



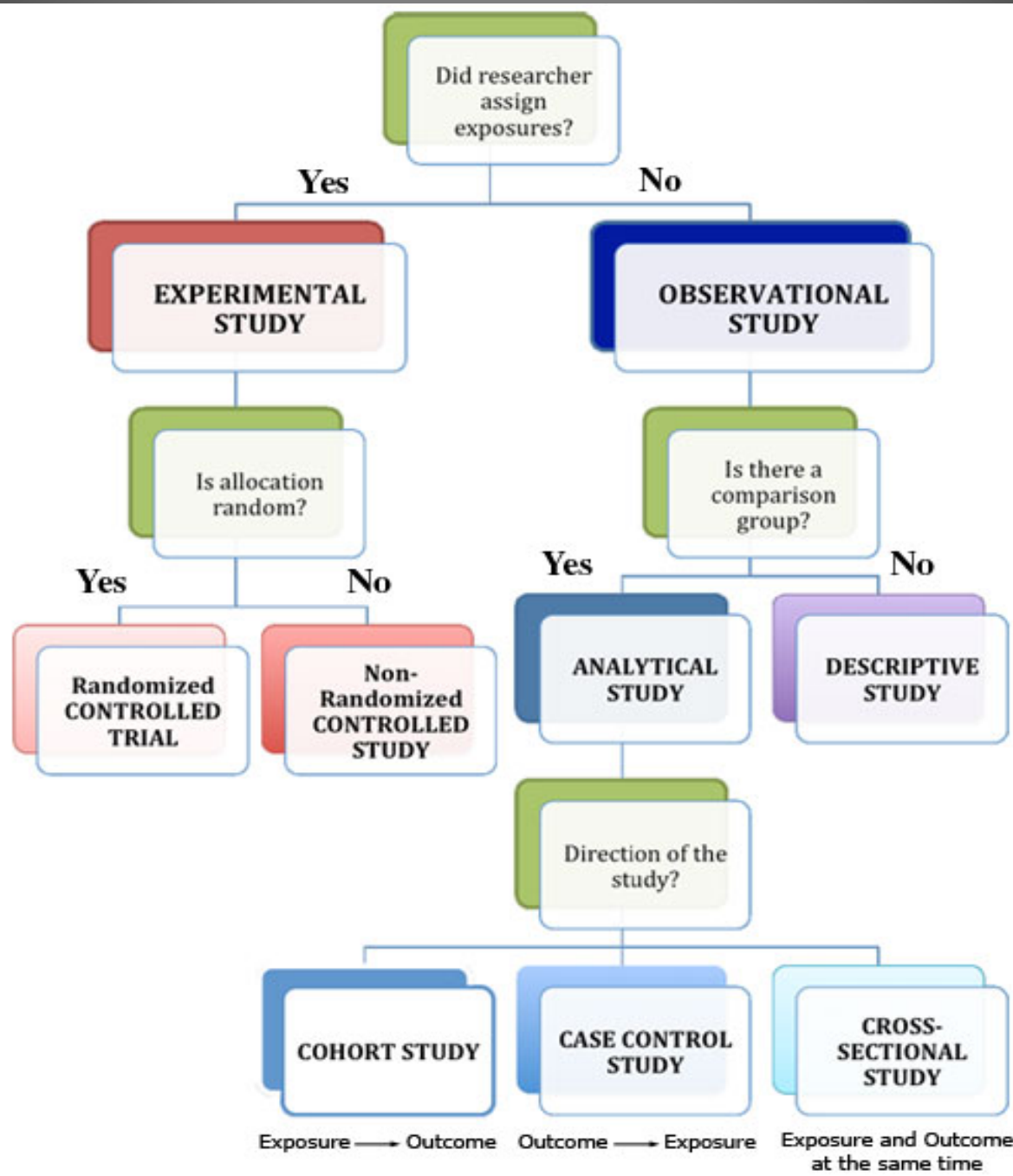


# Tutorial Two

## Measures of Association

Dr. Nurah Alamro  
Department of Family  
& Community Medicine

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Overview   
Tutorial Questions   
References 



**Table 3.2 Epidemiologic Measures Categorized as Ratio, Proportion, or Rate**

Condition	Ratio	Proportion	Rate
Morbidity (Disease)	Risk ratio (Relative risk) Rate ratio Odds ratio Period prevalence	Attack rate (Incidence proportion) Secondary attack rate Point prevalence Attributable proportion	Person-time incidence rate
Mortality (Death)	Death-to-case ratio	Proportionate mortality	Crude mortality rate Case-fatality rate Cause-specific mortality rate Age-specific mortality rate Maternal mortality rate Infant mortality rate
Natality (Birth)			Crude birth rate Crude fertility rate

# Measures of Association: Concepts!



Comparison

Two Groups

Quantifies the Association

Exposure Types



# Exposure Types



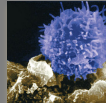
## Environment

- Food
- Mosquito
- Toxic waste dump
- Hospital ward



## Inherent characteristics

- Age
- Gender
- Race



## Biologic characteristics

- Immune Status



## Activities

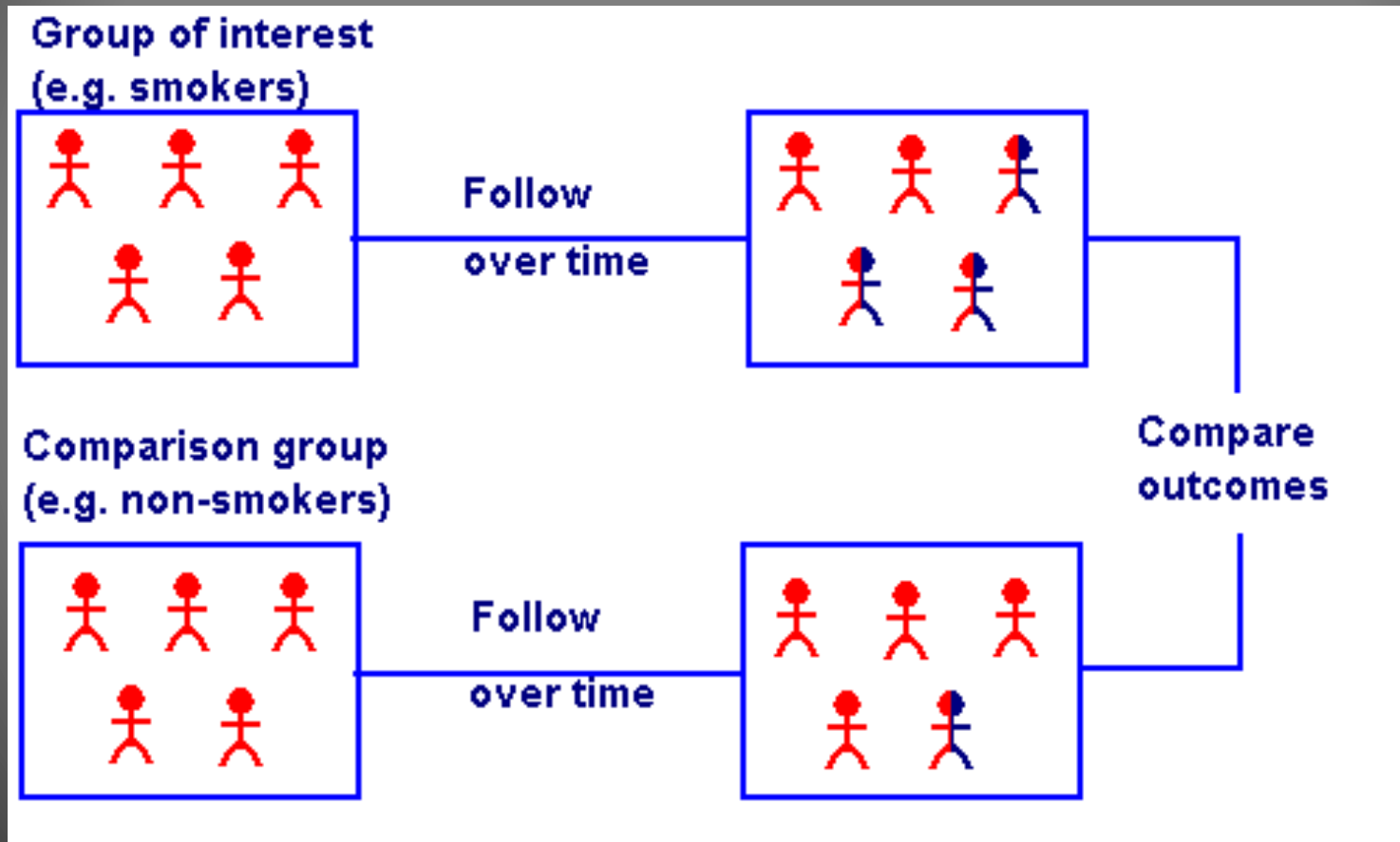
- Occupation
- Leisure activities



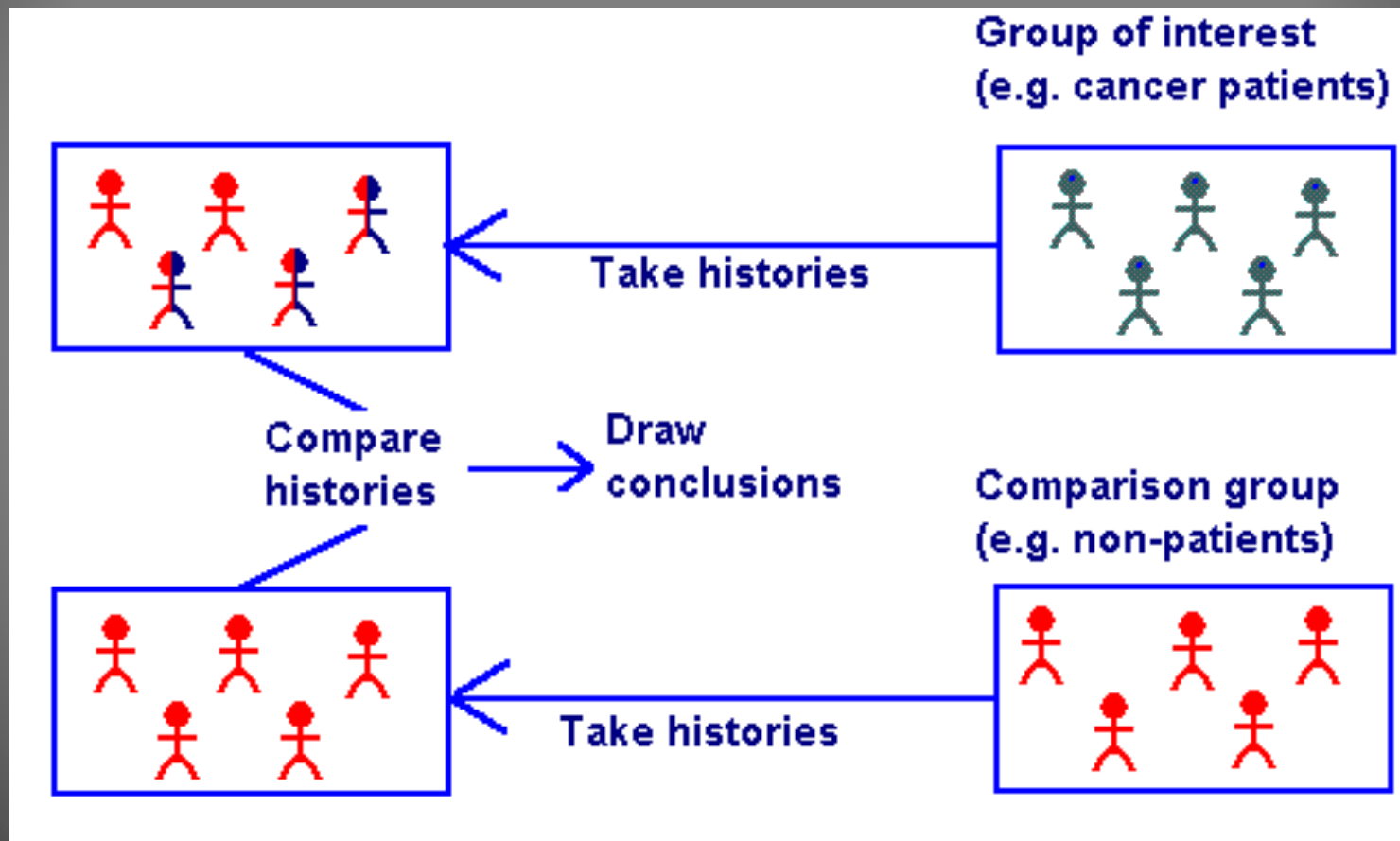
## Living Conditions

- Socio-economic status
- Access to medical care

# COHORT STUDIES



# Case - Control Studies



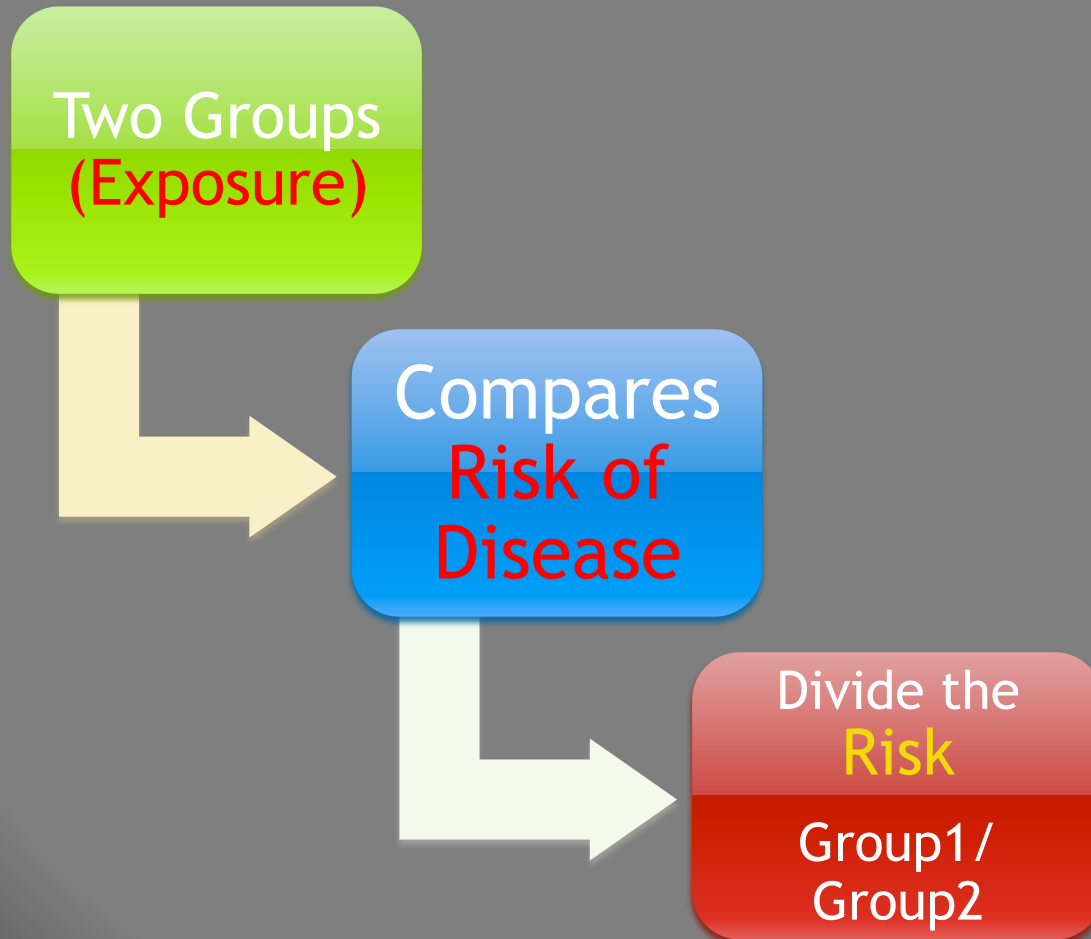
# Question One

**Describe in which studies the relative risk (RR) and the odds ratio (OR) are used. Outline the reason why they would be used in a particular study and not in another.**

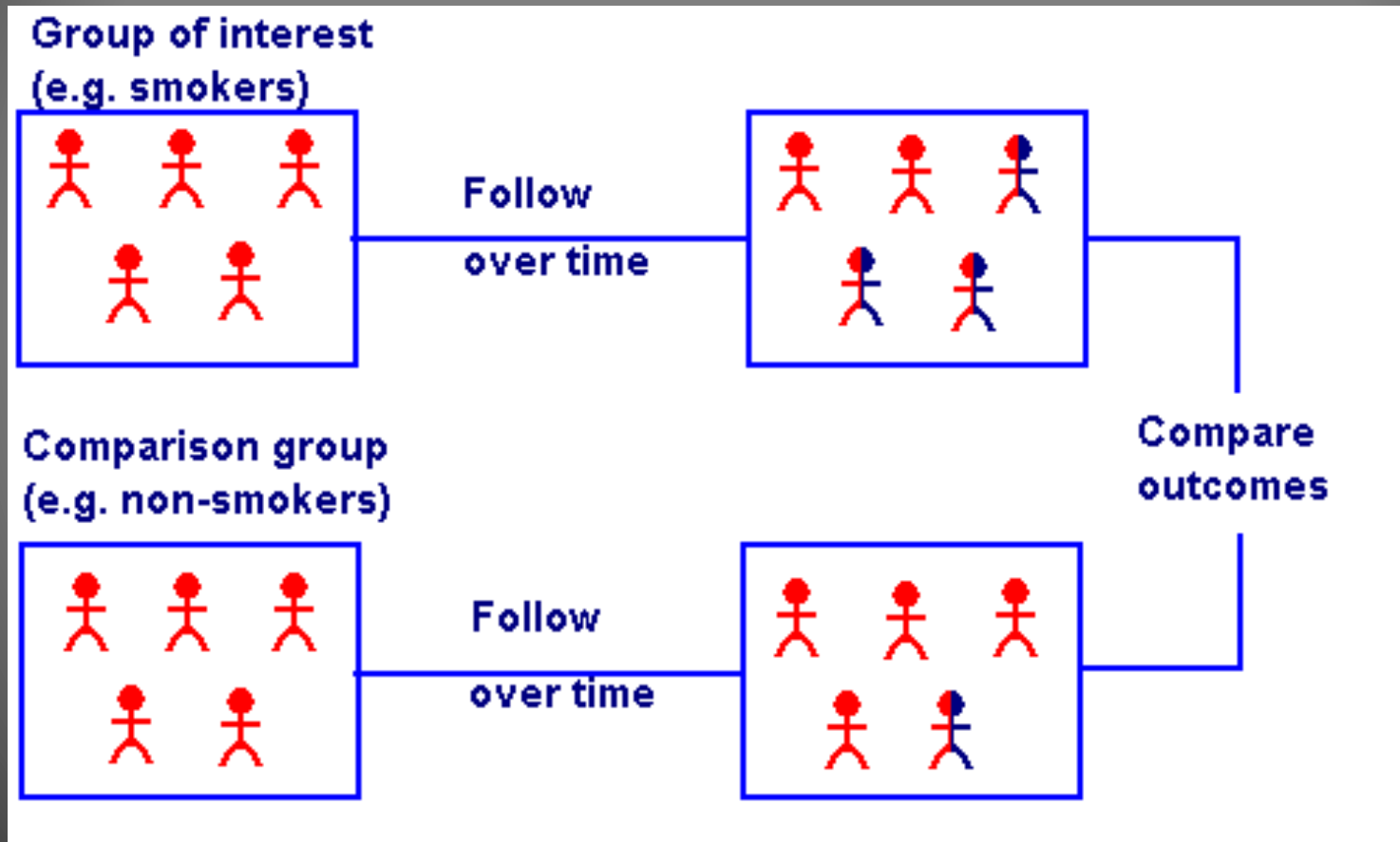




# RELATIVE RISK



# COHORT STUDIES



Remember!

RR is used in  
“Experimental Studies”  
Also!



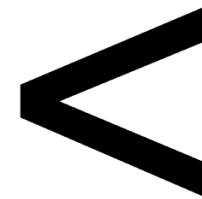
# Interpretation of RR: “1”



Increased  
risk for the  
exposed  
group

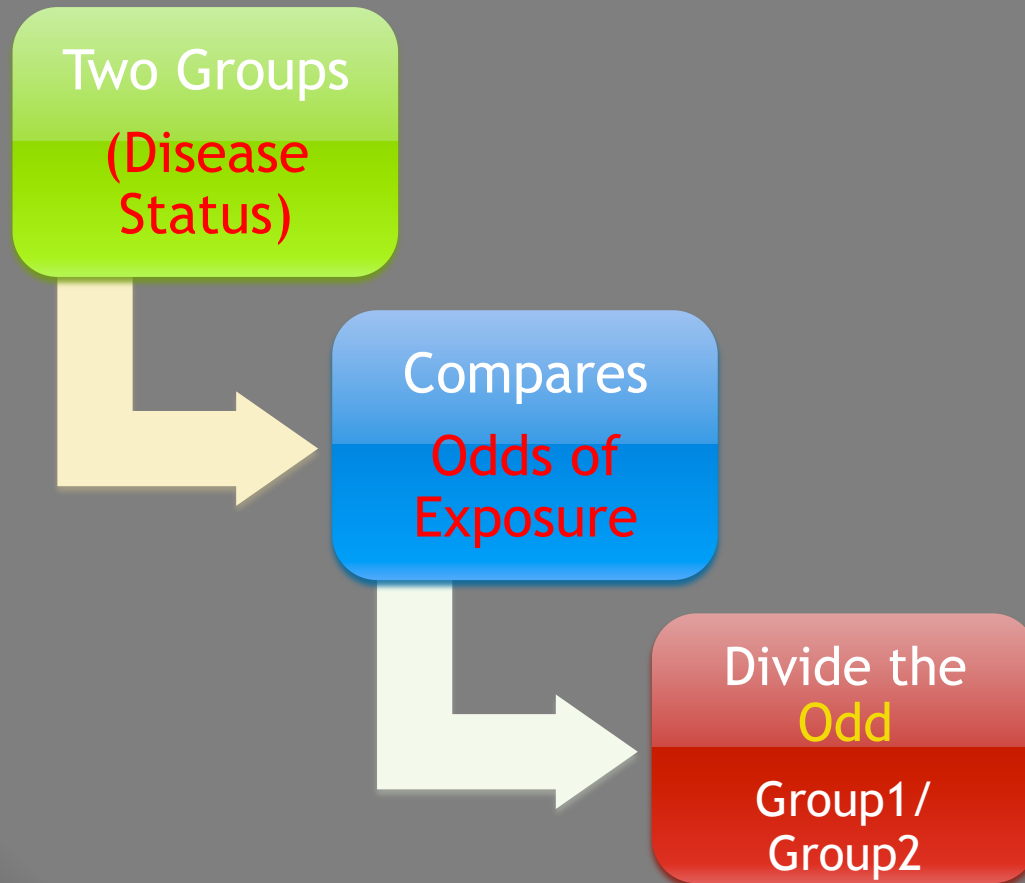


Identical risk  
among the  
two groups

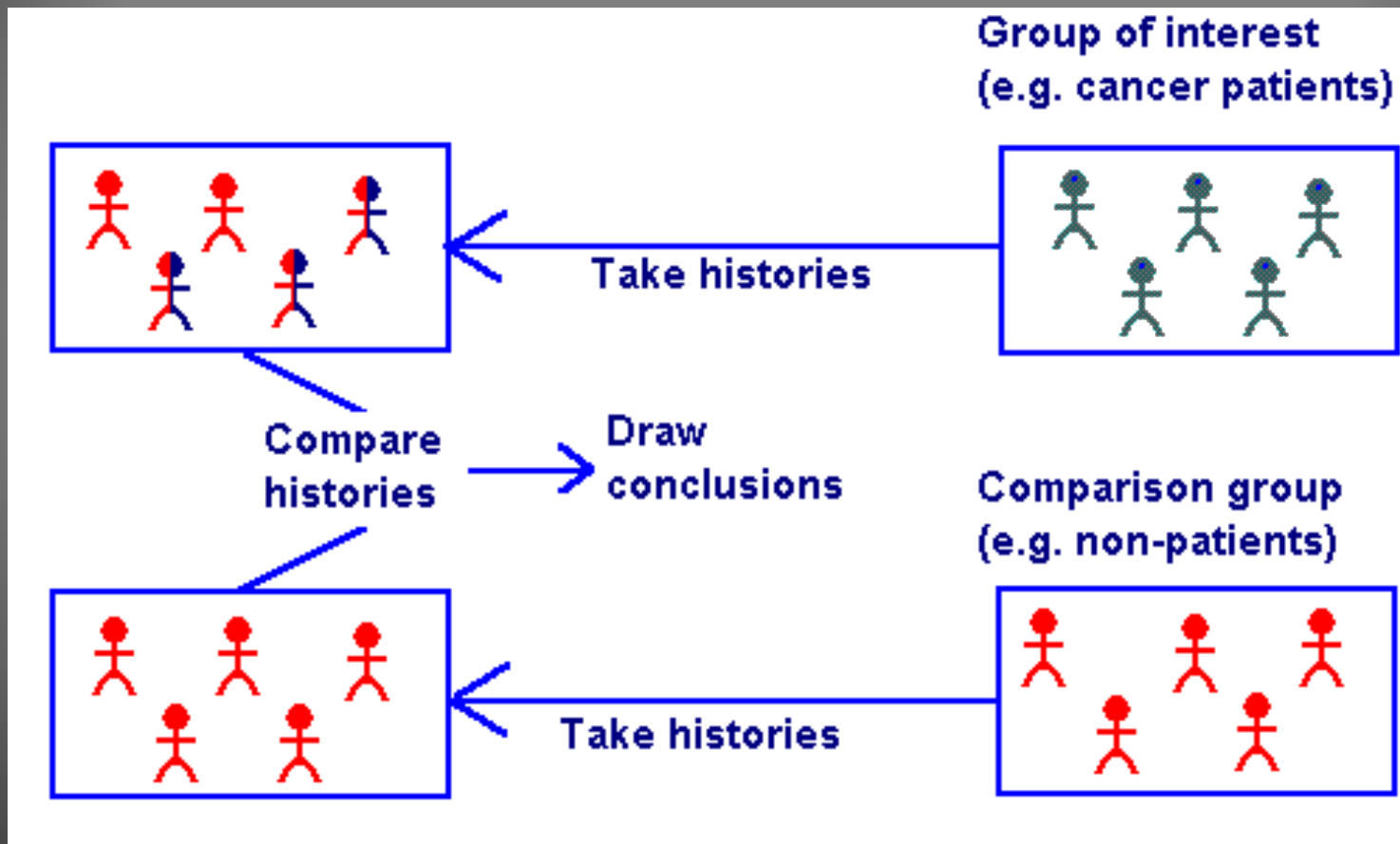


Decreased  
risk for the  
exposed  
group  
(protective!)

# Odds Ratio



# Case - Control Studies



Remember!

OR is used in “Cross Sectional  
Studies” Also!

*Exposure Status is Unknown*



# RR almost never calculated in Case - Control Studies

Because often **the size of the population** from which the case-patients came is not known.

As a result, **incidence rates needed for risk ratio** can not be calculated.



## Question Two:

In an outbreak of tuberculosis among prison inmates in South Carolina in 1999, 28 of 157 inmates residing on the East wing of the dormitory developed tuberculosis, compared with 4 of 137 inmates residing on the West wing.

**Build a two by two table, calculate the appropriate measure of association and interpret the result.**

## A) 2 X 2 Table

Disease  
(outcome)

	Developed tuberculosis?		Total
	Yes	No	
East wing	a = 28	b = 129	H <sub>1</sub> = 157
West wing	c = 4	d = 133	H <sub>0</sub> = 137
Total	32	262	T = 294

Exposure

What is the type of exposure?

## B) Calculate Appropriate Measure of Association

- First, decide what type of study is this? (Is the population well defined or not)

“Well defined → Cohort study → RR”

- $RR = \frac{\text{Incidence of TB among exposed (East Wing)}}{\text{Incidence of TB among unexposed (West Wing)}}$
- Incidence of tuberculosis among East wing residents  
 $= 28 / 157 = 0.178 = 17.8\%$   
Incidence of tuberculosis among West wing residents  
 $= 4 / 137 = 0.029 = 2.9\%$
- $RR = 17.8 / 2.9 = 6.1$

## C) Interpretation: >1

Inmates who resided in the East wing of the dormitory were 6.1 times as likely to develop tuberculosis as those who resided in the West wing.

## Question Three

In an outbreak of varicella (chickenpox) in Oregon in 2002, varicella was diagnosed in 18 of 152 vaccinated children compared with 3 of 7 unvaccinated children. **Calculate the risk ratio. Interpret the result**

## A) Calculate RR

First, build a two by two table:

	Varicella	Non-case	Total
Vaccinated	a = 18	b = 134	152
Unvaccinated	c = 3	d = 4	7
Total	21	138	159

- Calculate Incidences:

Incidence of varicella among vaccinated children

$$= 18 / 152 = 0.118 = 11.8\%$$

Incidence of varicella among unvaccinated children

$$= 3 / 7 = 0.429 = 42.9\%$$

- Risk ratio =  $0.118 / 0.429 = 0.28$
- Interpretation:  $<1$

The risk ratio is less than 1.0, indicating a decreased risk or protective effect for the exposed (vaccinated) children.



## Question Four

To study the causes of an outbreak of aflatoxin poisoning in Africa, investigators conducted a case-control study with 40 case-patients and 80 controls. Among the 40 poisoning victims, 32 reported storing their maize inside rather than outside. Among the 80 controls, 20 stored their maize inside. The resulting odds ratio for the association between inside storage of maize and illness is:

- A. 3.2
- B. 5.2
- C. 12.0
- D. 33.3





# Again 2 X 2

C. The results of this study could be summarized in a two-by-two table as follows:

		Cases	Controls	Total
Stored maize inside?	Yes	a = 32	c = 20	52
	No	b = 8	d = 60	68
Total		40	80	120

The odds ratio is calculated as  $ad/bc$ , or  $(32 \times 60) / (8 \times 20)$ , which equals  $1,920 / 160$  or 12.0.

# References

- CDC. Principles of Epidemiology in Public Health Practice. Third Edition. An Introduction to Applied Epidemiology and Biostatistics.
- Bonita R et al. Basic Epidemiology. 2nd Edition. WHO 2006.
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- <http://www.google.com/imghp>



# THANK YOU

Any Further Questions:

[nmalamro@ksu.edu.sa](mailto:nmalamro@ksu.edu.sa)

