

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



LXVIII



Epidemiological and Research Studies

Part I

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Learning objectives:

You will learn about

- ❖ Commonly used **epidemiological studies** and
- ❖ **measurements** to describe the occurrence of disease,
- that facilitate **understanding of distribution of disease in a given population.**

Epidemiology: Definition

“The study of **distribution** and determinants of health-related states or events in specified populations, and the application of this study **to control health problems**”

Study: includes surveillance, observation, analytic research, and experiments.

- **Distribution:** Refers to analysis by **time, place, and classes** of persons affected.

Determinants: **All the** physical, biological, social, cultural, and behavioral factors that influence health.



Uses of Epidemiology:-

- 1-To Describe the distribution & size of diseases in human population. Age, sex social class.....
- 2- To Identify **etiological factors** in the pathogenesis of disease
- 3-To Provide the data essential for **management**.
- 4- To **Evaluation** and planning of services for the prevention & control and treatment of disease

Measures of Disease Frequency

A prerequisite for any epidemiologic investigation is **quantify** the occurrence of disease.

The most basic & simplest method of expressing disease frequency is simple count. ♀ 25 ♂ 10

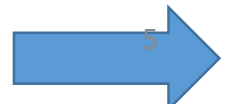
However

count data alone have **very limited** utility for epidemiologists.

No. of student with Tuberculosis(TB)

=20 City A

= 30 City B ??????????



it is also necessary to know

- The **size** of the population

♀ 25

♂ 10

♀ 200	♂ 50
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TB=20 City A

TB= 30 City

- 100 City A
200 City B

- The time period during which the data were collected



- Such measures allows **direct comparisons** of disease frequencies in two or more groups of individuals.

Measurements of disease frequency

There are two types of rates:

- ▶ Rates of **morbidity** (frequency of illness)
- ▶ Rates of **mortality** (frequency of deaths)

Sickness -Morbidity rates

Death -Mortality rates

are used as H. status indicator

Morbidity Rate

Morbidity is the extend of **illness**, injuries, or disability in a **defined population** during **specific period of time**

In epidemiology Two key morbidity

- ❖ 1 Incidence
- ❖ 2-Prevalence

Incidence

Incidence is the No. of new cases of disease which came into existence within a **certain period** of time per **specific unit of population**.

it is the No. of new cases of a disease occurring in a **specific population** in a **specified time** period

Incidence rate = $\frac{\text{number of persons developing a disease (new cases) in a specific time and locality} \times 1000}{\text{total number of population at risk}}$

Example

Cont.Incidence

A study done on **1500** school children during **2020** found **20** with TB. By follow up the school children during **2021** the number of students with TB was **28**

New cases were $8 = 28 - 20 = 8$

Incidence **new cases** only 2021 = $8 / 1500 \times 1000$

Incidence = $5.33 / 1000$ population/year

Incidence rate =
$$\frac{\text{No of new cases of a disease within a population in a given time period}}{\text{No of persons exposed to risk of developing the disease in the same time period}} \times 1000$$

A study done on **1500** school children during **2020** found **20** with TB. By follow up during **2021** the number of students with **TB 28**

Numerator & Denominator in incidence

Numerator

Is the No. of new cases within a time period. **8 cases**

Denominator

the number of **population at risk** .or under study in the group or population. **1500**

New cases were **8** = $28-20=8$

Incidence new cases only **2021** = $8/1500 \times 1000$

Incidence = $5.33/1000$ population/year

Prevalence

Prevalence

is the No of **All cases** of disease,, or condition, present **at a particular time** , in **relation to the size of population from which it is drawn**.

Prevalence means **ALL**. (Old+ New)

Prevalence

quantifies the **proportion** of individuals in a **population** who **have the disease at a specific time**

Prevalence: in the **number of cases** of a disease present **in a defined population** at a given **point of time**

A study done on 1500 school children at Al-Karak , during 2020 found 20 with TB. By follow up during 2021 the number of students with TB 28

□ Incidence new cases only 2021 = 8

prevalence ?? 2020

prevalence ?? 2021

□ Prevalence 2020 =

$$20/1500 \times 1000 = 13.33/1000 \text{ population/year}$$

□ Prevalence 2021

$$= 28/1500 \times 1000 = 18.66/1000 \text{ population/year}$$

example,

visual examination survey conducted in Al Karak among individuals , 52 - 85 years of age, during 2021

310 of the 2477 persons examined **had cataracts** at the time of the survey. **???????**

The prevalence of cataract in that age group was

$$P = \frac{\text{No of existing cases of a disease}}{\text{total population at risk at a given point in time}} \times 100$$

$310 / 2477 \times 100$,=**12.5%** prevalence of cataract among population aging 52 - 85 years in Al Karak during 2021

Epidemiology

The study of the **distribution and determinants** of health-related states in a **specified population**

AND

the application of this study to **control of this health problem**

Epi =

Demo=

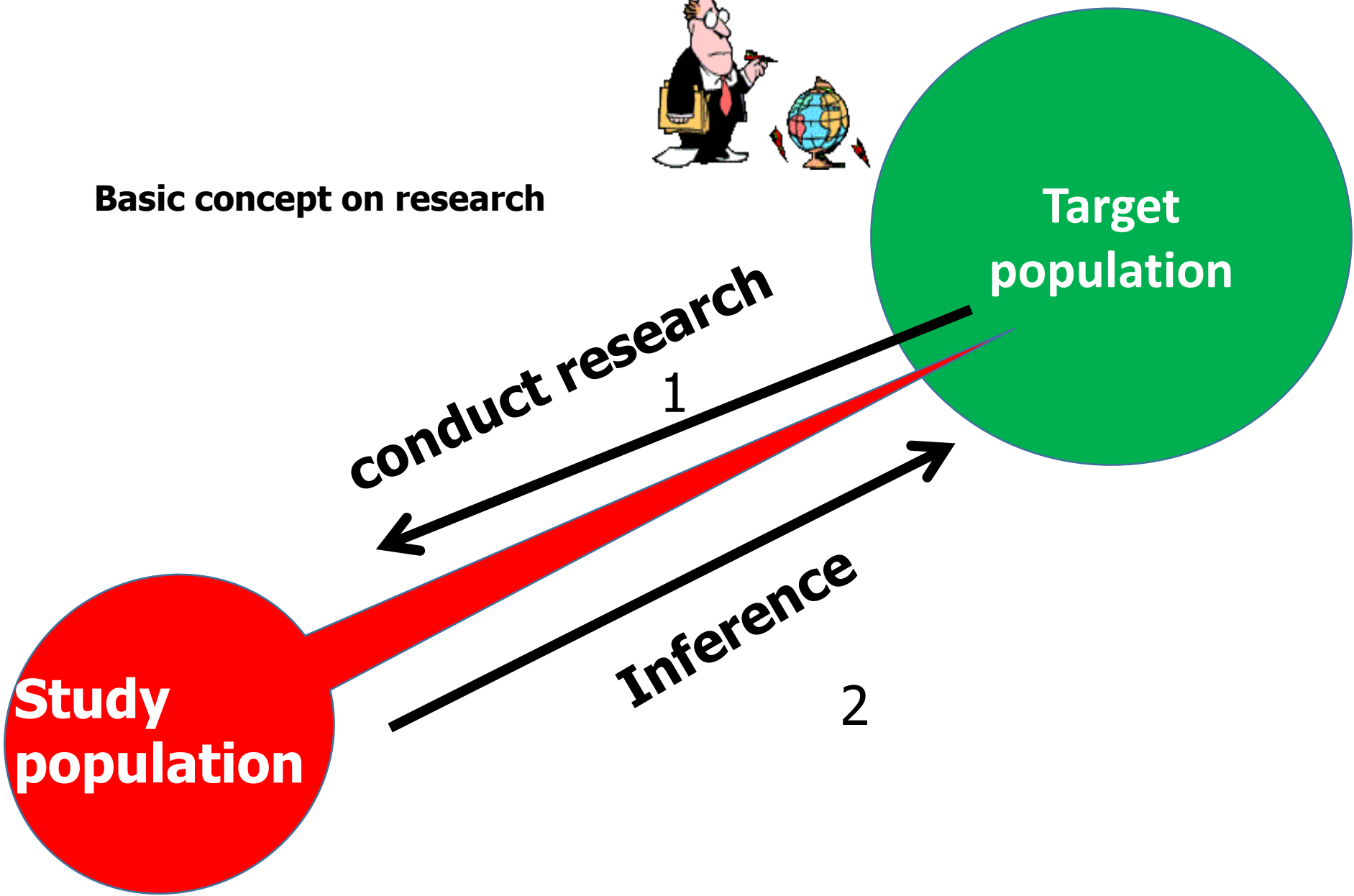
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The essence (core)of epidemiology is **to measure disease occurrence and make comparisons** between population groups.



Basic concept on research



Types of study Designs



Classification and sub-classifications may differ in different references

Qualitative studies

Quantitative studies



B- Quantitative studies:

- These are the studies we **use in medicine**, and **public health**
- Involving formal , objective information about the world, **with mathematical quantification**

TYPES OF STUDY DESIGNS

- Systematic review & meta analysis**
- Intervention(experimental) studies**
- Observational studies:**



A- Qualitative studies:

- It was introduced **from social sciences**
- Difficult to define
- But it does **not depend on mathematical quantification**,
- and relies on researcher(s) **observation and opinion**
- ✓ It is used to **gain an understanding** of underlying **reasons, opinions, and motivations.**
- ✓ It provides insights into the problem or **helps to develop ideas** or **hypotheses** for potential **quantitative research.**
- **Qualitative Research** is also used to **uncover trends in thought** and **opinions**, and **dive deeper into the problem.**

1-Quantitative studies

I. Observational studies

A- Descriptive

Case report

Case series

Epidemiological reports

Cross-sectional

B- Analytical studies

Cross-sectional

Case-control

Cohort

II. Experimental.

Clinical trials

Community trials

There are two forms of epidemiologic methods to investigate the pattern of a disease

A)I Observational epidemiology:-

It falls into two main categories

A-Descriptive study

B- Analytic study

-Cross-sectional study

-Retrospective study

-Prospective study

II Experimental epidemiology

Quantitative studies

Quantitative studies

I. Observational

Descriptive

Analytical studies

II. Experimental

I. Observational studies

Allow nature to take its course

- the investigator **measures** but **does not intervene**.
- They include studies called :

Descriptive & Analytical studies

A-Descriptive:

- ❖ A descriptive study is limited to a **description of the occurrence of a disease** (health problem) in a population
- ❖ **to describe the occurrence of a disease in relation Person, Place and Time.** And is often
- ☐ the **first step in an epidemiological investigation**



Quantitative studies

Cont. ..Observational studies

Quantitative studies

I. **Observational**

Descriptive

Analytical studies

II. Experimental

B- Analytical

- ❖ An analytical study **goes further** by analysing
 - ❖ relationships between **health status** and other **variables**
- Almost all epidemiological studies are analytical in character.
 - Pure descriptive studies are rare,
 - but **descriptive** data in reports of health statistics are a **useful source of ideas for epidemiological studies**

❑ Experimental studies

Experimental or **intervention** studies involve

an active attempt to change a disease determinant –

such as

- an exposure or
- a behaviour –
- or the progress of a disease **through treatment,**

❑ Major **experimental study** designs **include the following:**

- **Randomized controlled trials** using patients as subjects (clinical trials),
- **Field trials** in which the participants are **healthy people,** and
- **Community trials** in which the participants are the
 - **communities themselves**



Observational studies

Observational studies

Descriptive

Case report

Case series

Epidemiological reports

Cross-sectional

Analytical studies

Cross-sectional

Case-control

Cohort

Experimental.

Descriptive

Case report

Case series

Epidemiological reports



Observational studies

Observational studies descriptive

- Case report
- Case series
- Epidemiological reports

Descriptive

Case report:

- It is **thorough description of a case**, whether a
- ❖ new discovered findings,
- ❖ description of **signs and symptoms**, or
- ❖ response to new mode of treatment (**descriptive or intervention**).

Case report uses

- **Detecting novelties**, ابتكار
- **generating hypotheses**,
- **high** applicability when other research designs are not possible to carry out,

The major limitations were:

- Lack of ability to generalize,
- no possibility to establish cause-effect relationship,
- danger of over-interpretation, publication bias (**not reporting negative findings**)

Descriptive

- **Observational --descriptive**
- Case report
- Case series
- Epidemiological reports

Epidemiological reports

- **A simple description of the health status of a community,**
- ❖ **based on** routinely available data or
- ❖ **on data obtained in special surveys ,**
- is often the **first step in an epidemiological investigation.**
- In many countries this type of study is undertaken by a **national Centre for health statistics.**
- **Pure descriptive studies**
- ❖ **make no attempt to analyze the links between exposure and effect.**
- They are usually **based on mortality statistics** (life events) and may examine patterns of death by age, sex or ethnicity during specified time periods or in various countries.
Example: reporting data of child mortality rate in Jordan



Analytical studies

Study the **relationship** of **one type of event or characteristic or variable** to **another** e.g

relationship of obesity (independent variable) and occurrence of DM (dependent variable).

To study these relations there are **three methods of analytic studies**

1. Cross-sectional
2. Case-control
3. Cohort

Observational studies
Descriptive
Case report
Case series
Epidemiological report
Analytical studies
Cross-sectional
Case-control
Cohort



Analytical studies

Cross-sectional

Issues in the design of cross-sectional studies

2. Potential bias in cross-sectional studies
3. Analysis of cross-sectional studies
4. Strengths and weaknesses of CSS studies

- Health data which are routinely available are usually **restricted to people** who are in contact with health services.
However,
 - ❖ they give **incomplete picture** of the **frequency** and distribution of the disease in a population, **because**
 - ❖ they cannot give data about people who have the disease but **do not seek treatment.**
 - ❖ In order to **plan services or** identify disease **among population** it is necessary to conduct the **cross sectional study.**
In this ,
 - **the disease and the possible factors for it, are measured simultaneously.** So ,
 - **it is difficult to determine which came before the other.**





- ❖ **A cross-sectional study (CSS)**
- ❖ **examines the relationship**
- ❖ **Between disease** (or other health related state) **and other**
- ❖ **variables of interest** as they **exist in a defined population at a single point in time or over a short period of time** (e.g. calendar year). ???
- **CSS measure the prevalence of disease** and thus are often called **prevalence studies**.
- **A CSS measures the prevalence of health outcomes or determinants of health, or both,** in a population at **a point in time or over a short period**.
- ❑ **Such information can be used to explore aetiology.**
- Data is collected from a **sample of population at a point in time**.



Cont....Cross-sectional studies

- **CSS are used** to **assess**
- **the burden** of disease or
- **health needs** of a population and
 - are particularly **useful in informing the planning** and
 - **allocation of health resources.**

❖ In sudden outbreaks of disease, a **CSS** to **measure several exposures**

❖ can be the **most convenient first step in investigating the cause**



Observation

Population

Sample

Exposed

Not exposed



Disease

No disease

Cross-sectional studies

CSS the measurements of exposure and effect are made at the same time



Types of cross-sectional study

1-Descriptive

2-Analytical

1-Descriptive

A CSS may be purely descriptive and used to assess the burden of a particular disease in a defined population.

For example a random sample of schools across Jordan may be used to assess the prevalence of asthma among 12-14 y olds



2-Analytical

- ❖ Analytical CSS may also be used to investigate the
 - Association between a supposed (hypothetical) risk factor and a health outcome.
 - However this type of study is limited in its ability to draw valid conclusions as to the association between a risk factor and health outcome.

In a CSS the risk factors and outcome are measured simultaneously,
and therefore it may be difficult to determine whether the exposure preceded or followed the disease.

In practice, CSS will include an element of both types of design



1. Issues in the design of cross-sectional studies
2. Potential bias in cross-sectional studies
3. Analysis of cross-sectional studies
4. Strengths and weaknesses of CSS studies

3. Analysis of cross-sectional studies

- ❖ In a cross-sectional study **all factors (exposure, and outcome,)** are measured simultaneously.
- ❖ The main outcome measure obtained from a
- ❖ cross-sectional study is **prevalence**, that is:

$$\text{Prevalence} = \frac{\text{Number of cases in a defined population at one point in time}}{\text{Number of persons in a defined population at the same point in time}}$$

Prevalence of disease among **exposed**

Prevalence of disease among **non exposed**



Prevalence of disease among **exposed**

$$\text{Prevalence} = \frac{\text{No of diseased person among **exposed**}}{\text{total exposed population at a given point in time}} \times 100$$

Prevalence of disease among **non exposed**

$$\text{Prevalence} = \frac{\text{No of diseased among **non exposed**}}{\text{total unexposed population at a given point in time}} \times 100$$

Strengths and weaknesses of CSS

Strengths

- Able to measure prevalence
- Multiple outcomes & exposures can be studied.
- assessing the burden of disease
- in a specified population and
- in planning and allocating health resources

❖ Weaknesses

- **Difficult to determine** whether the outcome followed exposure in time or exposure resulted from the outcome.
- **Not suitable for studying rare diseases** or
- diseases with a short duration...
- Associations **identified may be difficult to interpret.**
- **Susceptible to bias due to**
- low response and
- misclassification

Thank you for attention

year 1ST
medical students

