# EPIDEMIOLOGICAL METHODS

Epidemiological methods classification:

1. **Observational studies**

a. Descriptive studies

b. Analytical studies

- Ecological
- Cross sectional.
- Case control.
- Cohort.

2. **Experimental studies**

1. Randomized controlled trials
2. Field trials,
3. Community trials

## DESCRIPTIVE STUDY

is limited to a description of the occurrence of a disease in a population.

## ANALYTICAL STUDY

goes further by analyzing relationship between health status and other variables.

# DESCRIPTIVE EPIDEMIOLOGY

These studies are concern with observing the distribution of disease and health related characteristics in human populations and identifying the characteristics with which the disease in question seems to be associated.

## Steps of descriptive study

1) Defining the population
2) Defining the disease under study.
3) Describing the disease by time, place and person.
4) Measurement of disease.
5) Comparing with known indices
6) Formulation of an aetiological hypothesis.

### 1. Defining the population

Descriptive studies are investigations of populations, not individuals.

The first step, is therefore , to define the population base not only in terms of the total number, but also its composition in terms of age, sex, occupation, cultural characters and similar information needed for the study.

The defined population can be the whole population in a geographic area or more often representative sample taken from it.

### 2. Defining the disease under study.

Once the population to be studied or specified, one must then define the disease or condition being studied.

### 3. Describing the disease by time, place and person.

The primary objective of descriptive epidemiology is to describe the occurrence and distribution of disease by time, place, person. And identifying those characteristics associated with presence or absence of disease in individuals.

## TIME DISTRIBUTION

The pattern of disease may be described by the time of its occurrence i.e. week, month, the day of the week, hour of onset etc.

Time trends classification:

1. Short term fluctuations
2. Long term fluctuations
3. Periodic fluctuations.end
4. Short term fluctuations

The best known **short term fluctuation** in the occurrence of disease is an epidemic.

**Types of epidemics:**

a. **Common source epidemics**

i. Single source exposure or point source epidemics

ii. Continuous or multiple exposure epidemics.

b. **Propagated epidemics**

i. Person to person.

ii. Arthropod vector.

iii. Animal reservoir.

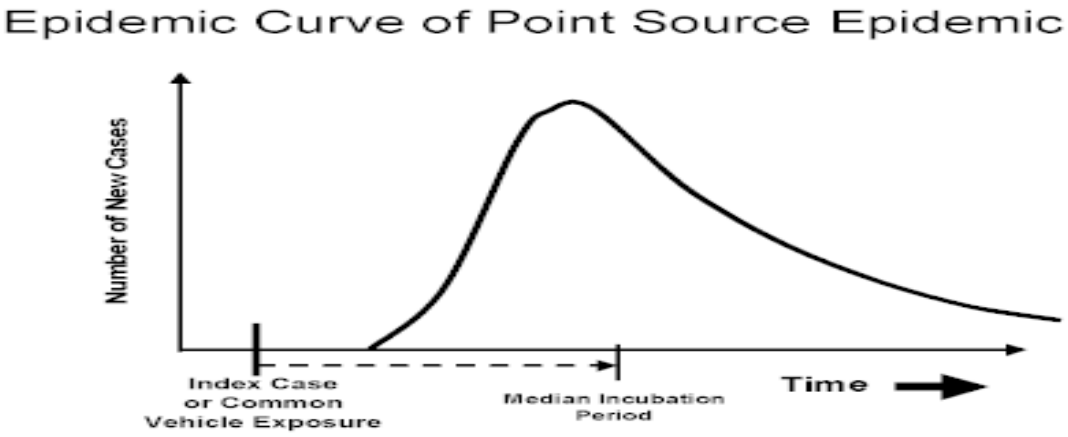
**C. low(modern) epidemics.**

**Single source exposure or point source epidemics**

The exposure to the disease agent is brief and essentially simultaneous; the resultant cases all develop within one incubation period of the disease.

Ex: epidemic of food poisoning.

**EPIDEMIC CURVE**




**Continuous or multiple exposure epidemics**

Sometimes the exposure from the same source may be prolonged,- continuous, repeated or intermittent – not necessarily at the same time and place.

**Propagated epidemics**

A propagated epidemic is most often of infectious origin and results from person- to- person transmission of an infectious agent.

**Periodic fluctuations**

**Seasonal trend :** Seasonal variation is well known characteristics of many communicable disease ex: measles is usually high at early spring season. Respiratory infections- winter season.

**Cyclic trend:** diseases occurs in cycles spread over short periods of time which may be days, weeks, months, years. Measles-2-3yrs, rubella: 6-9 yrs

**Long term or secular trends:** The term secular trend implies changes in the occurrence of disease i,e. progressive increase or decrease over a long periods of time , generally several years or decades.

Ex: CAD, DM, Lung cancer.

## PLACE DISTRIBUTION

Geographic patterns provide an important source of clues about the cause of disease. The range of geographic studies include those concerned with local variations.

- The variation may be classified as
  - International variations
  - National variations
  - Rural urban differences
  - Local distributions.
- The variation may be classified as

**International variations.** Ex: cancer all over the world.

**National variations** Ex: endemic goitre, flurosis, leprosy, malaria, malnutrition.

**Rural urban differences.** Ex: urban- accidents, lung cancer, CAD. Rural- skin and zoonotic diseases.

**Local distributions:** Inner and outer city variations in disease frequency are well known. These are best studied with the aid of spot maps or shaded maps.

## PERSON DISTRIBUTION

In descriptive studies, the disease further characterized by defining the persons who develop the disease by age, sex, occupation, marital status, behavior, stress, social class etc.

4. **Measurement of disease.**

- It is mandatory to have a clear picture of the amount of disease in the population.
- This information should be available in terms of morbidity, mortality and disability.
- Measurement of mortality is straight forward.
- Morbidity has 2 aspects: incidence and prevalence.

## CROSS SECTIONAL STUDIES

It is based on the single examination of a cross section of population at one point in time the results which can be projected on the whole population provided the sampling has been done correctly.

## LONGITUDINAL STUDIES

Here observations are repeated in the same population over a long period of time by means of follow up of examinations.

**5. Comparing with known indices:**

Making comparisons between different populations and subgroups of the same population it is possible to arrive at clues to disease etiology.

**6. Formulation of an etiological hypothesis.**

Epidemiological hypothesis should specify the following:

The population- the characteristics of the persons to whom the hypothesis applies.

The specific cause being considered.

The expected outcome- the disease.

The dose-response relationship: the amount of the cause needed to lead to a stated incidence of the effect.

The time response relationship: the time period that will elapse between exposure to the cause and observation of the effect.

Ex: cigarette smoking causes lung cancer.

Ex: The smoking of 30-40 cigarettes per day causes lung cancer in 10% of smokers after 20yrs of exposure.

**Uses of descriptive epidemiology**

1. Provide data regarding magnitude and types of problem.
2. Provide clues to disease etiology.
3. Provide data for planning, organizing, evaluating services.
4. Contribute to research.

# ANALYTICAL STUDIES

In contrast to descriptive studies that look at entire populations, in analytical studies, the subject of interest is the individual within the population.

2 types:

a. Case control study
b. Cohort study.

## CASE CONTROL STUDY

**Features:**

a. Both exposure & outcome have occurred before the start of the study.
b. The study proceeds backwards from effect to cause.
c. It uses a control or comparison group to support or refute an inference.

**Steps:**

1. Selection of cases and controls
2. Matching
3. Measurement of exposure
4. Analysis

1. **Selection of cases:**

Definition of cases:

- Diagnostic criteria(stage)
- Eligibility criteria(incidence & prevalence)

Sources of cases:

- Hospitals
- General population

2. **Selection of controls:**

The controls must be free from disease.

Sources of controls:

- Hospitals
- Relatives
- Neighborhood controls
- General population.

3. **Matching:**

The controls may differ from the cases in a number of factors such as age, sex, occupation, social status etc.

Matching is a process by which we select controls in such a way that they are similar to cases with regard to certain selected variables ex: age.

4. **Measurement of exposure:**

- Questionnaire
- Interview
- Hospital records
- Employment records.

**5. Analysis:**

a. Exposure rates: Frequency of exposure to a suspected factor in disease and non-diseased groups.
b. Estimation of diseases risk associated with exposure (Odds ratio)
   b) Estimation of diseases risk associated with exposure

**a. Exposure rates among cases and controls to suspected factor**

**Example:**

| **Suspected or risk factors** | **Cases (with lung cancer)** | **Control (without lung cancer)** |
|---|---|---|
| **Smokers** | **33 (a)** | **55 (b)** |
| **Non smokers** | **2 (c)** | **27 (d)** |
| | **35 (a + c)** | **82 (b + d)** |

**Exposure rates**

**Cases = a/ (a+c) = 33 /35 = 94.2%**

**Controls = b/ (b+d) = 55/82 = 67 %**

**§. Odds ratio**

Which is a measure of the strength of the association between risk factor and outcome. **Example:**

| **Suspected or risk factors** | **Cases (with lung cancer)** | **Control (without lung cancer)** |
|---|---|---|
| **Smokers** | **33 (a)** | **55 (b)** |
| **Non smokers** | **2 (c)** | **27 (d)** |
| | **35 (a + c)** | **82 (b + d)** |

**Odds ratio = ad/ bc**

**= 33x27/ 55 x2**

**= 8.1**

**So, Smokers of less than 5 cigarettes per day showed a risk of having lung cancer 8.1 times that of non smokers**

## BIAS IN CASE CONTROL STUDY

- ❑ Bias due to confounding
- ❑ Memory or recall bias
- ❑ Selection bias
- ❑ Interviewer's bias
- ❑ Berkesonian bias.

## ADVANTAGES OF CASE CONTROL STUDY

- ➢ Relatively easy to carry out
- ➢ Rapid and inexpensive
- ➢ Require comparatively few subjects
- ➢ No risk to subjects
- ➢ Risk factors can be identified
- ➢ No attrition problems

## DISADVANTAGES OF CASE CONTROL STUDY

- ✓ Problems of bias relies on memory or past records, the accuracy of which may be certain; validation of information obtained is difficult or sometimes impossible
- ✓ Selection of an appropriate control group may be difficult
- ✓ Do not distinguish between causes and associated factors

**Examples of case control study**

- Maternal smoking and congenital malformations
- Radiations and leukemia
- Oral contraceptive use and hepatocellular adenoma
- Physical activity and coronary deaths

Type of Cohort study:

1. Prospective: is the one which outcome has not occurred at the time of investigation.
2. Retrospective: is the one which outcome have all occurred before the start of investigation.

Type of Cohort study:

1. Combination of retrospective and prospective studies:

Here the cohorts are identified from past records and is assessed of date for the outcome.

- Steps of cohort study

1. Selection of study subjects

-General population

-Special groups

2. Obtaining data on exposure

-Interview

-Review of records

-Medical examination

-Environmental surveys

3. Selection of comparison group

-Internal comparisons

-External comparisons

-Comparison with general population.

4. Follow up

- Periodic medical examination
- Reviewing physician and hospital records
- Routine surveillance of death records.

5.Analysis

-Incidence rates of outcome among exposed and non exposed.

-Estimation of risk.