Measurements of Risk & Association ...

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Learning objectives

- Understand how to estimate the magnitude of the association between exposure & healthrelated events
- Estimate absolute, relative and attributable risks, AR%, Odds Ratio, in epidemiological studies.

Interpret these measures in a meaningful manner.

Definitions

Risk

 Probability of an individual to develop a disease or change in health status over a fixed time interval. (Absolute risk)

A risk factor

 Is any attribute, characteristic, behaviour or exposure that increases the likelihood of developing a disease or injury in an individual.

- CHD is associated with Depression
- Stress is associated with heart blockage
- DM increased likelihood of non-paroxysmal AF
- Being overweight raises your risk for type 2DM, HD and stroke.
- Premenopausal women are less likely to develop CVD than postmenopausal women.
- So on

Association

A statistical relationship between two or more variables.... Exposure & disease

Measuring of Risk Introduction:



• How we can determine the association between exposure & health-related events ??

- Applying an analytic type of Epidemiological Studies As :
- ✓ Case –Control study
- ✓ Cohort study
- ✓ Intervention studies

• Principles of epidemiology are ??

 Analytic studies .. Assess the likelihood of developing the disease in the exposed group in comparison to the non-exposed;

- So how we can determine the association is high or low from these studies??
- By measuring risk in these studies accordingly ...

In Cohort Study or prospective studies where the risk is estimated directly by:

- ✓ <u>Relative Risk (RR)</u>,
- ✓ Attributable Risk,
- ✓ <u>Attributable Risk %</u>,
- In case-control studies –

where the risk is estimated indirectly by

✓ Odds Ratio (as the incidence is not known)

• In intervention studies ..?? Why?

Relative Risk (Risk Ratio)

- Estimates the magnitude of an association between exposure & disease.
- It estimates the likelihood of developing a disease in exposed relatively to those not.

Relative risk (RR) = <u>incidence among exposed (Ie)</u> incidence among non exposed(Io) • It is the ratio of the Incidences.

Calculation can be either for morbidity or mortality.



Children

(<12 yrs)

1000



Family smoker 500 children *Exposed* Diseased 300

Not diseased 200

1 year

Family non-smoker 500 children *Not exposed* Diseased

Not diseased 380

2x2 Table (contingency) to determine the association..



<u>Rate</u>: Incidence rate

Incidence of Resp. Infection among *exposed* children: 300

500 * 100 = 60%

Incidence of Resp. Infect. Among *non exposed* children: 120

500 *100 = 24%

Relative Risk Incidence rate among exposed Risk Ratio =

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Incidence rate in non exposed.

60% / 24% = 2.5?

- **RR** = 1: **Risk in exposed equal to risk in unexposed** (no association).
- **RR** > 1: **Risk in exposed is greater than the risk in unexposed** *(positive association)*
- **RR** < 1: **Risk in exposed is less than the risk in unexposed** (negative association, possibly protective)
- Interpretation of RR

Children in Smoker family were 2.5 times as likely to develop chest infections as were children of non-smoker families.

Relative Risk give an indication to the "strength of association."

Why is relative risk important?

- Given its ability to identify protective and risk factors triats, in medical studies.
- It can intuitively convey the treatment effect in RCT.

Rate Ratio

A **rate ratio** compares two groups in terms of , persontime rates, or mortality rates.

Rate ratio = <u>rate for group of primary interest</u> rate for comparison group

The interpretation of the value of a rate ratio is similar to that of the risk ratio.

Exposure Category	Annual Death Rates / 100,000 persons		
	Lung Cancer		
Heavy smokers Nonsmokers	166		
	7		
<u>Measures of</u> <u>Risks</u>			
Rate ratio:	166 / 7 = 23.7		

Doll and Hill study : Mortality of British doctors cited from Mausner, 1985

Attributable risk (AR), *Risk difference*) Excess Risk, (Incidence Difference:

 Excess risk of the disease in those exposed compared with those none exposed.

AR = Inc.exp - Inc.non-exp



Attributable Risk:

60% - 24% = 36%

• *interpretation* 36% of Resp. Infection among <12 children can be attributed to family smoking. • Attributable Risk % (AR%):

(population attributable risk)

- The percentage of disease which could be prevented if we remove the exposure to that factor in the pop. Under study.
- The proportion prevented in Pop.

• AR% = Ie - Io * 100

Ie

AR% = 36% / 60% = 60% interpretation?

OR (Odds Ratio, Relative Odds)

- It is a measure of choice for <u>case-control study</u>.
 In (CCS), we cannot calculate the IR → NO RR.
- OR used to measure the association between exposure & disease in (CCs), instead of RR (cohort).

OR:

- Odds refer to single entity"
- Ratio of the proportions.
- Odds of factor among cases divided by odds of
- factor among control"



Case Control Studies

	Leukemia Cases	Healthy <i>Controls</i>	
Benzene Exposed	a	b	
Benzene <i>Non</i> <i>Exposed</i>	C	d	
	a+c	b+d	

CROSS -RATIO

Odds ratio

- a = No. of persons with disease and with exposure of interest
- b = No. of persons without disease, but with exposure of interest
- c = No. of persons with disease, but without exposure of
 interest
- d = No. of persons without disease & without exposure of interest

a + c = total number of persons with disease ("cases")
b + d = total number of persons without disease
("controls")

Example: A study of TB with alcohol consumtion in a case-control study.



 $OR = 100 \times 140 / 40 \times 80 = 4.4$

- TB patients have been exposed to alcohol 4 times than healthy.
- Alcoholism was seen among TB patients 4 times than non TB.

• Measuring of Risk in epidemiology, does it determine the cause of a disease in a given individual ??