Míry asociace a efektu 2

Podíl šancí, rozdíl rizik, atribuce rizika

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Odds ratio

- Alternative measure of risk

The odds of disease is the number of cases divided by the number of non-cases

$$\text{Odds} = \frac{\text{Cases}}{\text{Non cases}}$$

Odds ratio (**OR**) is ratio of odds of disease among exposed ($odds_{exp}$) and odds of disease among unexposed ($odds_{unexp}$)

$$\mathbf{OR = odds_{exp} / odds_{unexp}}$$

Odds of an outcome

- The analysis of the association between exposure and outcome is often based on **ODDS and ODDS RATIOS**

- Odds is the number of cases divided by the number of non-cases

$$Odds = \frac{Cases}{Non - cases}$$

Odds ratio = measure of the magnitude of the association

- It is defined as ratio of odds of outcome (e.g. disease) among exposed ($Odds_1$) and odds of outcome (e.g. disease) among unexposed ($Odds_0$)

$$\boldsymbol{Odds\ Ratio\ (OR) = \frac{Odds_1}{Odds_0}}$$

	Outcome		
Exposure	**Yes**	**No**	**Total**
Exposed	D_1	H_1	N_1
Unexposed	D_0	H_0	N_0
Total	D	H	N

- Calculating OR:
  - Odds (exposed): $O_1 = D_1/H_1$
  - Odds (unexposed): $O_0 = D_0/H_0$
  - Odds ratio: OR = $O_1/O_0 = (D_1/H_1)/(D_0/H_0) = D_1H_0/D_0H_1$

Back to our example...

	Hypertension		
Occupation	**Yes**	**No**	**Total**
Manual	96	144	240
Non-manual	72	228	300
Total	168	372	540

We can calculate

Odds (exposed) O_1=96/144

Odds (unexposed) O_0=72/228

Odds ratio (OR) = O_1 / O_0 = 0.67/0.32=2.11

Risk (last session)

- Risk: Proportion of people with a certain characteristic within a group

Mathematical:

$$\text{Risk } (r) = \frac{\text{Number of cases } (d)}{\text{Population at risk } (N)}$$

$$r = d / N$$

Risk ratio

- Often we compare 2 groups – exposed and unexposed to a risk factor
- Research question: Do exposed participants have a higher risk of disease compared with unexposed participants?
  - Risk in exposed (r_1)
  - Risk in unexposed (r_0)
- Risk ratio (RR) = $r_1 / r_0 = (d_1 / N_1) / (d_0 / N_0)$
- RR measures the strength of association between risk factor and disease

Example

		Hypertension		
Employment		Yes	No	*Total*
Manual		96	144	*240*
Non-manual		72	228	*300*
Total		*168*	*372*	*540*

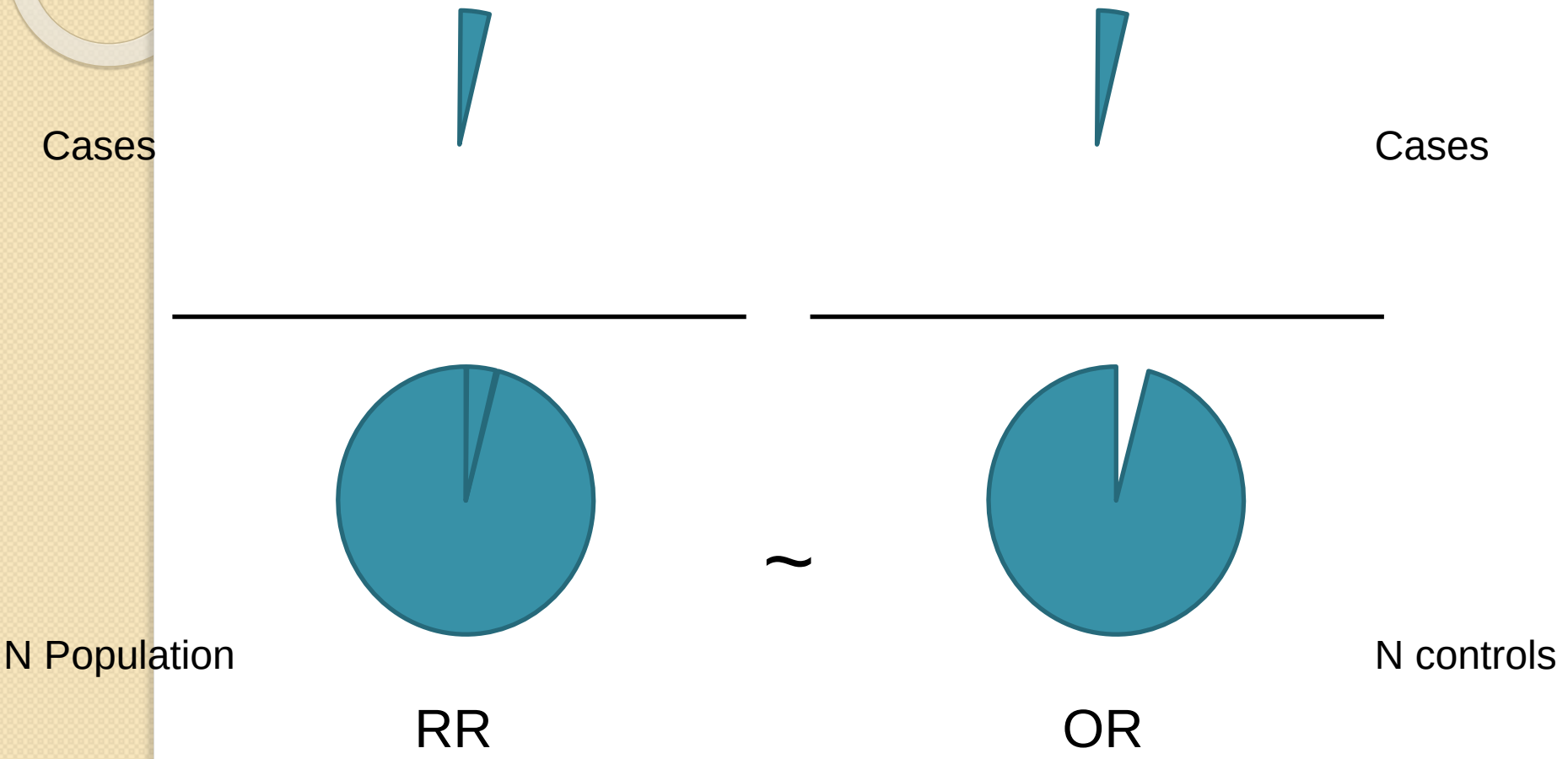
Risk (exposed) = 96 / 240 = 0.40
Risk (unexposed) = 72 / 300 = 0.24

Risk ratio = 0.40 / 0.24 = 1.67

Odds ratio → approximation of risk ratio

- Rare disease outcome: Odds ratio ~ risk ratio
  - Similar denominators
- Example of employment and hypertension
  - OR = 2.11
  - RR = 1.67

Rare disease → OR~RR



Measures of population impact

- **Population attributable risk (PAR)** is the absolute difference between the risk (or rate) in the whole population and the risk or rate in the unexposed group

$$PAR = r - r_0$$

Population attributable risk fraction (PARF or PAR%)

- It is a measure of the proportion of all cases in the study population (exposed and unexposed) that may be attributed to the exposure, on the assumption of a causal association
- It is also called the aetiologic fraction, the percentage population attributable risk or the attributable fraction

- If r is rate in the total population

$$\mathbf{PAF = PAR/r}$$

$$\mathbf{PAR = r - r_0}$$

$$\mathbf{PAF = (r-r_0)/r}$$

Risk or rate difference

Measure of the absolute effect

the absolute difference between two risks (or rates)

$$\mathbf{RD = r_1 - r_0}$$

Similar for rates = rate difference = incidence rate in exposed – incidence rate in unexposed

Example

Exposure Status	Diseased	No Disease	Population		Incidence (Risk)
Exposed	500	9,500	10,000		0.050
Not Exposed	900	89,100	90,000		0.010
Column Totals	1,400	98,600	100,000		0.014

Example – cont.

- Risk in exposed=0.05
- Risk in unexposed=0.01
- Risk ratio = 5

Example – cont.

- Risk in exposed=0.05
- Risk in unexposed=0.01
- Risk ratio = 5

- Odds in exposed=500/9500=0.0526
- Odds in unexposed=900/89100=0.0101
- Odds ratio=5.21

Example – cont.

- Risk in exposed=0.05
- Risk in unexposed=0.01
- Risk difference = 0.05-0.01=0.04

Example – cont.

- Risk in exposed=0.05
- Risk in unexposed=0.01
- Risk difference = 0.05-0.01=0.04

- PAR = r – r0 = 0.014-0.010=0.004

- PAF = PAR/r=0.004/0.014=0.286 (28.6% of cases)
- 0.286x1400=400 cases (80% of exposed cases)

Example -cont

Exposure Status	Diseased	No Disease	Population		Incidence (Risk)
Exposed	5000	5,000	10,000		0.50
Not Exposed	9000	81,000	90,000		0.10
Column Totals	14,000	86000	100,000		0.14

Example – cont.

- Risk in exposed=0.5
- Risk in unexposed=0.1
- Risk ratio = 5

Example – cont.

- Risk in exposed=0.5
- Risk in unexposed=0.1
- Risk ratio = 5

- Odds in exposed=5000/5000=1
- Odds in unexposed=9000/81000=0.111
- Odds ratio=9

Example – cont.

- Risk in exposed=0.5
- Risk in unexposed=0.1
- Risk difference = 0.5-0.1=0.4

Example – cont.

- Risk in exposed=0.5
- Risk in unexposed=0.1
- Risk difference = 0.5-0.1=0.4

- PAR = r – r0 = 0.14-0.10=0.04

- PAF = PAR/r=0.04/0.14=0.286 (28.6% of cases)
- 0.286x14000=4000 cases (80% of exposed cases)

Measure of effect	Use of the measure	How to interpret results
Risk Difference	Public Health Interested in excess disease burden due to factor (“Attributable risk”)	Close to 0 = little effect Large difference = large effect
Risk Ratio	Epidemiology Causation “This factor doubles the risk of the disease”	Close to 1 = little effect Large ratio = large effect Close to 0 = large effect!
Odds Ratio	As for Risk Ratio “This factor doubles the odds of the disease” Only possibility (case-control study) More advanced statistical methods (logistic regression)	

Exercise

- 50 persons attended a garden party
- 25 of them developed diarrhoea in the next 3 days
- What was the risk of diarrhoea among the participants of the party?

Exercise – cont.

- 30 party visitors had a BBQ (minced meat)
- 24 of them developed diarrhoea

- 20 people did not eat BBQ
- 1 of them developed diarrhoea

- How would you calculate RR related to eating BBQ?

Exercise – cont.

- Risk among unexposed R_0:
- 1/20

- Risk among exposed R_1:
- 24/30

- Relative risk $RR=R_1/R_0=(24/30)/(1/20)=16$