

## CASE CONTROL STUDY

- It is a type of analytical study also called as **retrospective studies**.
- It is most commonly used as first approach to test causal hypothesis i.e., to see **whether an association exists between the suspected causative factor and the disease and what is the strength of the association**.

### **Distinct features of case control study**

- Both exposure and outcome i.e. disease have occurred before the start of study.
- The study proceeds backward from effect to cause.
- It uses a control or comparison group to support or refute an inference.

### **Basic steps in conducting case control study/ methodology**

- Selection of cases and control
- Matching
- Measurement of exposure
- Analysis and interpretation

### **Selection of cases**

- The **diagnostic criteria** of the disease and the stage of disease, if any to be included in the study and must be specified before the study is undertaken.
- The **eligibility criteria** i.e., the only newly diagnosed cases within a specified period of time are eligible than old cases or cases in advanced stages of the disease.
- Sources of cases: **hospital** or **general population**.

### **Selection of controls**

- Controls should be free from disease under study, and should be similar to the case as far as possible except for the absence of the disease being studied.
- Sources of control: **hospital** (selected from the same hospital as the cases, but other than the study disease), **relatives**, **neighbourhood** (persons working in the same factory or children attending the same school) and **general population**.

## Matching

- It is defined as a process by which we select a control in such a way that they are similar to case with regard certain pertinent selected variables, which are known to influence the outcome of disease and which if not adequately matched could distort or confound the result.
- Confounding factors are factors that are known to be associated with exposure and are independent risk factor for the disease.
- For e.g. in the study of role of alcohol in the aetiology of oesophageal cancer, smoking is a confounding factor hence the effect of alcohol consumption can be determined only if the influence of smoking neutralised by matching.
- Matching can be either group matching or pair matching

## *Measurement of exposure*

- Information of exposure should be obtained in same manner for both cases and control.
- It may be obtained by [interviews, questionnaire, studying past records like hospital and employment records](#)

## *Analysis [how to analyse the data?]*

- To find whether association exist between the exposure and disease by estimating the [exposure rate among cases and controls](#).
- Estimate the strength of association between disease and exposure by [odds ratio](#)

## Framework of a case control study

<b>Risk factor</b>	<b>Cases (disease present)</b>	<b>Controls (disease absent)</b>	<b>Total</b>
<b>Present</b>	<b>a</b>	<b>b</b>	<b>a + b</b>
<b>Absent</b>	<b>c</b>	<b>d</b>	<b>c + d</b>
<b>Total</b>	<b>a + c</b>	<b>b + d</b>	<b>a + b + c + d</b>

## **Exposure rate**

$$\text{Exposure rate among cases} = \frac{a}{a + c} \times 100$$

$$\text{Exposure rate among controls} = \frac{b}{b + d} \times 100$$

If the exposure rate among cases is greater than control that means there is existence of association between disease and suspected risk factor.

### **Odds ratio**

- Tells the strength of association between the suspected risk factor and occurrence of disease.
- It is the cross-product ratio.
- Odds ratio =  $ad/bc$
- Interpretation: e.g. Odds ratio of 8 in a study of association of smoking and lung cancer means that lung cancer cases are 8 times more likely to be in smokers than non-smokers.
- OR = 1 exposure does not affect odds of outcome
- OR > 1 exposure associated with higher odds of outcome
- OR < 1 exposure associated with lower odds of outcome

### **ADVANTAGES OF CASE CONTROL STUDY**

- Relatively easy to carry out.
- Rapid and inexpensive (compared with cohort studies).
- Require comparatively few subjects.
- Particularly suitable to investigate rare/chronic diseases
- No risk to subjects.
- Allows the study of several different aetiological factors
- Risk factors can be identified. Rational prevention and control programmes can be established.
- No attrition problems, because case control studies do not require follow-up of individuals into the future.
- Ethical problems minimal.

### **DISADVANTAGES OF CASE CONTROL STUDY**

- Problems of bias relies on memory or past records
- Selection of an appropriate control group may be difficult.
- Incidence cannot be measured and can only estimate the relative risk.

- Do not distinguish between causes and associated factors.
- Not suited to the evaluation of therapy or prophylaxis of disease.
- Another major concern is the representativeness of cases and controls.

## **BIAS IN CASE CONTROL STUDIES**

**Bias due to confounding:** removed by [matching](#) in case control study

**Memory or recall bias:**

- When cases and controls are asked questions regarding past history, it may be more likely for the cases to recall the existence of certain events or factors, than the control who are healthy persons.
- Bias removed by good [interviewing skills](#).

**Selection bias**

- Occurs if there is absence of comparability between the groups
- The study population may not be a representative of cases and controls in the general population so there may be systematic difference in characteristic between groups.
- Bias controlled by [ensuring comparability of groups](#).

**Berkesonian bias**

- Arises because of the different rate of admission to hospitals for people with different diseases
- Controlled by [selecting cases and controls in appropriate settings](#) keeping in mind the study in question.

**Interview bias**

- Bias occurs when the interviewer knows the hypothesis and also knows who the cases are.
- Eliminated by [double blinding](#).

Previous UQ

1) A surgeon in a tertiary hospital has been seeing a number of cases of carcinoma of the oral mucosa. The surgeon also observed that several of the patients gave a history of chewing the leaves of a particular plant and now approaches you to help design a research study to test the association between carcinoma of the oral mucosa which is fairly rare and chewing the leaves of this plant.

2) Fifty underweight children were selected from an Anganwadi and fifty controls with ideal weight for age was selected from the corresponding Anganwadi, matched for age and sex. The objective was to find out the risk factors for malnutrition.

3) Final MBBS students observed that a high number of cases of oral cancer are admitted to the surgery department of teaching hospital where they are posted. They want to find out the risk factors for oral cancer.

4) The district health officer is concerned that there may be an increase in diabetes among young individuals aged 20-45 years after COVID-19 infection. It was decided to conduct an epidemiological investigation to study the risk of getting diabetes after COVID-19 infection.

5) In the primary health centre where you are the medical officer, there are more numbers of low-birth-weight babies being born. You want to find out without much delay whether maternal anaemia can be the associated risk factor.

6) Final MBBS students observed that, cases of cervical cancer are admitted to the gynaecology department of teaching hospital in which they are posted. They wanted to find out the risk factors.

7) Sunaina is a recent MBBS graduate who is working as a medical officer in a primary health centre. There have been a number of cases of fever from a nearby village. The villagers suspect it is because of contaminated water in the overhead tank that supplies parts of the village. She decides to investigate.

8) A third year MBBS student during his clinical posting observed many patients had leucoplakia in the oral cavity. He wanted to find out the risk factors for leucoplakia.

9) Ramesh 7th semester MBBS student while doing his community medicine stay posting in a rural CHC observed that, there are around 15% people suffering from hypertension. He decided to find out risk factors of hypertension.

