Measure of Disease Frequency

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Objectives:

- Define and calculate a range of measures of frequency of disease, including prevalence, incidence, risk, odds and rates

- Define and calculate crude and specific martality (morbidity) rates

What is it?

Tools to quantify how common an illness is in a
 population in a time.

• Case (event/outcome of interest)
• Size of a population (the population at risk)
• Time

Outcome/events of interest (case)

- Infection
- Disease (morbidity)
- Disability
- Death (mortality)
- Recovery
- Presence of antibodies
- Usage of health services

Types of measure of disease frequency

- Prevalence
- Proportion
- Incidence
- Incidence rate
- Attack rate
- Risk
- Ratio
- Case fatality rate
- Mortality rates

Prevalence vs. Incidence

- Prevalence: frequency of existing cases
- Incidence: frequency of new cases

- New cases are called *incident cases.*
- Existing cases are called *prevalent cases.*

Prevalence (point prevalence)

• Proportion of people in a defined population that has the outcome at a defined instant (a point) in time.

• Proportion of a population affected by a disease at a given time.

• Expressed as a percentage

$$\frac{\text{Number of existing cases of disease at a specific time}}{\text{Population at risk at that time}}$$

Prevalence - example

- The percentage of people with malaria parasite in their blood in a village in Kunduz in a survey in December 2007

- The proportion of female staff at Ministry of Public Health in 2008

- Percentage of under five children with acute malnutrition in Ghor in March 2008

- Proportion of women who get married under the age of 18 in Noorsitan in 1992

Period Prevalence

Period prevalence is a combination of prevalence and incidence. The numerator is the number of cases of disease existing at the beginning of the study, in addition to all new cases that develop during the study period. The denominator is the entire population from which the numerator was derived.
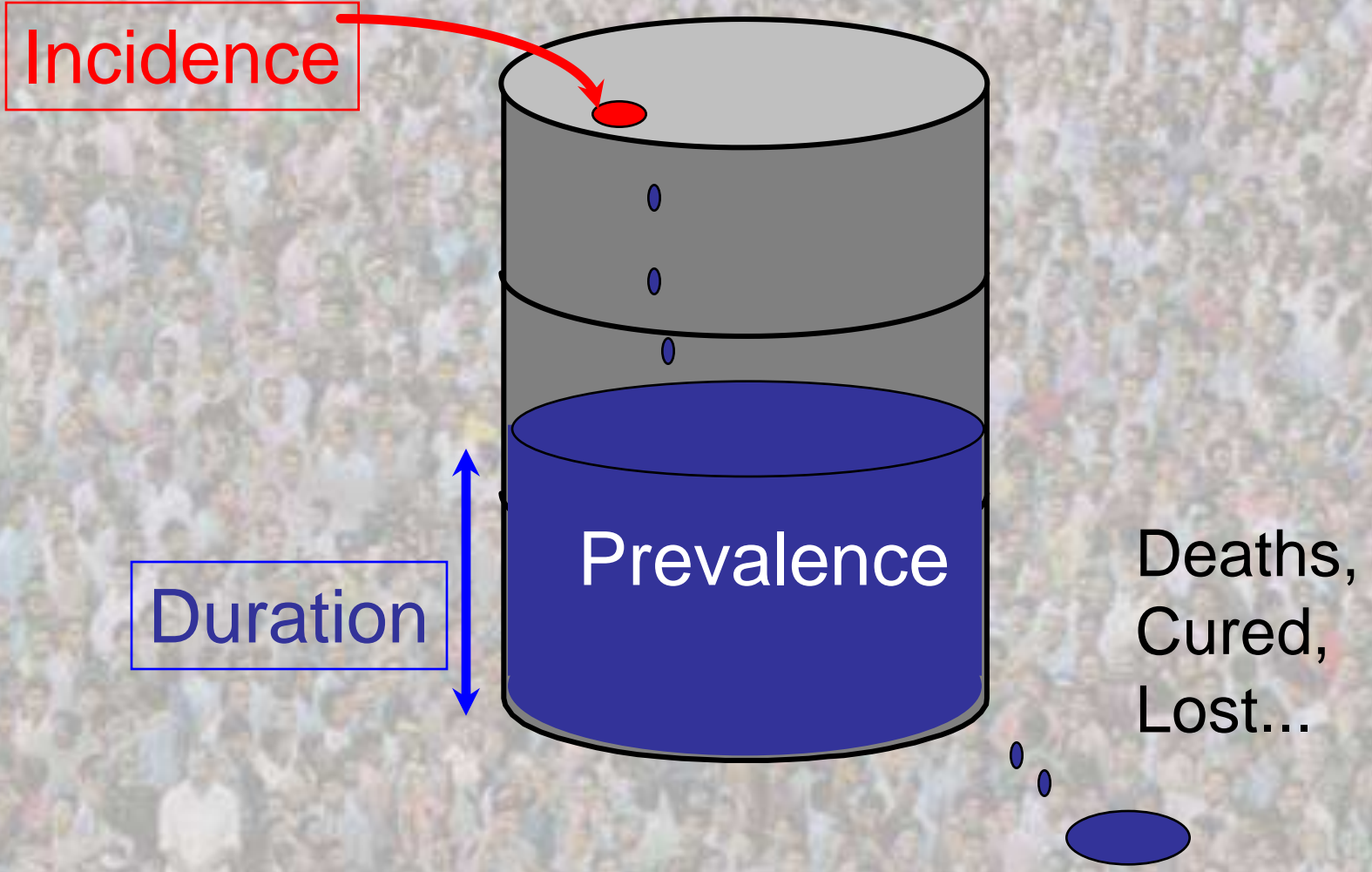
Incidence

- Number of <u>new cases</u> of a disease that occur in a given population during a defined period of time

$$Incidence = \frac{Number\ of\ new\ cases\ of\ disease\ during\ a\ period}{Population\ of\ interest\ during\ this\ period}$$

Cumulative Incidence

= The probability that an event will occur

= A proportion

= Risk

= Attack rate

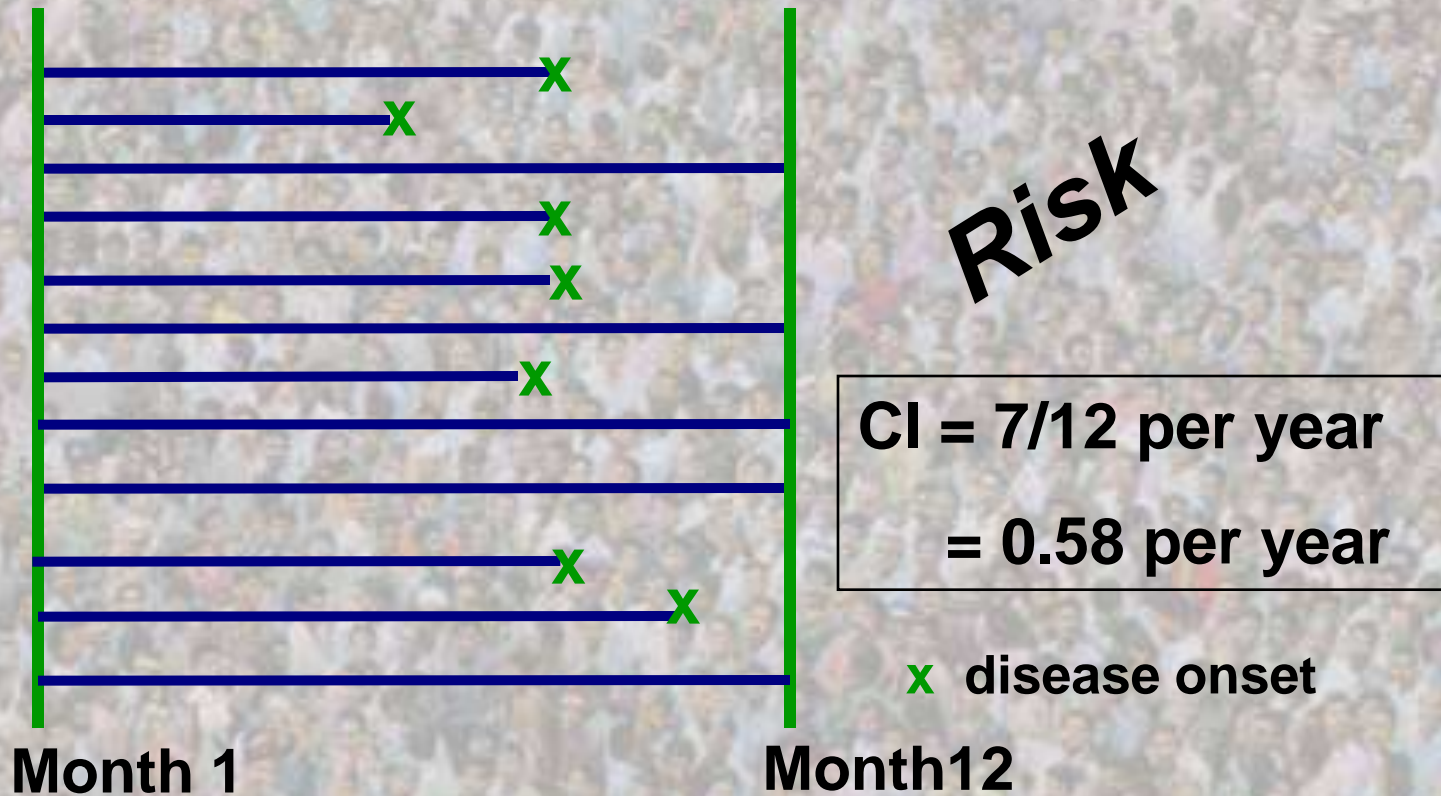$$CI = \frac{\text{Number of new cases with disease in a specified time period}}{\text{Number of disease-free people at the start of the time period}}$$

Disease-free = Population at risk

Cumulative Incidence

CI assumes that entire population at risk followed up for specified time period

Risk

CI = 7/12 per year

= 0.58 per year

x disease onset

Month 1   Month12

Attack Rate (AR)

- Cumulative incidence during an outbreak
    Usually expressed for the entire epidemic period, from the first to the last case

- Not really a rate but a *proportion*!

Ex: Outbreak of cholera in country X
    in March 1999
    – Number of cases = 490
    – Population at risk = 18,600
    – Attack rate = 2.6%

Odds of Disease

- The likelihood of an event occurring rather than not occurring

- Ratio of two proportions or probabilities

Number of new cases with disease in a specified time period

Odds = ---

Number of people who were still disease-free by end of the time period

Example: ARI cases=25

Total population =100

Time = 1 year

Odds of ARI= 25:75 = 0.33

Incidence rate

Number of new cases of disease during a specified time period

IR = ---

Total person-time at risk during that period

- Denominator:
  - is a measure of time
  - the sum of each individual's time at risk and free from disease

Person-time

	90 91 92 93 94 95 96 97 98 99 00	Time at risk
A	————————————	6.0
B	————————————X	6.0
C	———————————————————	10.0
D	—————————————————	8.5
E	—————————X	5.0
Total years at risk		**35.5**

-- time followed
x disease onset

IR = 2 / 35.5 person- years

= 0.056 / person-year

Incidence rate

- Larger studies: mid-period population
- Also called incidence density or force of morbidity (mortality)
- Expressed as number of new cases per person-time at risk
- Person-time can be person-days, person-months, person-years, but more common is per 100 person-years

Other Measures

Term	Formula
Mortality	$\dfrac{\text{Number of deaths from disease}}{\text{Number of persons in population}}$
Case Fatality Rate	$\dfrac{\text{Number of deaths from disease}}{\text{Total number of persons with disease}}$
Morbidity	$\dfrac{\text{Number of persons with disease}}{\text{Number of persons in population}}$

Other Measures

- **Maternal mortality ratio (MMR)**: The number of women who die as a result of pregnancy and childbirth complications per 100,000 live births in a given year.

- Crude death rate: Annual number of deaths per 1,000 population.

- Crude birth rate: Annual number of births per 1,000 population.

- Under-five mortality rate: Probability of dying between birth and exactly five years of age expressed per 1,000 live births.

- Infant mortality rate: Probability of dying between birth and exactly one year of age expressed per 1,000 live births.