PRACTICAL 6

23 – 27 MARCH 2020

EPIDEMIOLOGY
BASIC CONCEPTS - RISK, RISK FACTOR, RATIO, RATE, PROPORTION, POPULATION AT RISK. MEASURING DISEASE FREQUENCY - PREVALENCE, INCIDENCE RATE, CUMULATIVE INCIDENCE.

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 6:
To enable the students to understand the subject matter of epidemiology and its importance. To introduce the basic concepts of epidemiology and the basic measures of disease frequency and develop skills of calculating these measures.

Enabling objectives:
At the end of the lesson the students should be able to:
1. Define the terms risk, risk factor, exposed and unexposed groups and population and risk.
2. Distinguishing between rate, ratio and proportion.
3. Determine the difference between prevalence, incidence and cumulative incidence.
4. Underline the use of the measures of disease frequency in medicine.
5. Calculate and interpret the measures of disease frequency in particular epidemiological studies.

SYLLABUS OF THE PRACTICAL:
1. **Epidemiology –** *Reference to Lecture 3*
2. **Basic concepts -** *Reference to Lecture 3*
   - population
   - population at risk
   - risk group
   - risk - probability of disease occurring
   - risk factor
   - exposure
   - exposed group
   - nonexposed group
3. **Basic measures of frequency:**

3.1. SIMPLE COUNT OF AFFECTED INDIVIDUALS /CASES/

- describes the number of affected individuals and the magnitude of the problem
- describes the short-term trends in the distribution of disease
- useful measure for health planning and distribution of health resources
- does not relate the cases of a particular event to the population size and to the time period during which the cases have occurred

Example
population A - for 1 year - 50 registered cases of hepatitis A
population B - for 1 year - 100 registered cases of hepatitis A

Population B has 2 times more disease cases /2 times higher disease frequency? /

Size of population A - 5000 persons
Size of population B - 10000 persons

Disease frequency in pop. A is 10 per 1000
Disease frequency in pop. B is 10 per 1000
Disease frequency in both populations is the same.

3.2. RATE - *Reference to Lecture 3*

$$\text{Rate} = \frac{\text{numerator and time specification}}{\text{denominator and time specification}} \times \text{multiplier}$$

example: $\text{Death rate} = \frac{\text{number of deaths in a year}}{\text{mid-year population}} \times 1000$

3.3. RATIO - *Reference to Lecture 3*

example: $\frac{\text{the number of males}}{\text{the number of females at a certain time,}}$

showing how many males there for each female.

Other examples: doctor-population ratio, child-woman ratio, etc.

3.4. PROPORTION - *Reference to Lecture 3*

example: $\frac{\text{the number of children with scabies at a certain time}}{\text{the total number of children in the village at the same time}} \times 100$

4. Measures of disease frequency:

4.1. PREVALENCE - definition, special types /point and period/, calculation and use in medicine - *Reference to Lecture 3*

$$\text{Prevalence Rate} = \frac{\text{The total number of all individuals with a disease or condition at a specified time}}{\text{the population at risk at the specified time}} \times 10^n$$

$$\text{Point prevalence} = \frac{\text{number of all current cases /old and new/ of a disease existing at a } \textbf{\textit{given point in time}}}{\text{estimated population at the } \textbf{\textit{same point in time}}} \times 10$$

$$\text{Period prevalence} = \frac{\text{number of existing cases /old and new/ of a disease } \textbf{\textit{during a given period of time}}}{\text{estimated population at risk } \textbf{\textit{during a given period of time}}} \times 10^n$$

4.2. INCIDENCE - definition, special types /attack rate, secondary attack rate/, calculation and use in medicine - *Reference to Lecture 3*

$$\text{Incidence Rate / I /} = \frac{\text{number of people who get a disease in a specified period /number of new cases/}}{\text{sum of length of time during which each person in the population is at risk}} \times 10^n$$

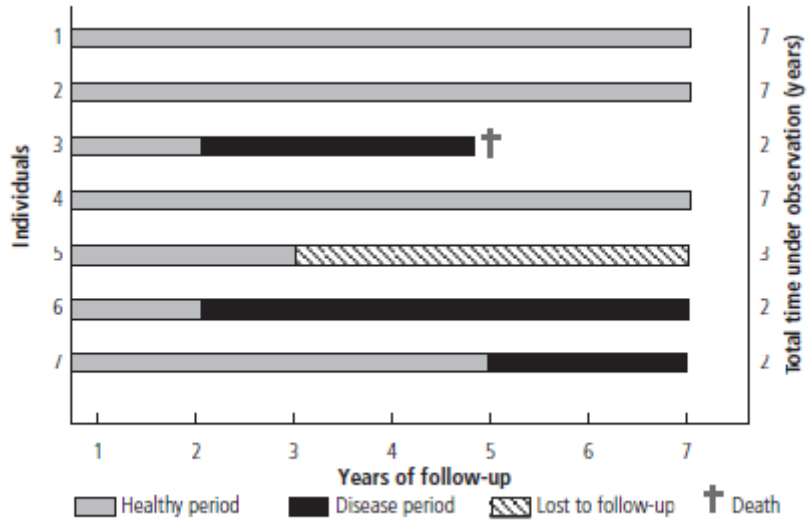
4.3. CUMULATIVE INCIDENCE - definition, calculation and significance in measuring individual risk - *Reference to Lecture 3*

$$\text{Cumulative incidence / CI /} = \frac{\text{number of people who get a disease during a specified period}}{\text{number of people free of the disease in the population at risk at the beginning of the period}} \times 10^n$$

PRACTICAL TASKS

Examples

✓ This hypothetical example is based on a study of seven people over seven years.



In Figure it can be seen that:

• the incidence of the disease during the seven-year period is the number of new events (3) divided by the sum of the lengths of time at risk of getting the disease for the population (33 person-years), i.e. 9.1 cases per 100 person-years;

• the cumulative incidence is the number of new events in the population at risk (3) divided by the number of people in the same population free of the disease at the beginning of the period (7), i.e. 43 cases per 100 persons during the disease (2) to the number of people in the population observed at that time (6), i.e. 33 cases per 100 persons.

• case fatality is 33% representing 1 death out of 3 diagnosed cases.

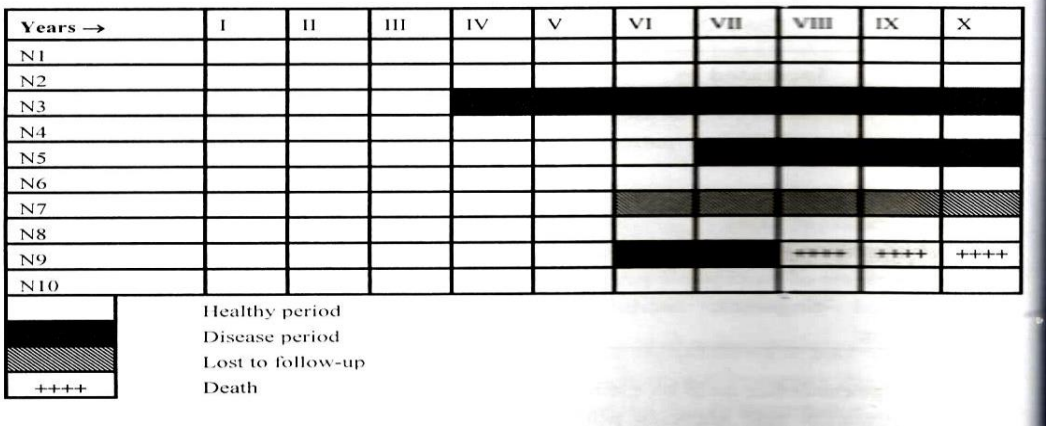
✓ ***How to define time at risk?***

Time at risk is the time when the person is under study and is disease-free.

It is measured by person-years: a year under study for one person = one person-year.

Example

Next table presents the approach used to determine the concept "person-years" in a hypothetical example of 10-year observation of a population, consisting of 10 people at the beginning of the observation.



There is hypothetical study: 10 people have been observed for 10 years.

- The person №1 do not get ill during this period – the time at risk is 10 person-years
- The person №3 is disease-free for three years and get ill. The time at risk is 3 person-years and he is registered as a case of disease.

Continue the analysis and calculate:

1. Time at risk for all people under study.
2. Incidence rate at the end of the period.
3. Point prevalence rate at 8th year.

TASK 1 - CALCULATE MEASLES PREVALENCE

Suppose that a random sample survey of 300 Under-5 children in your district found 70 of them with measles.

- What is the prevalence of measles in the sample, expressed as a rate per 1000 population?
- How many cases of measles would you expect to find in the entire district at any given time, if the total population of Under- 5s is about 25 000?

TASK 2 - CALCULATE RATE OF NEW CASES OF MEASLES

In the year following the survey, 12 cases of measles are notified. Assume that the mid¬year estimate of the population of Under-5s has increased to 26 000.

- Calculate the number of notifications per 100 000 population. Is this an incidence or a prevalence rate? Explain your answer.

TASK 3 - CALCULATE SPINA BIFIDA RATES

Of 129 600 children born in Cape Town between January 1, 1992 and December 31, 1994, 212 were diagnosed with spina bifida at birth.

- Which measure of disease occurrence can be calculated - prevalence or incidence rate?
- Calculate this as an annual rate.

TASK 4 - CALCULATE BREAST CANCER RATE

In a mass screening of 5 000 women, 25 of them were found to have breast cancer. During the next five years, 10 more women from the original screened group of 5 000 developed breast cancer.

- Which measure of disease occurrence can be calculated? Calculate this.

TASK should be submitted by mail to your group assistant as follows:

Assistant	Groups	E-mail for submission of the tasks
Assoc. prof. Mariela Kamburova	2, 6, 8, 10, 12, 13, 17, 18	mariela_kamburova@yahoo.com
Assoc. prof. Stela Georgieva	7, 9, 11, 14, 19, 20	georgieva_sl@yahoo.com
Assist. prof. Dima Tsanova	1, 3, 4, 5, 15, 16	d_krumova@abv.bg

The deadline for submission is 7 days after the date of regular class (30 March – 3 April 2020).

TEST FOR SELF-ASSESSMENT

1. The population at risk of prostate cancer is:
   A. The total population
   B. The male population over 55 yrs.
   C. The male population over 55 yrs. excluding men who have already had prostate cancer

2. That part of the population which is susceptible to a disease is called:
   A. Population
   B. Population at risk
   C. Exposed group

3. Incidence rate is a measure of:
   A. The disease status in a population at a point in time
   B. The strength of association between the risk factor and the disease
   C. The rate of disease occurrence during a period of time

4. The time at risk is that during which the person under observation remains disease-free.
   A. True B. False

5. The number of all current cases /old and new/ existing in a defined population at a specified point of time is measured by:
   A. Incidence rate
   B. Point prevalence
   C. Period prevalence

6. Improved cure rate of cases increases prevalence rate.
   A. True B. False

7. In a study of 200 cases of lung cancer and 400 healthy controls the investigator found a use of cigarettes in 50 of cases and in 20 of the controls. The incidence rate in the exposed group is:
   A. 5%
   B. 10%
   C. Cannot be calculated

Correct answers:
1-C / 2-B/ 3-C/ 4-A/ 5-B/ 6-B/ 7-C