

Principles of case control studies

Part I

- **Nature of the design of case control studies**
- **Odds ratio as the measurement of association**

Many slides in this presentation are from the World Health Organization and the European Programme for Intervention Epidemiology Training, thank you.

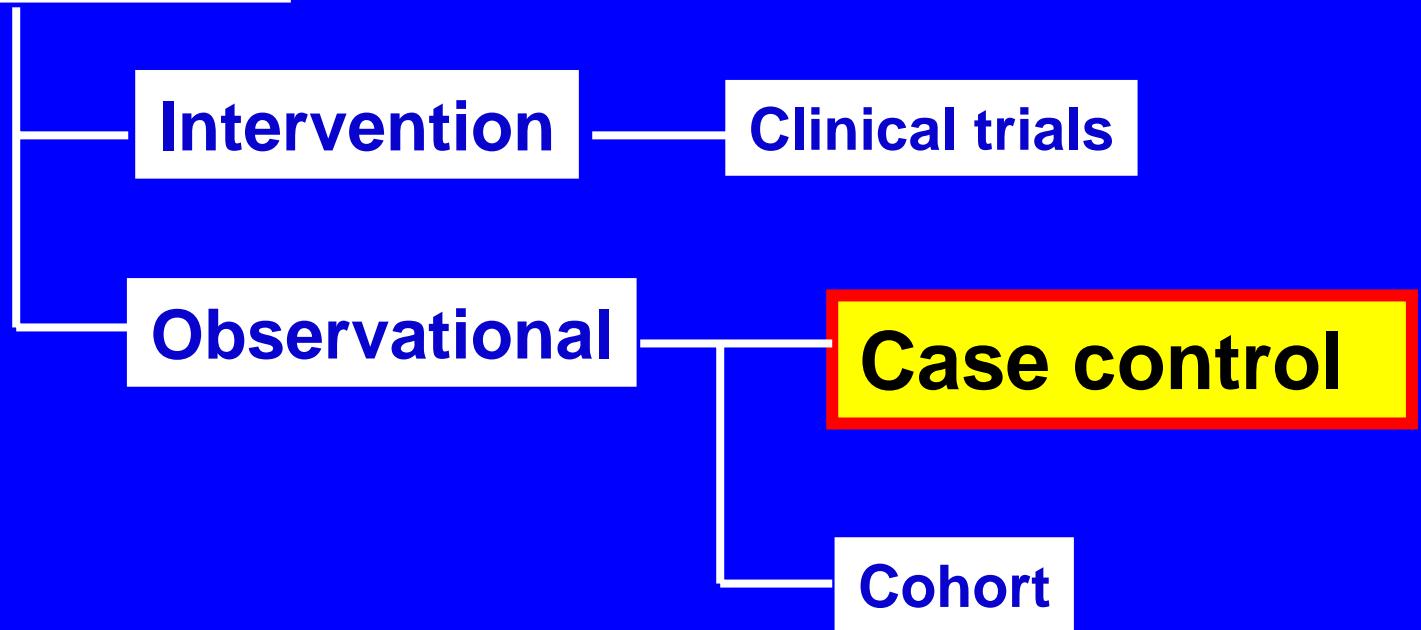
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Epidemiological studies

1. Descriptive

2. Analytical



Case control Study

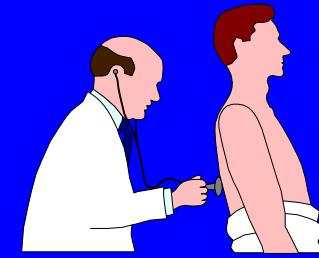
Exposure

?



?

Disease
(Case)

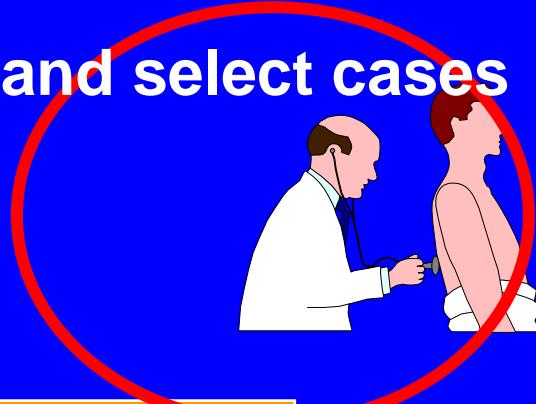


No disease
(Control)



Major Steps in case control study

1. Define and select cases



?

?

Measles case:

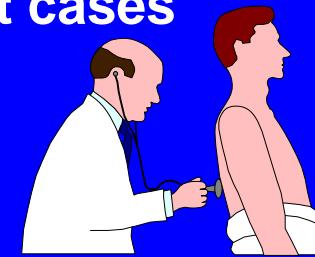
Children aged 0-10 yrs, living in BKK, who were diagnosed with measles by physicians during 2000-2005

Major Steps in case control study

1. Define and select cases

Measles case:

Children aged 0-10 yrs, living in BKK,
who were diagnosed with measles by
physicians during 2000-2005



?



?

2. Select controls

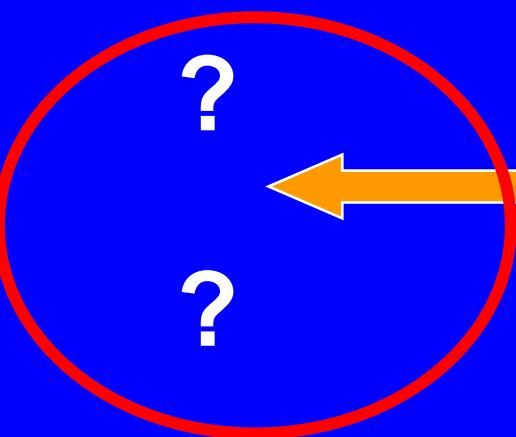
Control:

Children aged 0-10 yrs, living in
BKK, who were not diagnosed
with measles by physicians
during 2000-2005



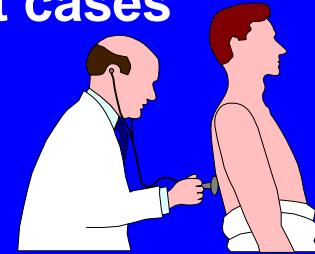
Major Steps in case control study

3. Ascertain exposures



Measles vaccination yes/no

1. Define and select cases



2. Select controls



Major Steps in case control study

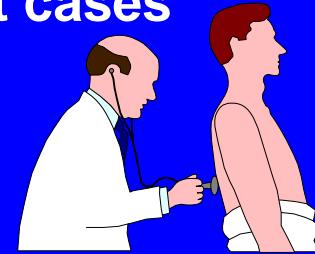
3. Ascertain exposures

?



?

1. Define and select cases

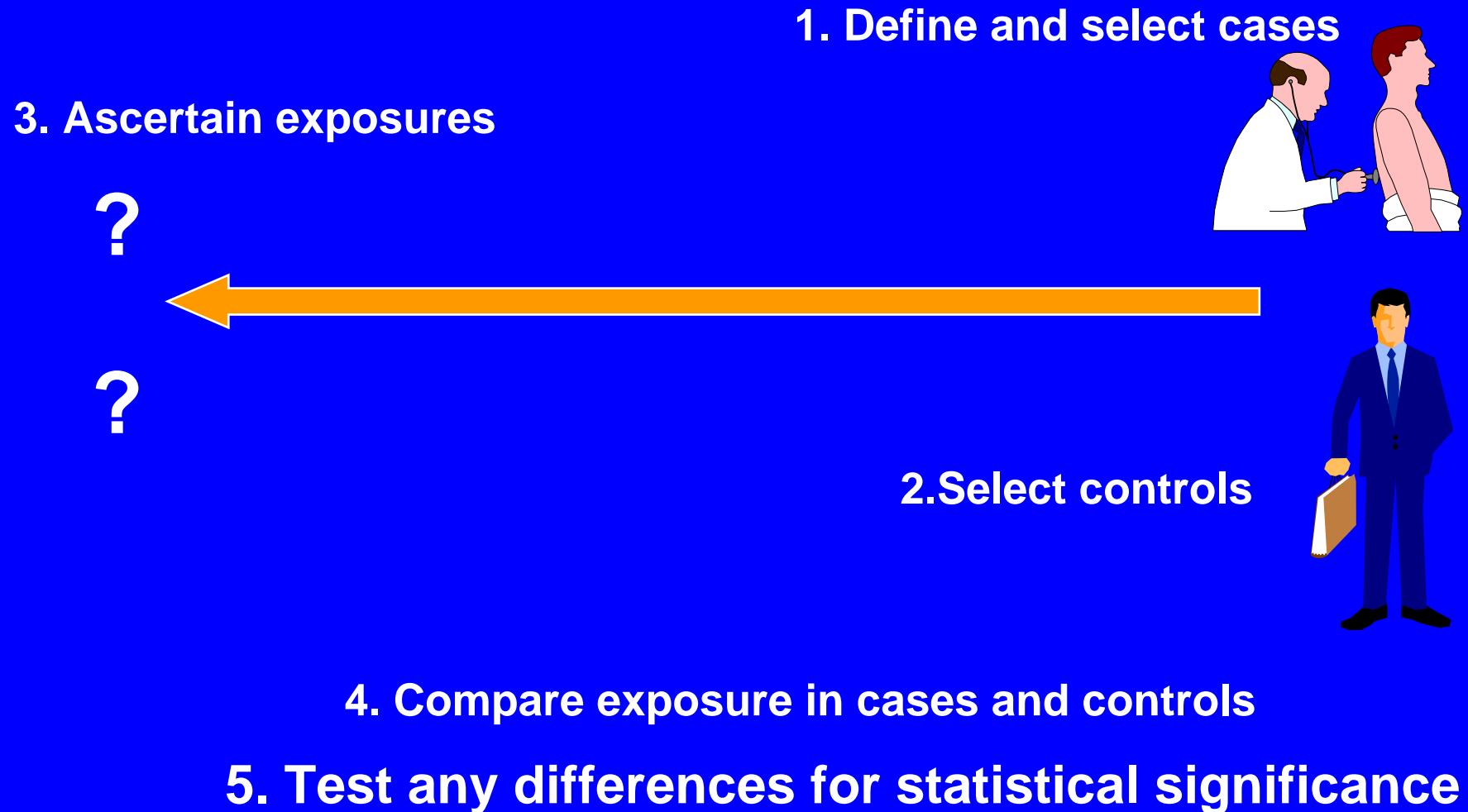


2. Select controls



**4. Compare exposure in cases and controls
(Calculation of Odds Ratio)**

Major Steps in case control study



Hypothesis in cohort study

Is the incidence higher among exposed than non-exposed?

Hypothesis in case control study

Is the observed exposure among cases higher than expected?

Thought

If the frequency of exposure is higher among cases than controls,
then the incidence will probably be higher among exposed than non-exposed

Example

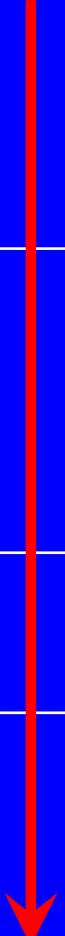
Is the proportion of oral contraceptive use among myocardial infarction cases higher than among controls?

(Is the observed exposure among cases higher than expected?)

If the proportion of oral contraceptive use is higher among MI cases than controls,
then the MI incidence will probably be higher among
oral contraceptive users than among non-users

Distribution of myocardial infarction cases and controls by oral contraceptive use

Oral contraceptives	Myocardial Infarction	Control
Yes	693	320
No	307	680
Total	1000	1000
% exposed	69.3%	32 %



Cohort studies

- Risk
- Risk difference
- Relative risk (strength of association)

Case control studies

- No calculation of rates, so no relative risk
- Proportion of exposure

Any way of estimating Risk & Relative risk ???

Odds

Probability that an event **will** happen
Odds = _____
Probability that the even **will not** happen

Probability that an event **will** happen
Odds = _____
 $1 - (\text{Probability that the event will happen})$

Foot ball game	Wins	Loose	Total
Team A	2884	97116	100000

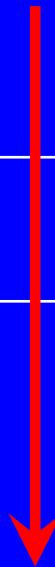
$$\text{Risk of winning} = 2884 / 100000 = 0.029$$

$$\text{Risk of not wining} = 1 - 0.029 = 0.971$$

$$\text{Odds of wining} = 2887 / 97116 = 0.029/0.971 = 0.030$$

Odds ratio in case control study

	Cases	Controls	
Exposed	a	b	Probability to be exposed among cases
Not exposed	c	d	Probability to be unexposed among cases
Total	$a + c$	$b + d$	



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

Odds of exposure among cases =

Probability to be exposed among cases
Probability to be unexposed among cases

$$\text{Odds Ec} = \frac{a / (a+c)}{c / (a+c)} = a / c$$

Odds of exposure among controls =

Probability to be exposed among controls
Probability to be unexposed among controls

$$\text{Odds Ec} = \frac{b / (b+d)}{d / (b+d)} = b / d$$

**OR in case control is a good estimate of RR
(if disease is rare)**

Distribution of myocardial infarction cases and controls by recent oral contraceptive use

Oral contraceptives	Myocardial Infarction	Control	OR
Yes	693	320	4.8
No	307	680	Ref.
Total	1000	1000	

$$OR = \frac{693 * 680}{320 * 307} = 4.8$$

Oral contraceptive users are 4.8 times more likely than non users to have myocardial infarction

End of part I