PRACTICAL 7

EPIDEMIOLOGY.
COMPARING DISEASE OCCURRENCE.
ABSOLUTE AND RELATIVE COMPARISON.

Lecture 3
Epidemiology – part 1. Definition and scope of epidemiology. Basic concepts in epidemiology. Measuring disease frequency. Comparing disease occurrence – absolute and relative comparison.

OBJECTIVE OF THE PRACTICAL 7:
To enable the students to understand necessity and importance of disease occurrence comparison, and the meaning of different measures of comparison.

Enabling objectives:
At the end of the lesson students should be able to:
1. Understand the essence of the disease occurrence comparison.
2. Distinguish different measures of the absolute and relative comparison.
3. Determine the application of different measures of disease comparison.
4. Calculate the measures of disease comparison.
5. Explain the distinctions between Relative risk and Odds ratio as measures of the association between a suspected exposure and a specific health outcome.

SYLLABUS OF THE PRACTICAL:

ABSOLUTE COMPARISON	**RELATIVE COMPARISON**
indicates on an absolute scale how much greater the frequency of the disease is in one group compared with the other	indicates how much more likely one group is to develop a disease than another
1. Risk difference /Excess risk, Attributive risk of exposed/ **2.** Ethiological fraction of exposed **3.** Population attributive risk	**1.** Relative risk **2.** Odds ratio

Example
Table 1 Relationship between cigarette smoking and incidence rate of stroke in a cohort of 118 539 women

Smoking category	Number of cases of stroke	Person-years of observation (over 8 years)	Stroke incidence rate (per 100 000) person-years
Never smoked	70	395 594	17.7
Ex-smoker	65	232 712	27.9
Smoker	139	280 141	49.6
Total	274	908 447	30.2

1. **ABSOLUTE COMPARISON:** calculation, interpretation and application-*Reference to Lecture 3*
   - **Risk difference** - the risk difference is the difference between incidence rates in the exposed and nonexposed groups. Indicates the number of cases of the disease among the exposed group that can be attributed to the exposure itself.

$$RD = I_e - I_0 \quad or \quad RD = CI_e - CI_0$$

   Ie - the incidence rate of the disease among the exposed group
   I0 - the incidence rate of the disease among the unexposed group

   For example, from the data in Table 1 the RD between the incidence rate of stroke in women who smoke, and the rate of stroke in women who have never smoked, is 31.9 per 100 000 person-years.

   - **Etiological fraction of exposed** - The etiological fraction is determined by dividing the risk difference by the incidence of occurrence among the exposed population. Estimates the proportion of disease in exposed that could be prevented by eliminating the exposure.

$$EF = \frac{I_e - I_0}{I_e} \times 100 = \% \quad or \quad EF = \frac{CI_e - CI_0}{CI_e} \times 100 = \%$$

   For the data in Table 1 the EF of smoking for stroke in the smokers is:
   $((49.6 - 17.7)/49.6) \times 100 = 64\%$.

   - **Population attributable risk** - It measures the proportion of disease in the total study population which is attributable to the exposure. Indicates the preventable proportion of the disease in the total population if eliminate exposure.

$$PAR = \frac{I_p - I_0}{I_p} \times 100 = \% \quad or \quad PAR = \frac{CI_p - CI_0}{CI_p} \times 100 = \%$$

   Ip - the incidence rate of the disease in the total population

   For the data in Table 1 the PAR of smoking for stroke in the population is: $((30.2 - 17.7)/30.2) \times 100 = 41\%$.

2. **RELATIVE COMPARISON:** calculation, interpretation and application–*Reference to Lecture 3*
   - **Relative risk -** estimates **the magnitude of an association between exposure and disease** and indicates the likelihood of developing the disease in the exposed group relative to those who are not exposed.

$$RR = \frac{I_e}{I_0} \quad or \quad RR = \frac{CI_e}{CI_0}$$

RR indicates **how many times the risk of developing disease by the exposed is greater than the risk of developing the same disease by the nonexposed**.

- A **relative risk = 1.0** indicates that the incidence rates of disease in the exposed and nonexposed groups are identical and thus that **there is no association observed** between the exposure and the disease in the data.
- A **relative risk greater than 1.0** indicates **a positive association**, or an increased risk among those exposed to the factor.
- A **relative risk less than 1.0** means that **there is an inverse association** or decreased risk among those exposed.

As shown in Table 1, the risk ratio of stroke in women who smoke, compared with those who have never smoked, is 2.8 (49.6 /17.7).

- **Odds ratio -** indicates **how many times the risk of developing the disease by exposed is greater than the risk of developing the same disease by the nonexposed.**
  In case-control studies we are not able to calculate the incidence rate among the exposed and unexposed because we have no data about the population at risk /we don't know the denominator/. Therefore, we can't calculate the relative risk. Instead we calculate Odds ratio as a measure of the strength of the association between risk factor and outcome.

disease exposure	yes	no	total
yes	a	b	a + b
no	c	d	c + d
total	a + c	b + d	a + b + c + d

$$OR = \frac{a \times d}{c \times b}$$

- *a – number of people exposed and ill*
- *b - number of people exposed and healthy*
- *c - number of people unexposed and ill*
- *d - number of unpeople exposed and healthy*

- An **OR = 1.0** indicates that **there is no association observed** between the exposure and the disease in the data.
- An **OR greater than 1.0** indicates **a positive association**, or an increased risk among those exposed to the factor.
- An **OR less than 1.0** means that **there is an inverse association** or decreased risk among those exposed.

PRACTICAL WORK on calculating and interpreting measures of disease occurrence comparison on the basis of epidemiological studies examples.

TASK 1
In a study of oral contraceptive (OC) use and bacteriuria among women aged 16-49 years was estimated that of 104 women with bacteriuria, 27 were OC users. Of 2286 women without bacteriuria, 455 were OC users.
1. Define the risk factor (exposure) and outcome (health related event)
2. Calculate risk difference
3. Calculate etiological fraction of exposed
4. Calculate population attributable risk
5. Calculate relative risk

TASK 2
In a study of postmenopausal hormone use and coronary disease with several exposure categories the following has been estimated:

Exposure – hormone use	Results – registered coronary disease	Period of time – person years
Ever use	30	54 308
• Past users	19	24 386
• Current users	11	29 922
Never use	60	51 477

1. Calculate possible measures of absolute and relative comparison
2. Explain the results
3. Do you think that separate a group of past users is appropriate and why?

TASK 3
In a study of oral contraceptive (OC) use and risk of myocardial infarction (MI) was estimated that of 156 women with MI, 23 were current OC users. Of 3120 healthy women (without MI), 304 were current OC users.
1. Calculate odds ratio

TASK 4
In a study of gastro-esophageal reflux disease (GER) and esophagus cancer was estimated that of 120 patients with esophagus cancer 80 have a past history for GER. Of 240 healthy people (controls), 60 have a past history for GER.
1. Calculate AN appropriate measure to assess the association between disease and suspicion risk factor.

TEST FOR SELF-ASSESSMENT

1. The excessive number of disease cases in the exposed group, attributable to the exposure is measured by:
   A. The odds ratio
   B. The risk difference
   C. The incidence rate of exposed

2. The proportion of disease in exposed that could be prevented by eliminating the exposure is called:
   A. Etiological fraction
   B. Population attributable risk
   C. Risk difference

3. Odds ratio indicates how many times the risk of developing the disease by exposed is greater than the risk of developing the same disease by the nonexposed.
   A. True   B. False

4. A relative risk greater than 1.0 indicates:
   A. there is no association between the suspected risk factor and the disease
   B. there is positive association between the suspected risk factor and the disease
   C. inverse association between the suspected risk factor and the disease

5. The strength of association between the risk factor and the disease is measured by:
   A. Risk difference
   B. Incidence rate
   C. Relative risk

6. An Odds ratio of 1.0 indicates a positive association, or an increased risk among those exposed to the factor.
   A. True   B. False

Correct answers:
1-B/ 2-A/ 3-A/ 4-B/ 5-C/ 6-B