**CMED 305 (2017-2018)**

**Practical Exercise on: Incidence & Prevalence and measurement of risk**

The most common terms used in epidemiology to express and describe disease frequency are rate, ratio, proportion and percentage. The main measures of disease frequency are incidence rate, prevalence rate and the attack rate which has already been discussed in the theory session.

Let us enumerate these terms in a tabular format and proceed with calculations for better understanding.

**Frequently Used Measures of Morbidity**

| **Measure** | **Numerator** | **Denominator** |
| --- | --- | --- |
| Point prevalence | Number of current cases (new and preexisting) at a specified point in time | Population at the same specified point in time |
| Period prevalence | Number of current cases (new and preexisting) over a specified period of time | Average or mid-interval population |
| Incidence proportion  (risk) | Number of new cases during a specified period of follow-up | Total population at risk during that same period |
| Incidence rate (or person-time rate) | Number of new cases of disease during specified time interval | Summed person-years at risk during time interval |
| Attack rate  (a special type of incidence proportion) | Number of new cases of disease during specified time interval | Population at risk at the period |
| Risk Ratio | Risk in the exposed group | Risk in the unexposed group |

**Let us calculate each of the term with simple examples:**

Prevalence:

Prevalence is a term referring to the number of existing and new cases of the disease present in a particular population at a given time. It thus means that numerator includes both the old and new cases. For instance, in a population of 30,000 of a small town, survey done in June and December reported the number of hypertensive to be 308 and 350. So the prevalence is determined as old and new cases divided by total population. So we obtain (308+350)/ 30000= 0.0219.

Alternatively this can be expressed as 2.2 % or 22 hypertensive patients per thousand population.

EXAMPLE 1: Calculating Prevalence

In a survey of 1000 women who gave birth in a town X, at a given time, a total of 50 women had preterm labor.

Calculate the prevalence of preterm delivery in this group.

Numerator = 50 preterm deliveries  
Denominator = 1000 deliveries surveyed

Prevalence = 50 ⁄ 1000 × 100 = 5%

**Prevalence Exercises:**

**A.** Calculate the prevalence of cataract in a 15000 population aged between 60 to70 years in the time period of summer months from June to August in city X, where 300 people were diagnosed to have cataract.

Solution:

**B**: In a classroom study involving 100 subjects, 15 students reported to have been suffering from influenza on January 1st. Calculate the point prevalence of 15 students suffering with influenza on a cold winter day on January 1st in a class of 100 students.

Solution:

**Incidence:**

Incidence proportion is the number of new cases of a disease in a population at risk.

EXAMPLE 2 – Calculating Incidence: In 2003, about 500 new cases of acquired immunodeficiency syndrome (AIDS) were reported in the country X. The estimated mid-year population of the country in 2003 was approximately 30,000. Calculate the incidence rate of AIDS in 2003.

Numerator = 500 new cases of AIDS

Denominator = 30000 estimated mid-year population

Incidence rate = (500 ⁄ 30000) \*100 = 1.6 %

Alternatively can be expressed as 16 new cases of AIDS per 1000 population.

**Incidence Exercises:**

**A**: A study followed 3,000 males ages 45 years and older for 5 years to assess the development of MI. During the study period, 150 men developed MI, who accumulated a total person-time of 14,625 person-years. Calculate the incidence proportion and the incidence rate.

Solution:

**B**: In a follow up study of 2000 IGT women, 150 women were diagnosed to have type 2 diabetes at the end of the follow up period. Calculate the incidence proportion.

Solution:

**Attack rate:**

 Example:

In an outbreak of gastroenteritis among people who ate meals at a hotel, 99 persons ate raw salad, 30 of whom developed gastroenteritis. Calculate the risk of illness among persons who ate salad.

Numerator = 30 persons who ate Salad and developed gastroenteritis

Denominator = 99 persons who ate salad

Food-specific attack rate = (30 ⁄ 99) × 100 = 0.303 × 100 = 30.3%

**Exercise Attack rate:**

A cholera investigation report found 22 persons to be positive for cholera among 200 persons who drank water from the same source. Calculate the attack rate.

Solution:

**Risk Difference**

**Example:** A study that followed 200 women in order to assess the development of endometrial cancer showed the following results:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Cancer** | **No Cancer** | **Total** |
| **Took HRT** | **18** | **102** | **120** |
| **Did not take HRT** | **4** | **76** | **80** |

Calculate the Risk difference of developing endometrial cancer comparing the women exposed to HRT to those not exposed.

Risk of development of endometrial cancer in HRT group of women = 15%

Risk of development of endometrial cancer in non HRT group = 5%

Risk Difference = 15-5 = 10%

This means that the risk for developing endometrial cancer among women who received HRT is 10% greater than the risk for developing endometrial cancer among women who did not received HRT.

**Exercise ( risk difference):** Users of tobacco were surveyed for development of leukoplakia. Incidence of leukoplakia is given among the exposure group and the control group was 19% and 5%. Calculate the risk difference.

Solution:

**Risk Ratio (Relative Risk):**

The risk ratio quantifies the relationship between exposure and disease. Risk quantification can be easily analyzed by a 2\*2 table in epidemiological studies.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Diseased | Non diseased | Total |
| Exposed | A | B | A+B |
| Non-exposed | C | D | C+D |
| Total | A+C | B+D | A+B+C+D |

Where, A = The number of people who both had the exposure and developed the disease,

B = The number of people who had the exposure but did not develop the disease

C = The number of people who did not have the exposure but did develop the disease

D = The number of people who neither had the exposure nor developed the disease

Formula: Risk Ratio = A/(A+B)/C/(C+D)

Risk ratio helps in identifying the risk of developing a disease in an exposed group versus risk of developing a disease in the non-exposed group.

Interpretation of the risk ratio:

If the risk ratio = 1, then there is no difference in risk between the two groups.

If the risk ratio is less than 1, then there is less risk in the exposed group relative to the unexposed group. (may have protective effect)

If the risk ratio is greater than 1, then there is greater risk of association with the disease in the exposed group than in the unexposed group.

**Example:** About 500 people complained of inflammation and fever, of which 400 reported wasp bites. Among the same number that served as controls, 200 still reported bites without symptoms and fever. Estimate the risk ratio and determine the association between the exposure and the disease.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Inflammation/fever | No inflammation/fever | Total |
| Had wasp bite | 400 | 200 | 600 |
| Did not have wasp bite | 100 | 300 | 400 |
| Total | 500 | 500 | 1000 |

Risk ratio = (A / (A+B)) / (C / (C+D))

(A / (A+B)) = (400 / (400+200)) ; (C / (C+D)) = (100 / (100+300))

(400 / 600) / (100 / 400) = (0.667/0.25) = 2.67

**Interpretation:**  the risk ratio of 2.7 indicates that the risk for inflammation or fever among people who got wasp bites is 2.7 times the risk among people who did not get bitten by wasps.

**Exercise (Risk ratio):**

1. A total of 160 children underwent measles vaccination at a camp, of which 20 children from vaccinated group developed measles. While 5 from the control group developed the disease. Calculate the relative risk for the following and interpret what it means.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Measles + | Measles - | Total |
| Vaccination | 20 | 140 |  |
| No vaccination | 5 | 7 |  |
| Total |  |  |  |

Solution:

1. About 300 workers were employed in an asbestos factory, of which 107 developed lung disease. Out of 250 controls from another factory, 24 developed the lung disease. Draw the contingent table and estimate the risk ratio for developing lung disease.

Solution: