Health Measures used in epidemiology

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Learning Objectives

By the end of the lecture you should be able to:
1. Distinguish between rate, proportion, and ratio
2. Know health measures used in epidemiology
3. Know and calculate commonly used measures of morbidity (incidence and prevalence rates).
4. Know the significance of incidence and prevalence rates.

Definition of Epidemiology

Epidemiology is the study of <u>frequency</u>, <u>distribution</u> and <u>determinants</u> of disease and health related events in population groups.

Health Measures used in Epidemiology

1. Measures of Morbidity

2. Measures of Mortality

3. Measures of Fertility

These Measures are expressed in terms of   Rates ,Proportions and Ratios
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1. The Rates
Rates are used to express the frequency of an event (disease, birth, death. .etc) in a defined population.

Characteristics of the rate

1- The numerator: the number of individuals with the event of interest

2- The denominator: population at risk

3- The numerator is part of the denominator (a/a+b)

4- It is related to a *specified period of time*

5-It is expressed as % ,per 1,000 ,10,000 , 100,000 population …etc

Rate = $\dfrac{\text{Number of individuals with the event of interest in a specified period}}{\text{Population at risk in the same period}}$

K is constant; usually 1,000, 10,000 or 100,000.

2- The Proportion

The number of individuals with the event of interest (numerator) divided by the total number of events (denominator) i.e. it refers to fraction of the total.

Characteristics of the proportion

1- The numerator: the number of individuals with the event of interest

2- The denominator: total number of events

3- The numerator is part of the denominator (a/a+b)

4- It does Not necessarily relate to a specified period of time.

5-It may be expressed as a number between 0 and 1 (0.1, 0.2, 0.35 …….),
   OR as a percentage (X 100).

Example 1:

$$\text{Proportion of male births} = \frac{\text{Number of male births}}{\text{Total number of births (male births+ female births)}}$$

Example 2:

$$\text{Proportion of deaths due to CHD} = \frac{\text{Number of deaths due to CHD}}{\text{Total deaths (deaths due to all causes)}}$$

3. The Ratio

The Ratio is the relationship between two different elements.

Characteristics of the ratio

1-The numerator is <u>not part</u> of the denominator = a/b

2- It <u>does not</u> relate to a ***specified period of time***.

Example:

$$\text{Sex Ratio} = \frac{\text{Number of male births}}{\text{Number of female births}}$$

Expressed for example as 1:1, 1:2, 2:3……etc.

Measures of Morbidity

Measures of morbidity refer to the extent of illness, injury or disability in a defined population.

The two most commonly used measures of morbidity are:-
1. Incidence Rate
2. Prevalence Rate

Incidence rate (IR)

Incidence rate is the number of <u>new cases</u> of a disease occurring <u>during a specified period of time</u> in a <u>population at risk</u> for developing the disease (in disease-free individuals)

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\text{Incidence Rate} = \frac{\text{Number of new cases of a disease during a period of time}}{\text{Number of population at risk (free of disease) during the same period of time}}
$$

Note: The period of time could be year, month, week   or even a day.

Significance of the incidence rate
1. Incidence rate (I.R)of disease is a measure of the **(Risk)** of acquiring the disease, i.e. the probability of healthy people to develop the disease during a specific time period.
2. A high incidence rate means a high occurrence of disease; a low incidence rate means a low occurrence of disease.

3. For communicable diseases incidence rate is a measure of <u>the extent of transmission (rate of transmission)</u> of the disease in a population.
4. It is an appropriate measure <u>for etiological studies</u> of diseases (cohort studies).
5. It is an appropriate measure to study diseases of short duration

Prevalence rate

-Point prevalence rate is the number of all cases of a disease <u>(new +old)</u> that are present at a point in time in the total population.

 -Period prevalence rate is the number of all cases of a disease <u>(new +old)</u> that are present during a specified period of time in the total population.

$$\text{Point Prevalence Rate} = \frac{\text{Number of all cases of a disease (new \& old) at a point of time}}{\text{Total population}}$$

$$\text{Period Prevalence Rate} = \frac{\text{Number of all cases of a disease (new \& old) during a specified period of time}}{\text{Total population}}$$

Significance of the prevalence rate

1. It measures the <u>burden</u> of the disease i.e. number of people in a population who have the disease at a given time.
2. It <u>does not measure the risk of acquiring</u> the disease because it is affected by the duration of the disease
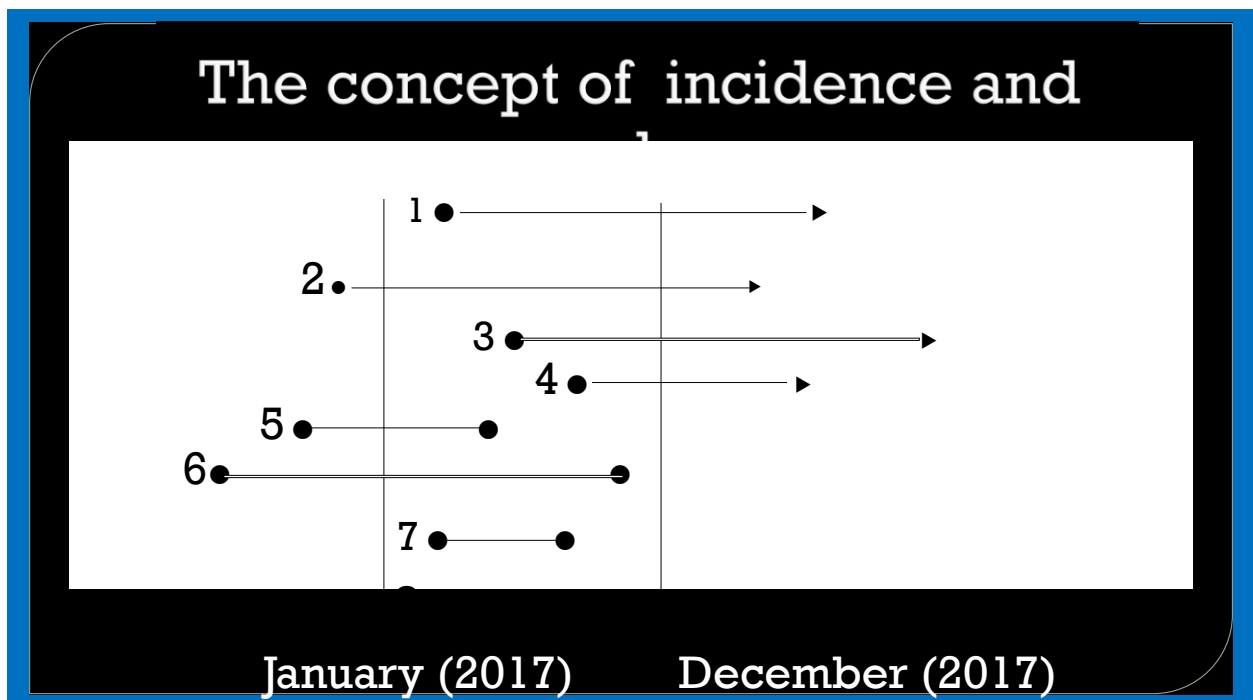
The relation between incidence and prevalence

In a stable situation (when there is no change in the incidence rate)

Prevalence = Incidence X Duration of disease

Example:

On the first of January /2014, a survey found 50 cases of diabetes among 400 tested persons. During the year, **20 new** cases were detected. If 5 persons with diabetes died during 2014.Calculate:-

1. Prevalence of diabetes on the first of January /2014

2. Incidence of diabetes during 2014.

3. Period prevalence of diabetes during 2014.

4. Prevalence of diabetes on 31st December / 2014

Solution

-**Point Prevalence in Jan/2014**=50/400x1000=125/1000 population

- **Incidence of diabetes during 2014**= 20/(400-50)x1000 = 57.14/1000 population per year

 - **Period prevalence in 2014**= 50+20/400x1000=175/1000 pop

 - **Point Prevalence in Dec/2014**= (50+20)-5/(400-5)x1000=164.56/1000 population

Question (home work)

A survey was carried out on primary school children in January 2009 covering 36 000 children. At this initial survey 10% of the children were found malnourished. A school feeding program was launched during 2009 and all children were examined at the end of 2009. A total of 1200 of the previously malnourished were still malnourished. In addition 120 more children were found as malnourished.

-Calculate indicators of nutritional morbidity in this population at the beginning, during and at the end of 2009.

Thank you