Epidemiological and Research Studies

Part 1

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Analytical studies

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

Case-control Study

1. Basic concepts, application of CCS
2. Issues in the design CCS
3. Analysis of CCS
4. Strengths and weaknesses of CCS

Types of study Designs

Classification and sub-classifications may differ in different references

Qualitative studies

Quantitative studies

Type of studies

Quantitative studies:

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

Qualitative studies:

- It is used in public health studies
- It was introduced **from social sciences**

- it does **not depend on mathematical quantification**,
- and relies on researcher(s) observation and opinion

- **Observational**
  - Descriptive
  - Case report
  - Case series
  - Epidemiological reports
- **Analytical**
  - Ecological
  - Cross-sectional
  - Case-control
  - Cohort
- **Experimental.**
  - randomized controlled trials
  - field trials
  - community trials

Quantitative studies

Qualitative studies:

Quantitative studies

Observational studies

Descriptive

- Case report
- Case series
- Epidemiological reports

Analytical studies

- Cross-sectional
- Case-control
- Cohort

Experimental.

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

Case control Study

1. Basic concepts, application of CCS
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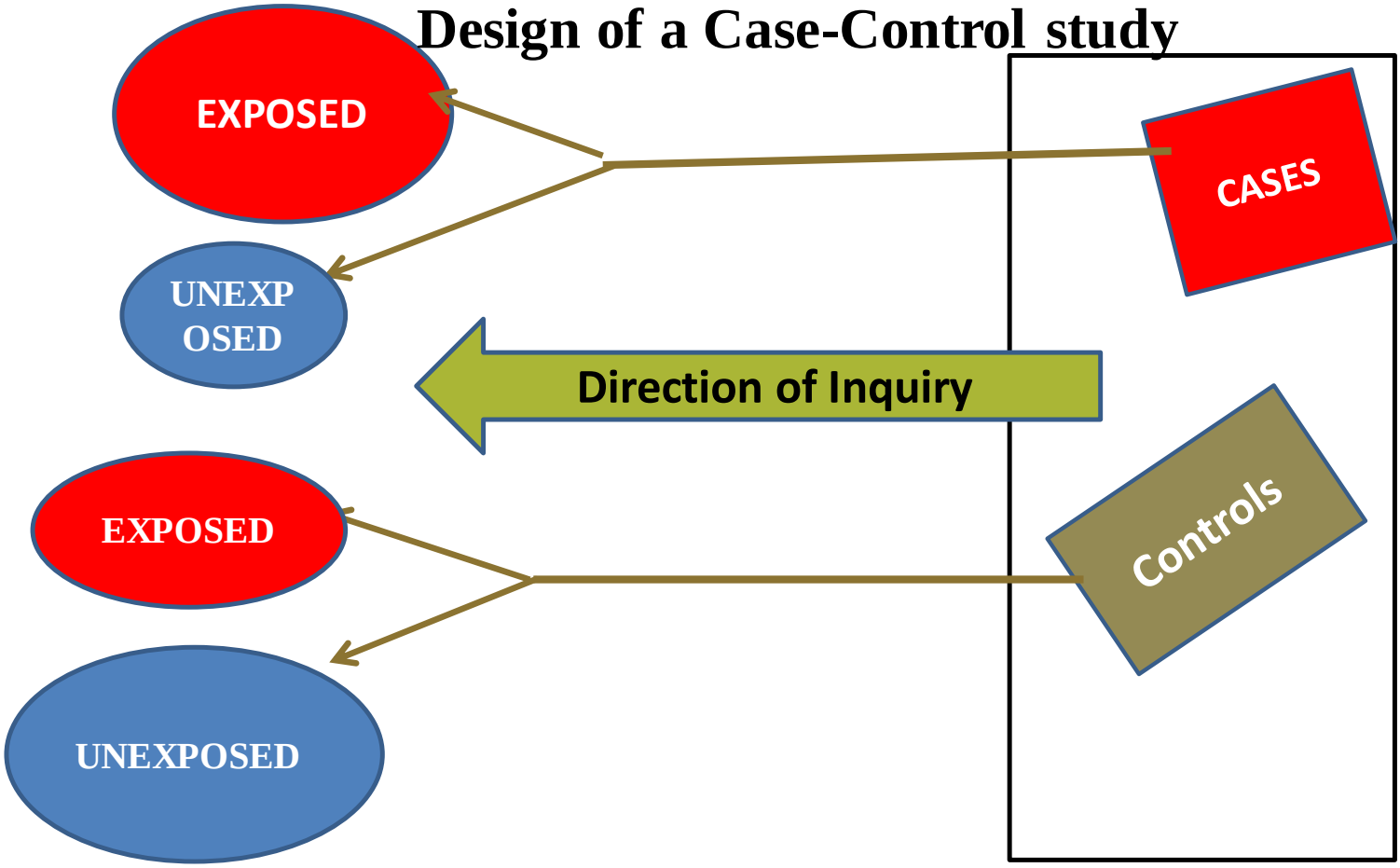
Design of a Case-Control study



Retrospective studies
investigator is looking backward to a possible cause.

case-control studies

Case-control studies are one of the frequently used study designs **due to the relative ease of its** application in comparison with other study designs

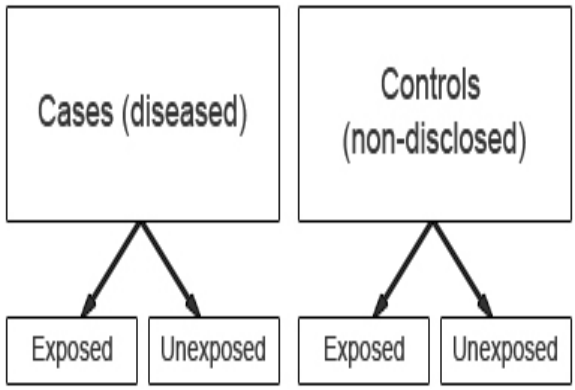
case-control studies (CCS)

start with the identification of

A . a **group of cases** (individuals **with** a particular health outcome) in a given population

B. and a group of controls (individuals **without** the health outcome) to **be included** in the study.

- In CCS the **prevalence of exposure** to a potential **risk factor**(s) **is**
- **compared between cases and controls**.



case-control studies

- In CCS the **prevalence of exposure** to a potential **risk factor(s) is**
- **compared between cases and controls**

If the prevalence of exposure
is **more** common among **cases** than **controls,** it **may be a risk factor for the outcome** under investigation.

❑ **CCS** provide a **relatively simple way to**
- **investigate causes of diseases,**
- **especially rare diseases** **(recall bias**

A major characteristic of CCS is
- that data on potential **risk factors are collected retrospectively** and
- as a result **may give rise to bias**. **(recall bias)**

This **is a particular problem** associated with case-control studies and
✓ **therefore needs to be carefully considered** during **the design** and **conduct of the** study.

case-control studies

- **CCSs** are **longitudinal**, in contrast to cross-sectional studies.
- **CCSs** have been called **retrospective** studies **since the investigator is looking backward from the disease to a possible cause.**

- The **terms retrospective** and **prospective** are also **used to describe the timing of data collection** in relation to the current date.

Issues in the design of case-control studies

- **Selection of cases**
- **Selection of controls**
- **Measuring exposure status**

- **Case definition** It is essential that the **case definition is clearly defined** at the outset of the investigation **to ensure that all cases included in the study are based on the same diagnostic criteria**

- **Source of cases** The **source of** cases needs to be clearly defined. **Cases may be recruited from a number of sources**; they may be recruited from a **hospital, clinic**, or may be **population bases**. Population based case control studies are generally **more expensive and difficult to conduct**

case-control studies

Selection of controls

- **A particular problem inherent in CCS is the selection of a comparable control group.**

❑ **The source of controls is dependent on the source of cases.**

In order to minimize bias,

controls should be selected **to be a representative sample of the population which produced the cases.**

Measuring exposure status

Exposure status is measured **to assess** the **presence** or **level of exposure** for each individual **for the period of time prior to the onset of the disease** or condition under investigation when the exposure would have **acted as a causal factor**. Note **that in CCS** the measurement of **exposure is established after the development of disease** and as a result **is prone to both recall and observer bias.**

Various methods can be used to ascertain exposure status.

These include:

- Standardized questionnaires
- Biological samples
- Interviews with the subject
- Interviews with spouse or other family members
- Medical records
- Employment records
- Pharmacy records

The procedures used for the collection of exposure data should be the same for cases and controls.

3. Analysis of case-control studies

RISK ESTIMATES(Odds ratio)

- **Odds ratio (OR)**
- **Used in cross sectional, case-control**

Results of a case-control study can be presented in a **2x2 table** as follow

	Case (diseases)	control	Total
Exposed	a	b	a+b
Unexposed	c	d	c+d
Total	a+c	b+d	N

- **OR= a/(a+c) ÷ b/(b+d)= a/c ÷ b/d =ad/bc**
- **c/(a+c) d/(b+d)**

3. Analysis of case-control studies

The odds ratio (OR) is used in CCS

to estimate the strength of the association between exposure & outcome.

that it is **not possible to estimate the incidence** of disease from a CCS :

The **OR is a measure of the odds of exposed in the disease compared to the odds of exposed in the controls** and is calculated as:

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$$

which is the ratio of the odds of exposure among the cases to the odds of exposure among the controls.

2x2 table

	Cases	Controls	Total
Exposed	a	b	a+b
Unexposed	c	d	c+d
Total	a+c	b+d	a+b+c+d

3. Analysis of case-control studies

Example case-control study was conducted to detect the relation **of smoking and cancer of the pancreas** among **100 cases** and **400 controls**,60 with **cancer of the pancreas** gave history of smoking ,while 100 health persons gave history of smoking Can we conclude that smoking is a risk factor for cancer of the pancreas
: Calculation of the OR from a hypothetical

	Cases	Controls	Total
Smokers	60 (a)	100 (b)	160
Non-smokers	40 (d)	300 (d)	340
Total	100	400	500

The OR estimates that **cancer of the pancreas**

Prevalence of smoking among CA
Prevalence of smoking among non CA

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$$

$$OR = \frac{60 \times 300}{100 \times 40} \qquad OR = 4.5$$

smoking is 4.5 times more among CA than non-CAs.

Example

To study the relation of small birth weigh and smoking during pregnancy . A sample of 460 women were chosen, consist of 150 women, delivered small birth weight babies , and 310 delivered normal weight babies . History of Smoking was detected in100 women having low birth babies, and 60 having babies with normal birth weight. is smoking during pregnancy act as a risk factor for small birth weight babies?

smoking during pregnancy	birth weight babies		total
	small	normal	
positive	100	60	160
Negative	50	250	300
total	150	310	460

odds ratio (OR)=

smoking during pregnancy	birth weight babies		total
	small	normal	
positive	100	60	160
Negative	50	250	300
total	150	310	460

Prevalence of exposure among the cases

Prevalence of exposure among the control

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$$

$$\frac{100 \times 250}{60 \times 50} = \frac{25000}{3000} =$$

OR= 8.3

small birth weight babies have been exposed to smoking during pregnancy 8.3 times more than those with normal weight

OR= 1 no effect of exposure

OR= more than 1 = there is a risk factor there is effect

OR= less than 1 means it is protective factor there is effect

4. Strengths and weaknesses of CCS

Strengths

- ✓ **Cost effective** relative to other analytical studies such as cohort studies.
- ✓ CCS are retrospective, and cases are identified at the beginning of the study; therefore **there is no long follow up** period (as compared to cohort studies)
- ✓ **Efficient** for the study of **diseases with long latency periods.**
- ✓ **Efficient** for the study of **rare diseases**
- ✓ Good for examining **multiple exposures.**

Weaknesses

- ➢ Particularly **prone to bias**; especially **selection**, **recall** and **observer bias**.
- ➢ CCS limited to **examining one outcome.**
- ➢ **Unable to estimate incidence rates** of disease
- ➢ **Poor** choice for the study of **rare exposures.**
- ➢ **The temporal sequence** between exposure and disease may be **difficult to determine.**

A study compared 150 children with an Asthma disease with 300 asthma free children to examine past experiences of passive smoking , that may contribute to the development of the asthma . 1oo childe from each group reported past experiences of passive smoking . Can we say that passive smoking act as a risk factor for childhood Asthma

Cohort Study

Thank you for attention