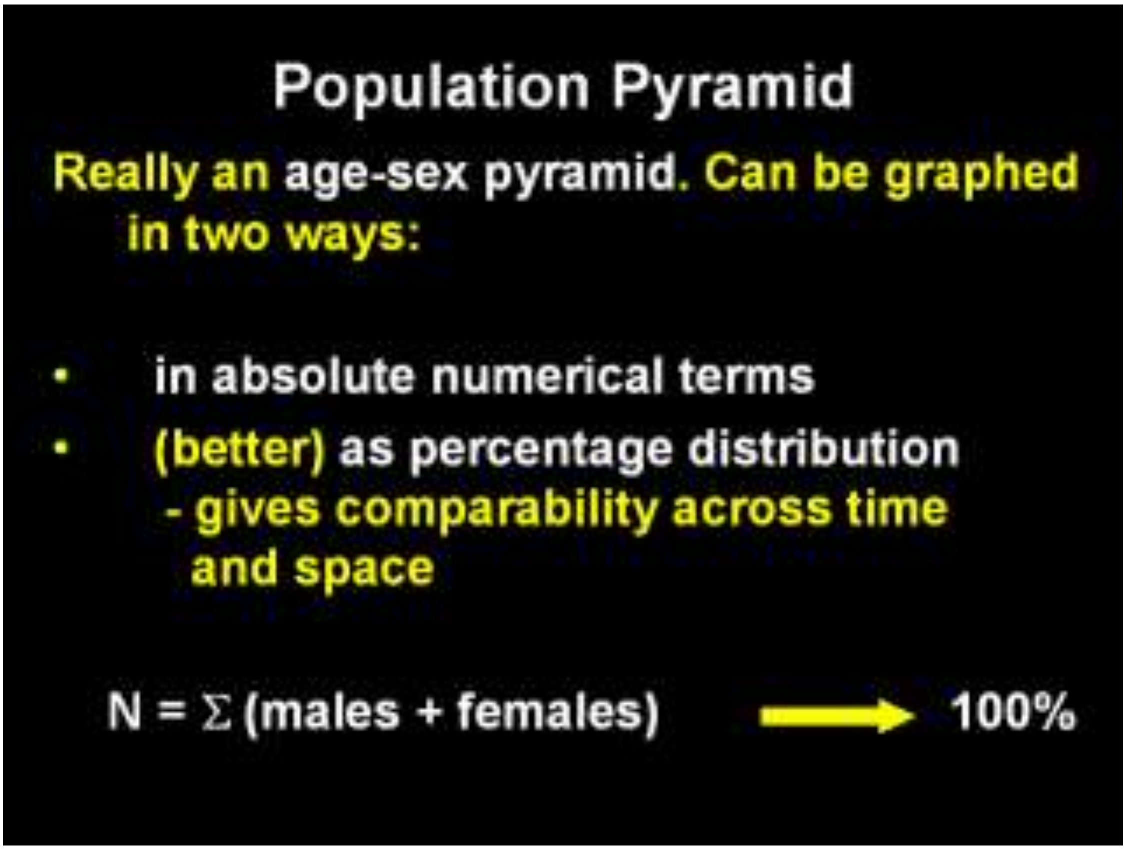
The answer to the question posed by the preceding paradox lies in differences in the age distributions of the various populations – age is a confounding variable. The less developed countries have much younger populations than the more developed countries, as a result of having much higher fertility rates. In our contemporary world younger people, especially those who aren't infants, are much less likely to die than older people. We take this as a given, but this was not always the case as John Graunt's life table data attest.



Crucial to rate calculation is the determination of an appropriate denominator. For many mortality rates, such as the crude death rate and age- and cause-specific death rates, and also some incidence rates, denominators typically derive from the census. However, population census data perform another very useful function in descriptive epidemiology. They furnish the building blocks for constructing population pyramids. Valuable for comparisons, population pyramids graphically display the composition of a population broken down by age and sex. Although a pyramid is a cross-sectional snapshot of a population, it also reflects that population's history.

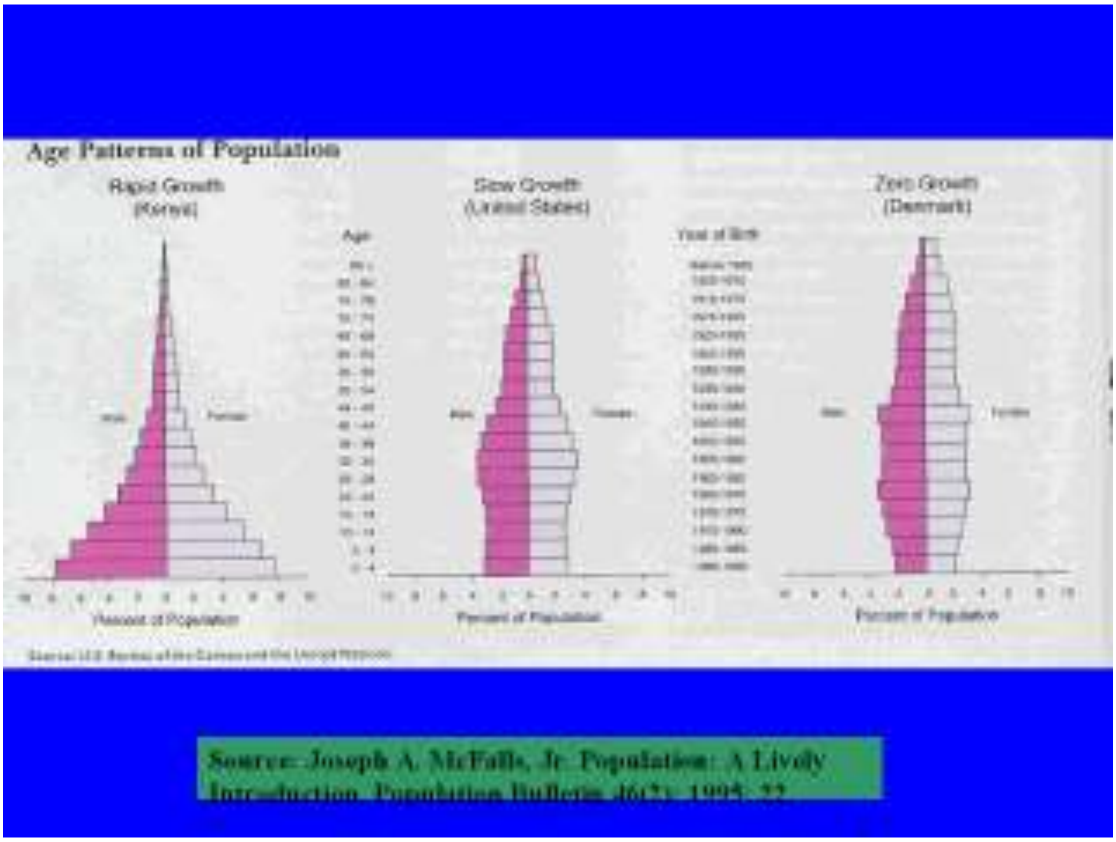


This slide shows the US population depicted as a pyramid. Please move to the next slide to learn how to construct such a population pyramid.

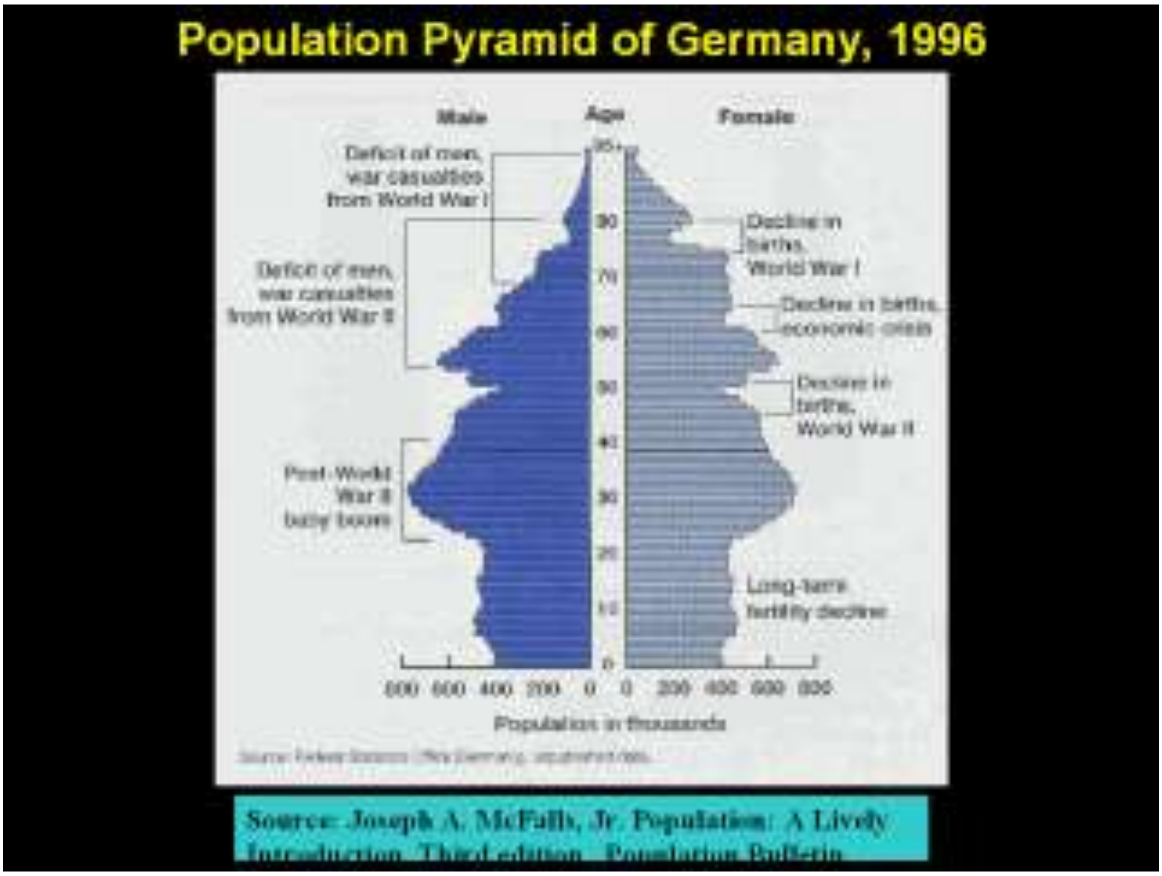


Note that the percentages for each age and sex-specific population segment should total 100. In other words, the cumulations should not be performed separately for each sex lest a misleading picture of the population emerge.

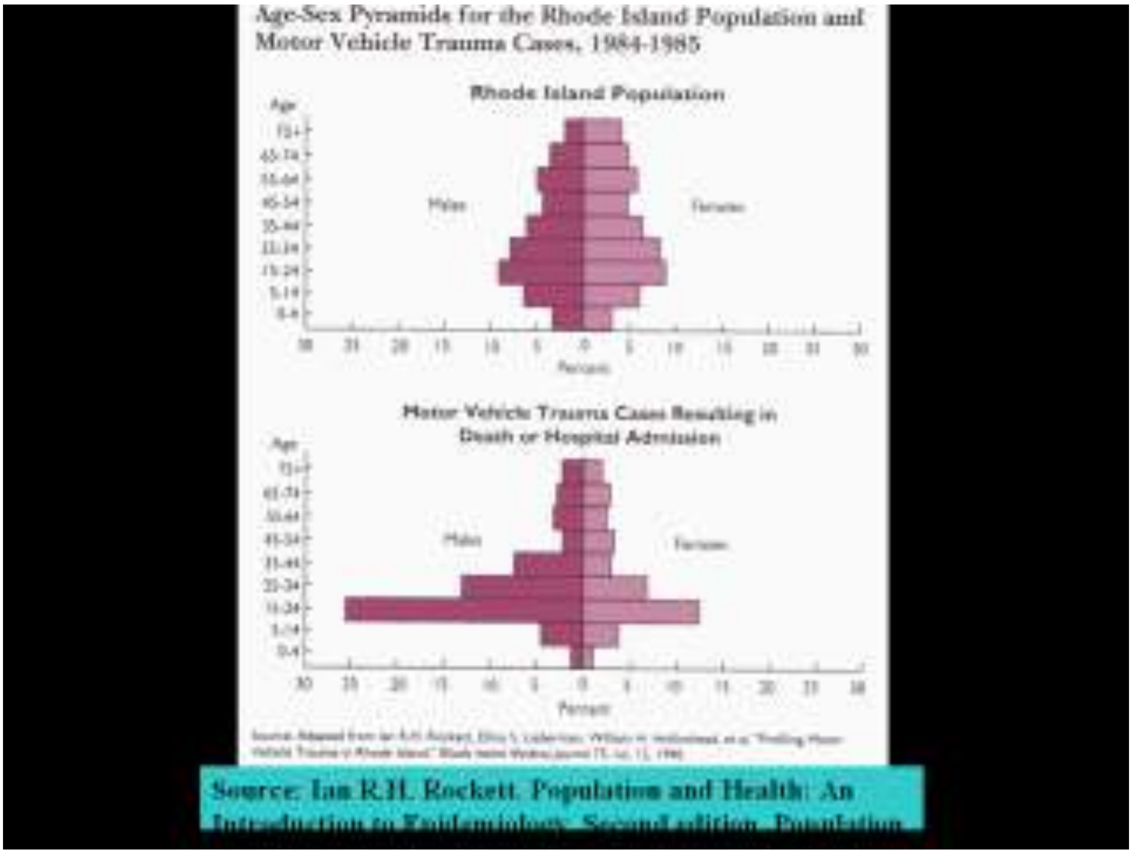

Bases for Comparison
• variation across age groups
• variations within age group by sex



This slide displays pyramids for three populations exhibiting very different age distributions. Kenya's pyramid is typical of pyramids for populations in less developed countries. The US population pyramid would resemble Denmark's much more closely than it does if not for its heavy immigration that is highly selective of younger adults and children.



While a population pyramid represents a cross-sectional view of a population, its bumps and indentations do reflect the past as the German pyramid vividly illustrates.



Population pyramids are versatile comparative tools. The two pyramids constructed using the Rhode Island population and serious motor vehicular trauma cases, respectively, show how Rhode Island's teens and young adults are highly over-represented among the severely and fatally injured. In the second pyramid, morbidity and mortality data were combined.