

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Types of epidemiological studies

Epidemiological studies are conducted for examining the pattern of disease among the population. They are essential for identifying disease determinants and causes, as control and preventive measures are then applied accordingly.

There are various types of studies. The differences between them are according to their purposes and aims.

The main types are divided as:

Epidemiological studies:

A. Observational:

I. Descriptive studies:

- 1. Case report & case series**
- 2. Ecological**
- 3. Cross sectional**

II. Analytic studies:

- 1. Case Control study**
- 2. Cohort study**

B. Interventional :

- . Randomized Clinical Trial**
- . Community trials**

A. Observational

B. Interventional

In observational study methods, the examiner only observes the investigation. While in interventional studies the examiner makes a further step that is to intervene in the course of the investigation.

Observational studies are divided into:

- . Descriptive studies**
- . Analytic studies**

Descriptive studies: The most basic form of epidemiology, which is the description of the patterns of occurrence of health-related states or events in groups. Descriptive studies are used to describe disease in respect to certain characteristics e.g. age, sex, social background ...etc

Analytic studies usually include at their beginning some description of the studied population and then followed by analytic detailing of the factors relevant to disease under study.

Analytic studies are widely used in epidemiology for their importance in identifying the risk factors in disease etiology.

Interventional studies are regarded as super studies among all types of epidemiological investigation. This importance is due to the obvious and clear cut association between an exposure to a factor and the development of an outcome. This association is prepared for carefully by the investigator.

Descriptive studies:

1. Case report and case series:

The objective of this study is to describe unusual presentation or variation of a disease or a new aspect of treatment of in a patient.

Case series refers to a group of cases of a similar illness, describing important clinical aspects.

No comparison subjects are used in these studies.

e.g. Recognition of AIDS began with case reports and case series's describing cases of young otherwise healthy men in California and New York City with *Pneumocystis carinii* pneumonia (PCP) and Kaposi's Sarcoma (*MMWR* 1981;30:250-2 and 305-8). Before that time, it had been seen only in persons who had been medically immunosuppressed in connection with a transplant operation. Kaposi's Sarcoma had been known as a disease of Africans and elderly men of Mediterranean origin. The initial case series described common and variable features of the syndrome. For example : all of the patients were homosexual men, and many used inhalants, a type of recreational drugs. The case series's led to an initial AIDS case definition for the purposes of identifying additional cases.

Case reports and case series are the clinical route to definition and recognition of disease entities and to the formulation of hypotheses.

These studies are not "epidemiologic" in the sense that they have no explicit comparison group or population reference.

Advantages: they are easy, of low cost , not time consuming studies.

They are essential for extending clinical aspect of the diseases.

Disadvantages : they have no control comparison. They don't represent

the total picture of disease in the community.

2. Ecological studies:

The results of this studies are derived from the population and not from individual persons. These information could be derived from national surveys or other source of information.

e.g.

There were cigarette consumption rate of 1500 per capita /year in a city in 1945 which raised to 3500 in 1965. This don't mean that every person in the city was a smoker.

The total consumed cigarettes were calculated and divided by total pop. This type of studies depends on the correlation between an event and disease occurrence either (+)ve or (-)ve or no correlation.

Observations made from population-level data require additional caution in their interpretation. For example, colon cancer rates are higher in developed countries that use high per capita meat consumption.

These relationships suggest that something about meat consumption, e.g.,

saturated fat intake, might be factors in the development of colon cancer.

Other factors may also contribute to colon cancer. This could be confirmed by an analytic study later on.

So ecological studies give us a clues to a possible association between a factor and a disease. This study has no comparison groups.

3. Cross sectional studies:

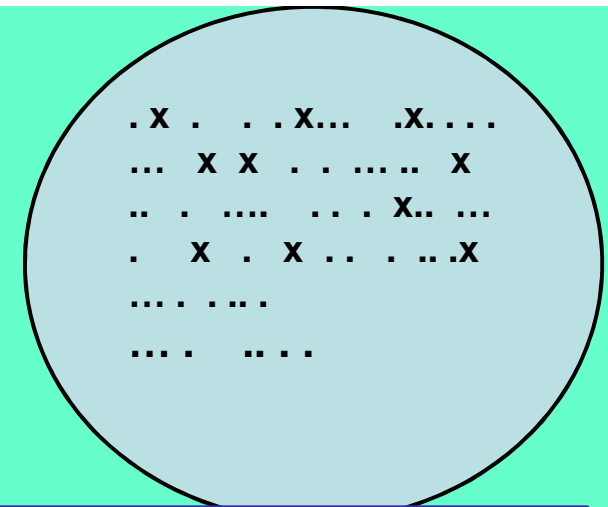
The term "cross-sectional study" (or "prevalence study") are studies that are conducted in the community at a cross section level. The total pop are examined at one time . Cross-sectional study examines relationship between diseases and other factors at one point in time (usually) in a defined population.

Cross sectional studies lack any information on timing of exposure and outcome relationships and include only prevalent cases.

This type of study and the other analytic studies are conducted at individual level.

The current or historical status of individuals is assessed and may be examined in relation to some current or past exposure. (e.g., elevated blood pressure, elevated blood cholesterol, many psychiatric disorders, diet, sub-clinical infection, and serologic markers of previous infections). The prevalence of a disease is measured and often called " prevalence studies" .

The community at a cross section level .



(.) is well person (x) is diseased person

This study counts the diseased and divides them by the total population examined .

Advantages: easy to conduct , needs less time and measures the prevalence of disease which gives us the extent of disease. Various forms of disease could be found. The main characteristics of the affected persons are detected, and could be related to disease occurrence .

Disadvantages:

The time sequence of the risk factors in respect to disease occurrence is not well defined. So that the casual association could not be clearly determined.

Seasonal variation of disease is not identified in this type of studies .
Epidemics could occur and change the observed frequency of disease.

Analytic studies:

These studies examines the occurrence of disease in respects to various factors that may have a role in the causation of the disease.

Risk of disease is the likelihood of getting disease.

Risk Factor: An individual attribute or exposure that is positively or negatively associated with the occurrence of a disease. (e.g., nutrition, housing, husbandry practice, or toxic agent).

The analysis of the association of these risk factors with the development of disease is conducted by two types of studies:

- 1. Case Control study**
- 2. Cohort study**

Case Control Studies:

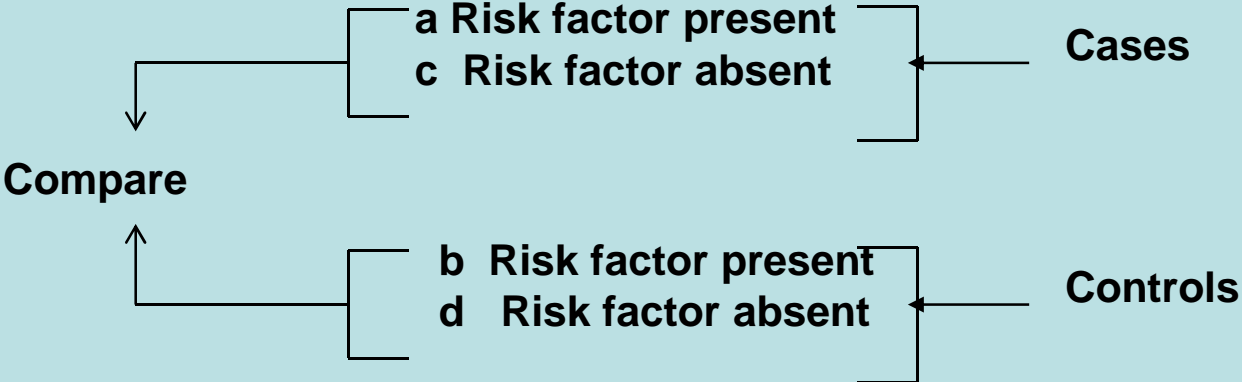
A type of observational analytic study, where the subjects are selected on basis of “whether they do have the disease (cases) or they do not have the disease (control) under study“ i.e. Case versus Control / the groups are then compared for the proportion of having a history of previous exposure or characteristics of interest.

Because persons are identified after the disease has developed, and inquiry then investigates prior exposure, the case-control study is sometimes referred to as a "retrospective" or "backwards" design.

Two groups :

- 1. Cases (i.e. persons with disease under study).**
- 2. Controls (i.e. persons without disease under study).**

Time



Past **present**

Diagram of a case-control study

The results of the comparison is demonstrated in what we call 2x2 table .

This is the simplest form. Other forms could be 2x3, 2x4, 3x3... etc.

2x2 table means 2 rows and 2 columns 4 totals 1 grand total

		Disease		Total
		Present	Absent	
Exposure to factor	Present	a Disease present factor present	b Disease absent factor present	(a+b) factor present
	Absent	c Disease present Factor absent	d Disease absent factor absent	(c+d) factor absent
Total		(a+c) (cases)	(b+d) (controls)	a+b+c+d

The Definition of Cases Should be :

1. Homogenous disease entity.

Certain dis. affect certain organs at different exposure to risk factors.

As when we say cancer of the uterus we have to be specific because there are different anatomical parts of the uterus that are affected by cancer due to different risk factors. As an example cancer body of the uterus occurs in women with high socio-economic classes while cancer cervix in low class. So we have to specify what we are talking about.

2. Based on strict diagnostics criteria.

We have to be strict in the diagnostic criteria so that any one who fulfills the criteria will be included in the study.

e.g. MI criteria by the WHO should be : chest pain exceeding 30 mm. & having specific ECG changes & enzymatic changes.

We should be strict so as not to include someone that does not have the disease under study, in the study we are doing.

Strengths (Advantages) of Case Control studies:

- 1. Easy, need less time & inexpensive.**
- 2. Suitable for disease of long latency period. : The latency period is the period between the exposure to a certain risk factor & the appearance of the disease (like the incubation period in on infectious disease), so if we take a disease as MI due to smoking we are starting from a group that already has the disease (the cases), already available (have the disease & ask them about the exposure, while in a cohort study we have no disease because we. start with exposure.**

3- Suitable for Rare disease. Rare disease as in Alzheimer or Multiple Sclerosis because we cannot wait until a case appears so we use available cases.

4- Can examine multiple etiologic factors for a single disease. Which means different factors act at the same time, so we can ask about them.

5- Dose of the factor under study can be assessed e.g. the previous exposure could be divided into degrees or +,++,+++ etc

Disadvantages:

- 1- Susceptible to selection bias (e.g., cases or controls may not be appropriately "representative")**
- 2- Difficult to establish that "cause" preceded "effect".**
- 3-Not suitable for rare exposures.**
- 4- Because case-control studies select participants on the basis of whether or not they have the disease, the case-control design does not provide an estimate of incidence or prevalence of the disease, unless data about the population size are available.**

Basic procedure

- 1. Identify cases, determine their characteristics estimate the prevalence of the exposure in people who get the disease.**
- 2. Select controls (non-cases), determine their characteristics estimate the prevalence of the exposure in people who have not developed the disease.**
- 3. Compare the characteristics of cases with characteristics of non-cases.**
- 4. Draw inferences about the underlying processes that led to differences in characteristics of cases and controls.**

Odds ratio (OR = odds of exposure in cases/odds of exposure in controls)

Risk assessment of case control study:

The results of case control study is estimated by : Odds ratio

Odds of factor among cases divided by odds of factor among control

$$\text{Odds ratio} = \frac{a \times d}{b \times c}$$

results: 1, more than 1, less than 1

1: no risk

>1: risk

<1 : protection

e .g. of a case control study: we selected 100 cases of duodenal ulcer and 100 controls (persons who have no duodenal ulcer) and ask the two group about cigarette smoking . The results showed that 70 of the 1st group and 30 of the 2nd group were smokers . The 2x2 table for the results will be as follows:

Smoking	Cases (DU)	Control (No DU)	Total
Yes	a 70	b 30	100 (a+b)
No	c 30	d 70	100 (c+d)
Total	(a+c) (cases) 100	(b+d) (controls) 100	200

< 1 or 1 or > 1 . > 1 is risk 1 no risk < 1 is protection
 Odds ratio = $ad / bc = (70 \times 70) / (30 \times 30) = 5.4$

So those who smoke have a 5.4 times risk to develop lung cancer than those who don't smoke.

Sources Of Selection Of Cases

1- Hospital-Based, Case-Control Studies:

Common : taken from hospital, clinics & health centers.
Also they are easy to get & inexpensive.

2- Population-Based Case Control Studies :

We can take a certain area where every one is diseased & take them all in the study or use a random sample of those diseased.

1- Avoid selection bias in selecting certain hospitals.

As if we take Typhoid cases in certain hospitals We shall only find severe cases that required admission to hospital.

2- describes the picture of the disease in the whole population.

As severe, moderate mild typhoid cases . . .etc.

3- Computes rates of the disease in exposed & non exposed.

Selection of controls

Cases & Control should be similar to each other in every thing except the fact that the Case has the disease & the control does not have the disease. So, if we take the case from the hospital the control should be taken from the hospital too & this is the same for the general population. Even the way of taking information should be the same as in Hypertension we use the same instruments, same atmosphere , place & time . . .etc.

***Types of controls**

1. Hospital controls :

Taking people who are diseased but free of the disease that we are studying.

Advantages :

- Easily identified, in sufficient no , with minimum cost & effort .**
- Know more about previous exposure than healthy individuals because they scan there minds to try & find a cause for their illness (think more & recall)**

BUT this will lead to a :

- Recall Bias: which is difference in recalling things between the two groups, but if both groups are from the hospital this bias will be overcome. So if we take them both from the hospital we will not have such a bias.**
- More willing to cooperate than healthy individuals**

Disadvantage :

.The controls are not healthy, they are diseased

2. General Population Controls

They are in general healthy controls.

Difficulties :

a-Identification & interviewing is more costly & time-consuming

b-Pop. list are not always available (we need the sample frame in order to get a random sample from the general population.

c-Difficult to contact healthy people who might be busy at work

d-Less motivation to participate.

e-Those who accept to participate may differ systematically from those who refuse.

3. Special Group Controls :

-No selection bias: because we will take the friends, neighbors of the cases.

-They are healthy (not diseased).

-It is not costly & not time consuming.

-No Recall Bias : because every one is trying to remember.

Factors affecting validity of studies:

1. Confounding:

It is the distortion of the effect of one risk factor by the presence of another. Confounding occurs when another risk factor for a disease is also associated with the risk factor being studied but acts separately.

e.g. when a study detect an association of coffee with heart disease, another factor may be responsible for the association e.g. smoking because mostly coffee consumers are smokers. So, the effect is due to smoking in fact not coffee consuming. Smoking here is Confounding factor.

Ideally, one control group for each case is used, but sometimes more than one control group especially in hospital based studies. So ideally no. of individuals in the control group to the no. of individuals in the cases is 1:1 & the maximum is 4:1 because if we increase the no. of control to more than 4 the benefit will be negligible .

2. Bias (Systematic Error): Any process or effect at any stage of a study from its design to its execution to the application of information from the study, that produces results or conclusions that differ systematically from the truth.

Types of Bias :

1- Selection Bias. Selection of cases and controls.

2- Observational Bias: variation in reporting, recording or interpreting the case.

3- Recall Bias.

4- Misclassification Bias: this is caused if we do not follow strict diagnostic criteria in diagnosing the case. Underestimate the true association between the exposure & the outcome.