Revised by
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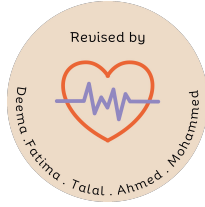
Measures of Disease Frequency

Lecture No. 14

Objectives:

1. To explain counts, proportions, ratios and rate
2. To calculate measures of disease frequency (prevalence & incidence)
3. To know how to compare rates
4. To select appropriate measures for different context

~ This lecture was presented by **Dr. Basma Almujadadi**
~ It is included in the **Midterm Exam**
~ We highly recommended reading the **Ayah** in the first page

Slides

Color code

Original text
Dr. Notes
Important
Golden note 🎁
Extra

Editing file

Types of Epidemiological Measures

1. **Measures of disease frequency** "quantity"

To measure disease frequency is to quantify the occurrence of disease in populations.

2. **Measures of association (effect)**
3. **Measures of potential impact**

سُورَةُ الزُّمَرِ

أَفَمَن شَرَحَ ٱللَّهُ صَدْرَهُۥ لِلْإِسْلَٰمِ فَهُوَ عَلَىٰ نُورٖ مِّن رَّبِّهِۦ فَوَيْلٌ لِّلْقَٰسِيَةِ قُلُوبُهُم مِّن ذِكْرِ ٱللَّهِ أُوْلَٰٓئِكَ فِى ضَلَٰلٖ مُّبِينٍ ۝
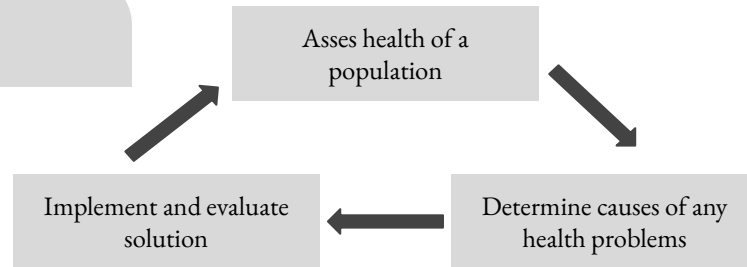
المختصر في التفسير

أفمن شرح الله صدره للإسلام، فاهتدى إليه، فهو على بصيرة من ربه، مثل من قسا قلبه عن ذكر الله؟! لا يستويان أبدًا، فالنجاة للمهتدين، والخسران لمن قست قلوبهم عن ذكر الله، أولئك في ضلال واضح عن الحق.

Measures of disease frequency

Mathematical parameters:

1. Counts
2. Fractions (Rate, Ratio, Proportion/Percentage)

Asses health of a population

Determine causes of any health problems

Implement and evaluate solution

Epidemiological measures:

1. Prevalence
2. Incidence

"based on it they built the epidemiological measures"

How many people have this disease?

- The most simple and basic measure used in epidemiology
- The **absolute number** of people who have disease or characteristic of interest or health phenomenon being studied "*counting cases*"
- Useful for **allocation of resources** (e.g. quantity of ORS "oral rehydration solution" needed for diarrheal cases)
- Useful for **surveillance** of infectious disease such as early detection of outbreaks.

Rate, ratio, and proportion

Rate

- Measures the frequency of **events** that occurred at a specific/defined period of time divided by the **average population at risk.**
- Used to **compare** experiences between populations at different **times**, **different places** or among different **classes** of people.
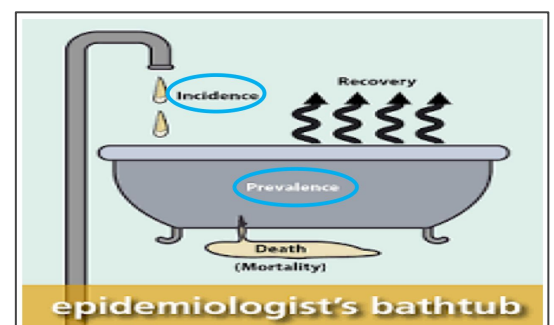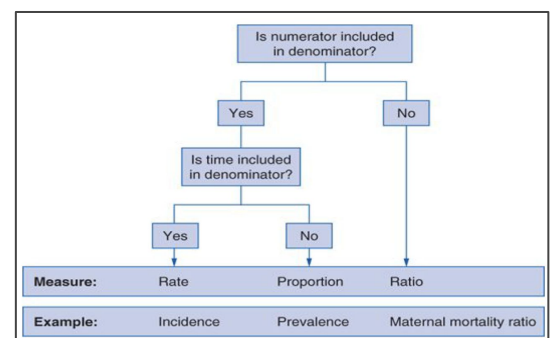- Composed of: Numerator (بسط), denominator (مقام), time specification and multiplier.

Ratio

- Is a fraction in which the **numerator is not a part of denominator** "not related to each other" and it is calculated by dividing one variable by the other; e.g., Male:Female
- Relation of size between two random quantities without implying any specific relationship between the numerator and denominator (a/b).
- The numerator and denominator are **mutually exclusive** (neither included in each other).

Proportion

- Is a fraction where the numerator is included in the denominator e.g., number of male births/total births
- Are dimensionless "they use the same unit so they cancel each other" as in it doesn't have a unit of measure and always lies between 0 or 1
- Often expressed as a percentage %

Incidence

- Measures new cases of disease, the number of individuals who develop a specific disease or experience a specific health-related event during a particular time period.
- Typically calculated as a proportion or a rate.
- This is the primary outcome of **experimental and cohort studies** "Gives you a cause and effect so best used for: experimental and cohort studies"
- This is what it is needed for the **investigation of causal inference and determining risk factors.**

> **Incidence proportion =**
>
> **number of new cases in a population during a specific period of time**
> _____
> **total population at risk "disease free" during the specific period of time x 10^n**

Attack Rate (AR)

incidence proportion هو نفسه

- Is a type of incidence measure that is calculated in acute recurrent diseases and mostly in outbreak investigations "how long a person wait to develop the disease"

AR= No. of episodes during a specified period
_____
   Population at risk during the same period x $10n$ "usually 100 but we need a %"

> Attack rate = incidence risk = incidence proportion

Example: مارح تسأل عنها

- During an outbreak of shigellosis, 18 people in 18 different households became ill. The population of the community was 1,000.

Calculate the attack rate?

Attack rate= no. of new cases / population at risk x 100 =

18/1,000 x 100 = 1.8%.

Prevalence

Doesn't give you an association between cause and effect

- Measures new and pre-existing cases of disease, the total number of individuals in a population who have a disease or health condition at a specific period of time.
- Usually expressed as a percentage of the population.
- This is what it is needed for understanding the **magnitude of a health problem.**
- Useful for assessing the health status of a population , current burden of disease and thus planning the appropriate health services.
- This is the **primary outcome of cross-sectional studies.**

Two types of prevalence

1 **Point prevalence** for the estimates at a specific time.

2 **Period prevalence** for the estimates within a range of time.

$$\text{Point Prevalence} = \frac{\text{Total cases (old + new) at fixed point of time in place}}{\text{Total population at risk in the same place and time}} \times 10^n$$

$$\text{Period Prevalence} = \frac{\text{No. of existing cases (old+new) of a specified disease during a given period of time interval}}{\text{Estimated mid-interval population at risk "give you an average"}} \times 10^n$$

Example:

❑ At the beginning of 1980 there were 55 existing cases of stomach cancer in New-Delhi. During 1980, 75 new cases of stomach cancer were diagnosed. Midyear population of New-Delhi in 1980 was 522,922.

Calculate the incidence of stomach cancer in New-Delhi in 1980?

Calculate the prevalence of cancer stomach in New Delhi, India in 1980?

Incidence = new cases / population at risk x 100,000=

=75 / 522,922 x 100,000

 = 14.3 / 100,000 population

Prevalence = total cases / midyear population X 100,000

= (55+75) /522,922 x 100,000

 = 24.86 per 100,000 population

How to select appropriate measures for different context

Just for your knowledge and will not come in exam

	Point prevalence	Period prevalence	Incidence risk	Incidence rate
Numerator	All cases counted on a single occasion	Cases present at period start + new cases during follow-up period	New cases during follow-up period	New cases during follow-up period
Denominator	All individuals examined	All individuals examined	All susceptible individuals present at the start of the study	Sum of time period at risk for susceptible individuals present at the start of the study
Time	Single point or period	Defined follow-up period	Defined follow-up period	Measured for each individual from beginning of study until disease event, exit from the population, or end of the follow-up period
Study type	Cross-sectional	Cohort	Cohort	Cohort
Interpretation	Probability of having disease at a given point in time	Probability of having disease over a defined follow-up period	Probability of developing disease over a defined follow-up period	How quickly new cases develop over a defined follow-up period

MCQ:

Q1: which of the following assess the incidence?
A. Case control
B. Cross sectional
C. Case report
D. Cohort

Q2: in cross sectional study, what measure of disease frequency is used?
A. Prevalence
B. Incidence rate
C. Relative risk
D. Incidence proportion

MCQ:

Q3: what is best way to measure existence of disease in population?
A. Odd ratio
B. Relative risk
C. Prevalence
D. Incidence

Q4: what is the appropriate measure to estimate the risk of CVD during 7 years of follow up period?
A. Risk ratio
B. Point Prevalence
C. Incidence risk