



COMMUNITY MEDICINE *Notes*

Done by:

ديمة يعقوب

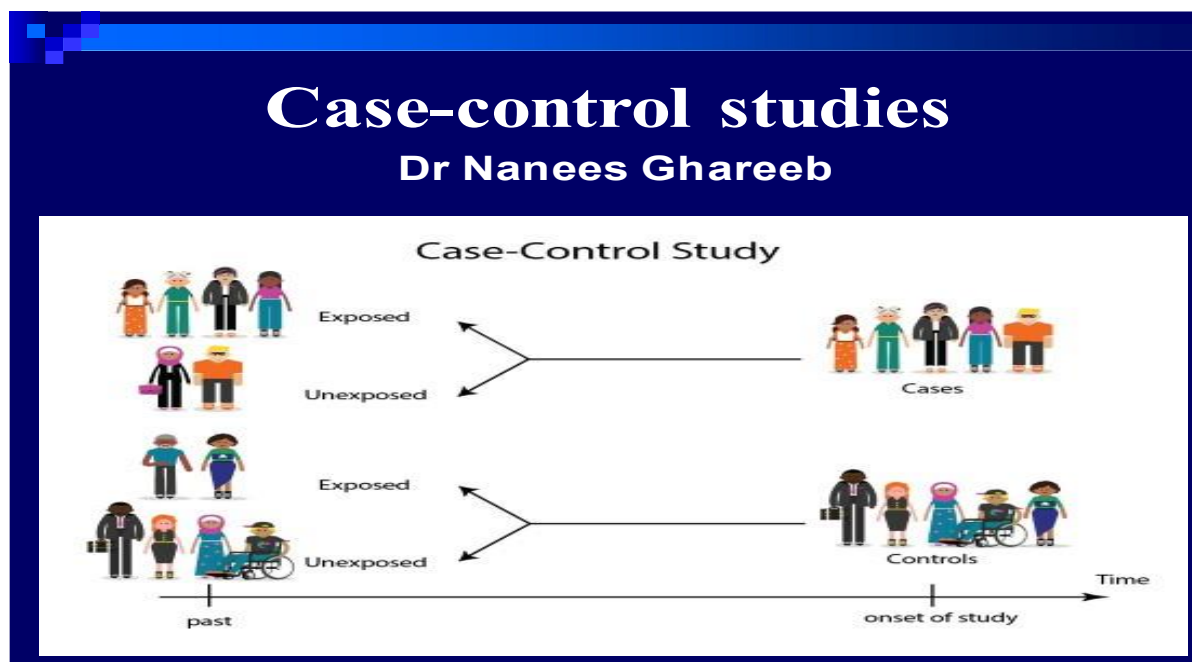
CASE- CONTROL STUDY

- Note from previous lecture:

We have two types of observational studies

1) descriptive 2) analytical (have comparison group)

Today we are talking about case control study which is a type of analytical studies.



*In this type of study, we start from cases then we ask them about previous exposure (past exposure) to the risk factor that we want to study.

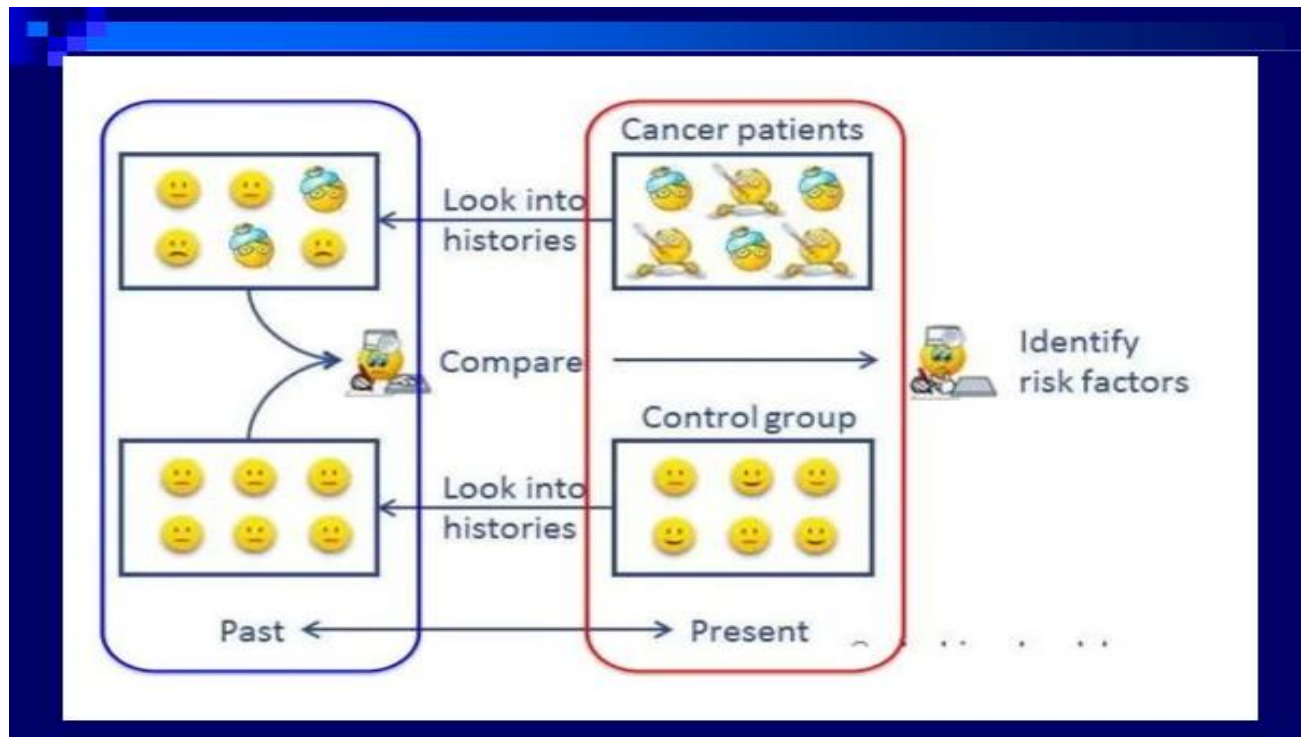
Then take another group from the same population but they don't have the disease (control group) and ask them about previous exposure...

Then we will compare cases to control group.

Case-control studies

Are studies in which a group of people with a particular disease (the cases) are compared with a group of people without the disease (the controls). The purpose of the comparison is to determine whether, in the past, the cases have been exposed more (or less) often to a specific factor than the controls

- This type of study is done to identify factors that could be responsible for the development of a disease or drug use problem.



**example: ask cancer pt (cases) about risk factors and ask healthy people(control) about it , then compare the result ...

CASE-CONTROL STUDIES

- The direction of time
- Cases identified now
- Data on past events collected

Data ← Backwards in time ————— Case

**these 3 points must be done in case control study and here is there explanation:

- 1) We will ask about past “previous exposure” .
- 2) How will the cases identified (characteristics of them)
- 3) Collect data from secondary sources like records

CASE-CONTROL STUDY DESIGN

- Designed to assess association between disease occurrence and exposures (e.g., causative agents, risk factors) suspected of causing or preventing the disease.

**Is there any risk factor that can prevent a disease??

Yes, but how to know during the study?

By calculating odds ratio if it was less than 1 then the factor is protective, for example, sun exposure decrease vit D deficiency.

Case-control studies

- A group of people with a disease are compared to a group without the disease from the same population.
- Compare exposure to risk factors in both groups
- Able to look at many different possible risk factors
- Able to study diseases with a long latency period
- Most common analytic study design seen in the medical literature today

Case-control studies

- In general, the cases included in a case-control study include people with **one** specific disease only
- But, a case-control study can provide information on a wide range of possible **exposures** that could be associated with that particular disease
- Useful for the study of rare diseases
- Not suitable for the study of rare exposure
- Relatively small and inexpensive
- Takes a relatively short time to complete
- Can test current hypotheses
- Cannot measure disease incidence

**not suitable for rare exposure because the rare exposure means that not much people exposed and as we asking them about past event it will be difficult to find someone recall the exposure event.

****case control study** can test current hypothesis, and tell about association between factor and disease but doesn't tell that there is obvious cause effect relationship why??

Because we are talking about things happened in the past >>

On the other hand to **cohort study and experimental studies** are reliable in addressing cause effect relation, because we follow up pt for a period of time.

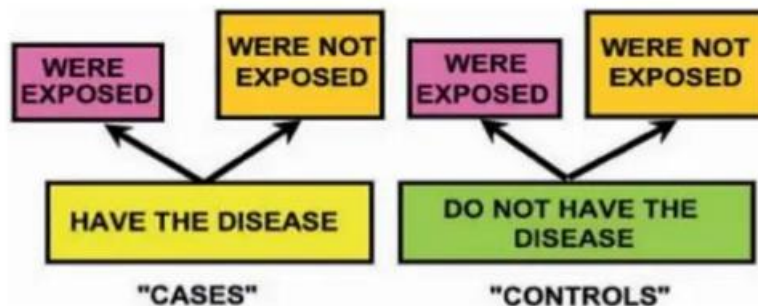
*remember: **cross sectional** study can generate hypothesis.

*case control study **can't** measure incidence and prevalence.

CASE-CONTROL STUDIES

- Cases have the disease of interest
Eg. Cerebral palsy
- Controls do not have the disease
Eg. Healthy babies born at the same time

Design of a case-control study



Hallmark of Case Control Study:
from cases and controls and searches for exposure.

*عند اختيار ال control يشترط ان تكون المجموعة مشابهة لل cases بمعظم الخواص عدا المرض الذي تتم دراسته, بالتالي اختيار ال control يكون بناء على عدم تواجد المرض ويتم سؤالهم عن التعرض لل risk factor لاحقا.

Example

Alcohol Consumption and Risk of Tuberculosis: Seattle/King County, Washington, 1988 through 1990

Alcohol Consumption ^a	Case Patients (n = 151)	Control Patients (n = 545)	Adjusted for Age		Adjusted for Age and Smoking ^b	
			OR	95% CI	OR	95% CI
None	60	263	1.0	Reference	1.0	Reference
Light to moderate	52	214	1.1	0.7, 1.7	0.9	0.6, 1.5
Heavy	39	68	2.8	1.7, 4.8	2.0	1.1, 3.7

Buskin et al (1994). *American Journal of Public Health*, 84, No. 1 1

**OR: odds ratio

=1 so, no relation , <1 the factor is protective , >1 there is association between them
بس ما باكدلنا العلاقة

*so, here this means that pt with heavy alcohol consumption have greater risk X2 to develop TB.

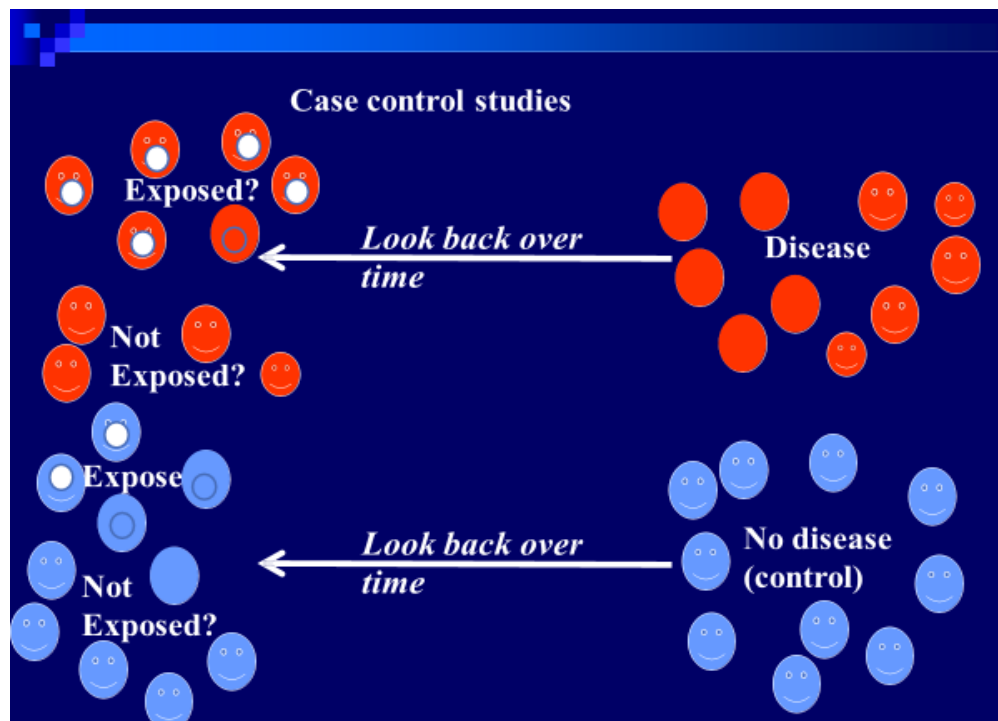
CASE-CONTROL STUDY DESIGN

- More efficient than a cohort study because a smaller sample size is required.
- One key feature of a case-control study, which distinguishes it from a cohort study, is the selection of subjects based on disease status.
- Controls are chosen from the same population yielding the cases

**more efficient (less cost) but cohort study is stronger for research purpose.

*controls must be matched with cases from the same population

For ex. Cases from hospital A ,controls must be from the same hospital but free from the disease.



CASE-CONTROL STUDIES

Strengths

- Suited to study disease with long latency periods, but can be used in outbreaks investigations
- Optimal for rare diseases
- Efficient in terms of time and costs: relatively quick and inexpensive
- Allows for evaluation of a wide range of possible causative factors that might relate to the disease being studied
- Odds ratio estimated

**used for disease with long latency period means that it take long time to appear (need follow up), and for outbreak like the cases will have for example food poisoning symptoms and we will ask them about previous exposure (did they ate meat from that place...)

**most appropriate way to present data of case control study is to calculate odds ratio.

CASE-CONTROL STUDIES

Limitations

- Very susceptible to bias (especially selection and recall bias) as both the disease and the exposure have already occurred when participants enter the study. Cases and controls might not be representative of the whole population
- We cannot calculate incidence or prevalence rate of disease
- We cannot be certain that exposure came before disease
- Choice of controls difficult
- Controls do not usually represent non-exposed population
- Past records incomplete
- No absolute risk estimates

**selection bias in determining the sample and recall bias from pt when they are talking about previous exposure.

*third point: as we said before we cant determine specific cause effect relationship we just know that there is a connection between them.

for example, studying alcohol consumption in relation to lung cancer assume that at end of study odds ratio was >1 so, there is relation but we cant say that alcohol consumption was the cause of lung cancer because maybe patients were smokers and that was the cause of cancer.

*we cant use it to calculate absolute risk because it need follow up and we cant calculate incidence rate.

Design of case control studies

- **Comparability:** Two groups must be as similar to each other as possible so selection of controls is very important. Controls must be as similar as possible to cases – except that they do not have the outcome (disease). (matching)
- **Outcome (disease) must be very clearly defined.** (Diagnostic criteria must be clear)
- **Use objective data about exposure status wherever possible, to reduce the risk of bias (biological or environmental indicators)**

*subjective data: is the symptoms that pt tell about

Objective data: is sign that seen by doctor or by investigation, and this one is more accurate to us.

2. Matching

Comparable



How many controls?

- **control-to-case ratio is 1 : 1**

is the optimal when the number of available cases and controls is large and the cost of obtaining information from both groups is comparable

- **control-to-case ratio is 1 : n**

When the number of cases is limited or when the cost of obtaining information is greater for cases or controls

- **As the number of controls per case increases, the power of the study also increase**

- **It is not recommended that this ratio increase beyond 4 : 1**

**ratio 1:1 is most common used but if we can take more control than cases this will add strength for our study.

Highest ratio we can reach is 4 controls:1cases

*Sometimes if the cases was very rare and its difficult to find cases will be low in comparison to control not 1:1 ratio.

CASE-CONTROL STUDY DESIGN

- The first step in a case-control study, beyond the research question, is to identify and select cases
- The most important step in designing a case-control study is to specify the case definition.
- In some situations, complete identification of cases in a well-defined source population may be too time consuming or otherwise impossible.

CASE-CONTROL STUDY DESIGN

- **Selecting Cases and Controls**
- Identification and collection of cases involves specifying the criteria for defining a person as a case—in other words, as having the disease (also called *case definition*).
- This definition consists of a set of criteria, also called *eligibility criteria*, for inclusion in the study. There also are criteria for exclusion from the study.

*eligibility criteria:

هي المواصفات التي نضعها لل cases وبناء عليها بنعمل exclusion and inclusion for people in the study

مثلا لو بندرس تاثير تعرض عمال للاشعة في مصنع معين رح نستثني العمال الي تعينو جديد مثلا اخر شهرين ...

CASE-CONTROL STUDY DESIGN

Selecting Cases and Controls

- Cases are found through registries, health care systems, and other sources that identify new or incidence cases.
For example, cases may be sampled from those admitted to particular hospitals or clinics.
- Other sources of cases can be all cases diagnosed in the community ; cases diagnosed in a sample of the general population as from **cross sectional survey**

**second point: we can take our cases from cross sectional study that done before about the same issue to calculate incidence and prevalence ,so we are going to choose our cases from the same sample of the cross sectional study.

CASE-CONTROL STUDY DESIGN

The next step is selection of the controls.

- Controls are chosen from the same source population of cases .
- The source population is usually defined by geographic area.
- It is important to select controls so that participation does not depend on exposure.

CASE-CONTROL STUDY DESIGN

Source of controls

- The ideal situation is a random sample from the same source population as the cases.
- Investigators may use more than one control group.
- Controls can be selected by sampling from:
The general population in the same community; the hospital community (patients in the same hospital); individuals who reside in the same block or neighborhood; and spouses, siblings, or associates (schoolmates, co-workers) of the cases.

**we can use multiple control group and study multiple risk factors and that's it the importance of case control study.

Obtaining cases and controls for case control studies

Study	Source of cases	Source of controls
PROM (premature rupture of membrane)	Hospital patients	Hospital patients
Rheumatoid arthritis	Outpatient clinic	Other outpatient clinic
Cervical screening	GP register	GP register

**هذا الجدول موجود في محاضرة ال cohort study الدكتورة حكمت نحذفه من هناك لانه تابع لل case control

**the table shows how we choose cases and controls from the same population like in studying PROM we take both of them from hospital...

CASE-CONTROL STUDY DESIGN

Matching Cases and Controls

- Matching is a popular approach to control for confounding and selection bias in case-control studies.
- Matching cases and controls helps to ensure that these groups are similar with respect to important risk factors, thereby making case-control comparisons less subject to confounding or selection bias.

CASE-CONTROL STUDY DESIGN

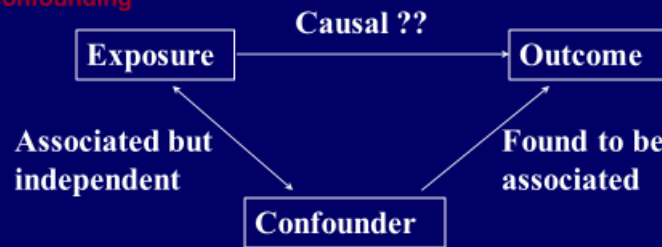
Prior exposure to the risk factor(s) of interest

- Once cases and controls are selected, information must be collected on prior exposure to the risk factor(s) of interest.
- Interviews and questionnaires are the most common means of determining a subject's exposure history and medical records review is another source
- The most objective means for characterizing exposure is the use of a biological marker.

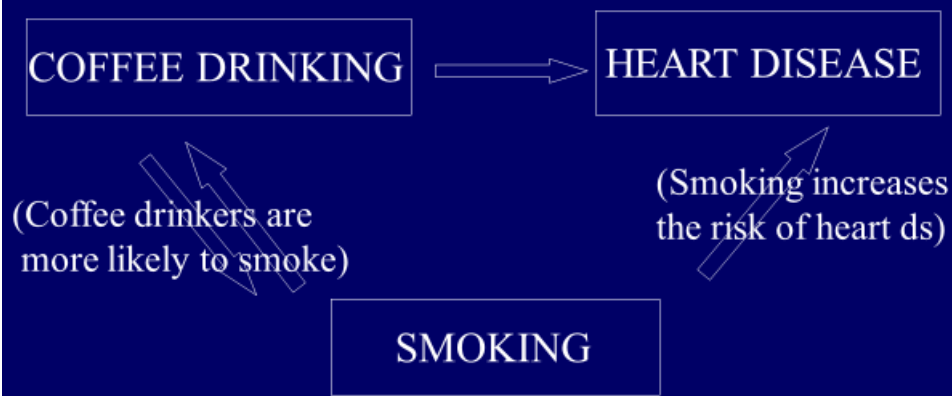
Confounding

A confounding factor is one that is associated with the exposure and that independently affects the risk of developing the outcome, but that is not an intermediate link in the causal chain between the exposure and the outcome under study

Matching - often used in case-control studies to decrease confounding



Examples ... confounding



**for example here smoking affect coffee drinking and heart disease so, to avoid its effect I can choose both cases and controls from pt who are smoking so, the risk of smoking among cases and controls is equal so, I can study coffee drinking now.

Confounding

Matching Cases and Controls

- For example, if age and sex are the matching variables, then a 35 year old male case is matched to a 35 year old male control
 - Pair matching (one to one individual matching)
- The use of matching usually requires special analysis techniques (e.g. matched pair analyses and conditional logistic regression)

**pair matching : take one from cases and match him with one person from controls.

matched pair analyses and هذه الطريقة تستخدم في دراسات معينة اسمها conditional logistic regression

CASE-CONTROL STUDY DESIGN

The disadvantages of matching include

- (1) It is time consuming and expensive
- (2) Some potential cases and controls may be excluded because matches cannot be made
- (3) Unmatched cases and controls must be discarded
- (4) Matched variables cannot be evaluated as risk factors in the study population
- (5) Continuous matching categories may be too broad, and residual case control differences may persist.

CASE-CONTROL STUDY DESIGN

- **Data Analysis**
- Data collection and analysis are based on whether the case-control study involves a matched or unmatched design. The measure used typically in case-control studies is the odds ratio.
- **Odds ratio (OR):** odds of a particular exposure among people with a specific condition divided by the corresponding odds of exposure among people without the condition under study

**odds ratio :

احتمالية اصابة الناس المعرضين لعامل خطر الى احتمالية اصابة الناس غير المعرضين له

$$OR = \frac{\text{Odds of exposure}_{\text{cases}}}{\text{Odds of exposure}_{\text{controls}}}$$

**so, if OR was >1 then the exposure of risk is associated with that disease.

<1 then exposure was protective.

So, in case control odds ratio

Cross sectional prevalence

Cohort study we calculate relative risk, absolute risk... by using follow up and incidence.

Analysis

- Find out
 - Exposure rates among cases and controls to suspected factor
 - Estimation of disease risk associated with exposure (Odds Ratio)

معنى الجملتين انه نحسب odds ratio في الامتحان ممكن تكتب الدكتوراة الجملة من غير ما تحكي مباشرة
احسب OR

Exposure rates

A case control study between smoking and lung cancer

	Cases (with Ca Lung)	Controls (without Ca lung)	Total
Smokers (<5/day)	33 (a)	55 (b)	88 (a+b)
Non-smokers	2 (c)	27 (d)	29 (c+d)
Total	35 (a+c)	82 (b+d)	117 (a+b+c+d)

Exposure rates

- Cases= $a/(a+c) = 33/35 = 94.2 \%$
- Controls= $b/(b+d) = 55/82 = 67 \%$
- So frequency of smoking was definitely higher among lung cancer patients than those without cancer

- exposed among cases = $a/(a+c)$

$$= 33/(33+2) = .942 * 100 = 94.2 \% \text{ (multiply by 100 to convert it into percent)}$$

- بنعمل نفس الاشي لل controls

$$\text{Exposure among controls} = b/(b+d)$$

$$= 55/(55+27) = 67\%$$

Outcomes of Case Control Study

- Odds ratio:

	Diseased/ Cases	Not diseased/ Controls
Exposed	a	b
Not exposed	c	d

Odds that case was exposed

Odds ratio =

Odds that control was exposed

$$= (a/c) / (b/d) = ad / bc$$

- كيف وصلنا لقانون انه ال $odds\ ratio = ad/bc$ ؟

Estimation of risk

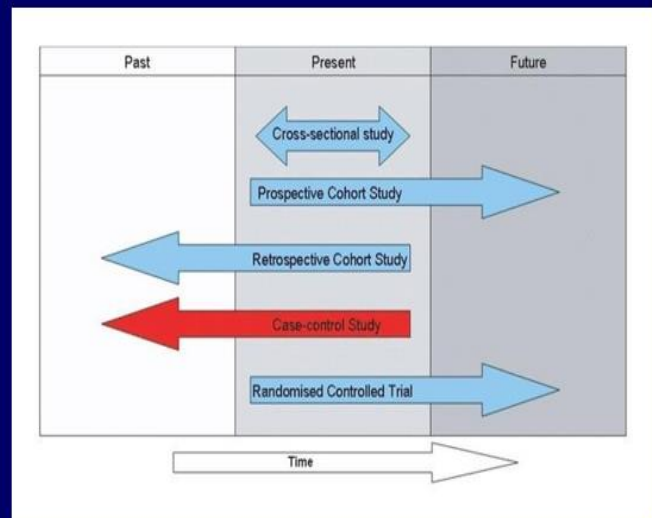
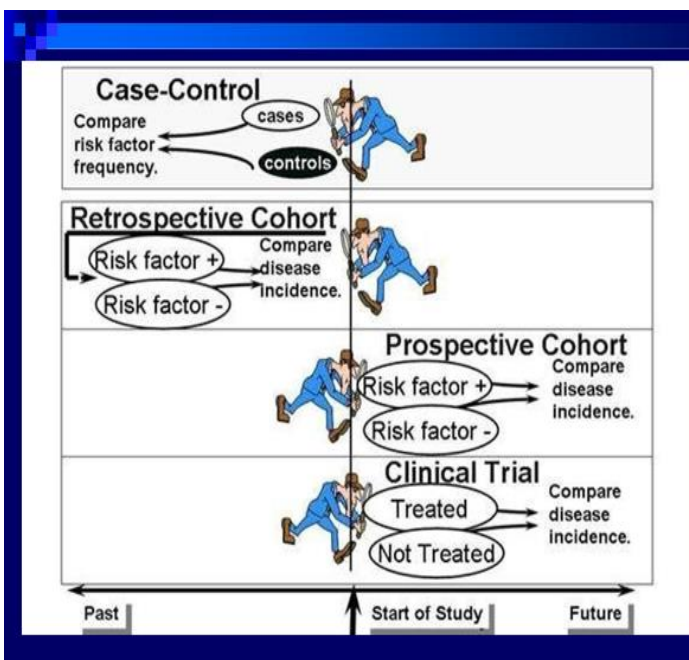
- Odds Ratio (Cross-product ratio)
- Odds that cases were exposed = a/c
- Odds that controls were exposed = b/d
- Odds ratio = $(a/c)/(b/d) = ad/bc = 8.1$

Interpretation

- The odds of smoking more than 5 cigarettes per day was 8.1 times more in the lung cancer patient than those without lung cancer.

OR

- Smoking (>5/day) was found be associated 8.1 times more in patients with lung cancer than those without lung cancer.



**as we can see in these two pictures :

Case control study and retrospective cohort study are going to past by asking pt about previous exposure.

Whereas prospective cohort and experimental study comparing if the pt will have ds in future or not like follow up to reach the results.