Learning objectives

By the end of this lecture you (will) be able*:*

- ✓ List the main measures of mortality.
- ✓ Define Mortality Rates.
- ✓ Calculate Mortality Rates by age, sex, location and time provide invaluable health data
- ✓ Understand the importance of mortality and morbidity as indicators of health status of a population.
- ✓ Describe, calculate and interpret infant mortality rate and different indicators for measuring maternal mortality rate.

*Outline

- **The main measures of mortality:**

  1- Mortality Rates.

  2- Crude Mortality Rate Crude Death Rate.

  3- Cause-specific mortality rate.

  4- Age-specific mortality rate.

  5- Sex-specific mortality rate.

*Definition

Mortality rate: The number of deaths from all causes divided by the total population at a particular time and place.

Main measures of mortality:

1- Mortality rate

$$Mortality\ rate = \frac{deaths\ occurring\ during\ a\ given\ time\ period}{size\ of\ the\ population\ among\ which\ the\ deaths\ occurred} \times 10^{n}$$

2- Crude Mortality Rate (Crude Death Rate(CDR))

The crude mortality rate is the mortality rate from all causes of death for a population. We usually multiply by 1000.

$$Crude\,Death\,Rate = \frac{Total\,number\,of\,deaths\,in\,a\,certain\,year\,and\,locality}{Estimated\,mid-year\,population(Same\,year\,and\,locality)} \times 1000$$

- It is important to use the population size at the midpoint of the time interval as an estimate of the average population at risk especially if:

- A denominator population is growing or shrinking during the period of time for which a rate is to be computed.

- E.g. If a death rate is to be calculated for the year 2000, then the population of July 1, 2000 is used for the denominator.

- Risks of death change by age, so CDR is affected by population age structure, so it's lack comparability for communities.

- Aging populations can have rising CDRs, even as the health conditions are improving .Therefore mortality comparisons across countries should always use mortality indicators that are adjusted for differences in age composition

3- Cause-specific mortality rate

The cause-specific mortality rate is the mortality rate from a specified cause for a population.

- The **numerator** is the number of deaths attributed to a specific cause.

- The **denominator** remains the size of the population at the midpoint of the time period. We multiply by 1000.

> **Death of a specific cause in a given year and locality**
>
> = --- **X 1000**
>
> **Estimated mid-year population in the same year and locality**

Q) Calculate the cause specific death rate per 100,000 for tuberculosis in South Africa in 1993.if total population 39, 544, 974 and No of death due to tuberculosis   was 7474.

Answer: No of death from TB in specific time and locality
--   X1000
Estimated mid-year population in the same time and locality

$$= \frac{7474}{39,544,974} \ X1000$$

$$= 0.189$$

- This rate permits the comparison of causes of death (within the same country and between different countries).

4- Age-specific mortality rate:

An age-specific mortality rate is a mortality rate limited to a particular age group.

- The **numerator** is the number of deaths in that age group

- The **denominator** is the number of persons in that age group in the population.

- Example: In the United States in 2003, a total of130, 761 deaths occurred among persons aged 25-44 years, or an age-specific mortality rate of 153.0 per 100,000 25–44 year olds.

- Examples of age-specific mortality rates are neonatal, post-neonatal, infant and under 5-years mortality rates.

$$\text{Age specific death rate} = \frac{\text{Number of persons dying in a certain age and a certain year and area}}{\text{Total number in the same age group in the same year and same area}} \ x1000$$

Why did you measure Age Specific Death Rates?

- Can compare mortality at different ages
- Can compare mortality in the same age groups over time and/or between countries and areas

➢ **Prenatal Mortality Rate**

- It is expressed as the sum number of still births and early neonatal deaths (less than 7 days of life) per 1000 total births (still births plus live births).

➢ **Neonatal mortality rate:**

- The neonatal period is defined as the period from birth (7 days) up to (but not including) 28 days.

- The numerator of the neonatal mortality rate is the number of deaths among children under 28 days of age during a given time period.

- The denominator of the neonatal mortality rate is the number of live births reported during the same time period.

- The neonatal mortality rate is usually expressed per 1,000 live births.

Infant Mortality Rate (IMR):

Number of deaths of infants under age 1 per year per 1000 live births in the same year

$$IMR = \frac{\text{No of death of infant in a given Year}}{\text{Total live birth in that year}} \times 1000$$

➢ **Post neonatal mortality rate:**

- The post neonatal period is defined as the period from 28 days of age up to (but not including) 1 year of age.

- The numerator of the post neonatal mortality rate is the number of deaths among children from 28 days up to but not including 1 year of age during a given time period.

- The denominator is the number of live births during the same time period.

- The post neonatal mortality rate is usually expressed per 1,000 live births.

Example

• In 1988, infant mortality rate in the United States was 9.9 per 1,000 live births

- In 1988, the neonatal mortality rate in the United States was 6.3 per 1,000 live births

What are the causes of neonatal and post neonatal mortality?

What is the ratio of neonatal to post neonatal mortality?

5- Sex-specific mortality rate:

A sex-specific mortality rate is a mortality rate among either males or females.

Both numerator and denominator are limited to the one sex.

Combinations of specific mortality rates

Different combinations of specific mortality rates can be calculated e.g. cause-specific, age-specific.

➢ **Maternal mortality**
- The World Health Organization defines maternal mortality as:
- Death of the women while pregnant or within 42 days of termination of her pregnancy.

  (I.e. during pregnancy, delivery and puerperium), for any reasons related to / or aggravated by the pregnancy or its management, but not as a result of unrelated accidental or incidental causes

- The maternal mortality rate is really a ratio used to measure mortality associated with pregnancy.
- The numerator is the number of deaths assigned to causes related to pregnancy during a given time period.
- The denominator is the number of live births reported during the same time period.
- Because maternal mortality is much less common than infant mortality, the maternal mortality rate is usually expressed per 100,000 live birth

- **Number of women who die as a result of complications of <u>pregnancy or childbearing</u> in a given year per 100,000 women of childbearing age in the population**

$$MMR = \frac{\text{No of maternal death}}{\text{Total life birth}} \times 100{,}000$$

*Case-fatality rate

The case-fatality rate is the proportion of persons with a particular condition (cases) who die from that condition. It is a measure of the severity of the condition.

The formula for its calculation is:

$$= \frac{\text{Number of cause-specific deaths among the incident cases}}{\text{Number of incident cases}} \times 100$$

EXAMPLE: Calculating Case-Fatality Rates

In an epidemic of hepatitis A traced to green onions from a restaurant, 555 cases were identified. Three of the case patients died as a result of their infections. Calculate the case-fatality rate.

$$\text{Case-fatality rate} = \frac{\text{Number of cause-specific deaths among the Incident cases}}{\text{Number of incident cases}} \times 100$$

$$= \frac{3}{555} \times 100 = 0.5\%$$

*Proportional Mortality Rate

$$= \frac{\text{Death attributed to cause specific death}}{\text{Total deaths during year}} \times 100$$

Example:

1) Population in city (x) :500,000
   - No of women : 100,000
   - No of children :200,000
   - Case of diabetes begging 2004 : 200 case

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- Cases developed diabetes in 2004: 100
- Death from DM women :10
- Death in children :100
- Death from puerperal sepsis : 10

Calculate the following

1. **Proportional mortality rate of DM**
2. **Curd death rate**
3. **Children specific of rate death of DM**
4. **Sex specific death rate**

<u>Answer</u>

1. **Death of DM**

   -------------------- X 100

   All Death NO

   $$= \frac{20}{110} \times 100 = 8.33$$

2. **No of death for all cases**

   --------------------------------- X 1000

   Mid-year population size

   $$= \frac{120}{500,000} \times 1000 = 0.24 \text{ Per } 1000$$

3. **No of death from DM**

   ---------------------------- X 1000

   Midyear population size

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$$= \frac{10}{200,000} \times 1000 = 0.05$$

NO of women death

4. $\dfrac{\text{------------------------------}}{\textbf{Midyear women population}} \quad X1000$

$$= \frac{10}{100,000} \times 1000$$

$$= 0.1 \text{ per } 1000$$