CMED 305 Course

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 rate (or person-time rate)	Number of new cases of disease during specified time interval	Summed person-years of observation or average population during time interval
Attack rate	Number of new cases of disease during specified time interval	Population at risk at the period

Let us calculate each of the term with simple examples:

Prevalence rate:

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 rate 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 = $50/1000 \times 100 = 5\%$

Practical Exercise:

    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. 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 rate:

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

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.

Practical Exercise:

    A. The number of women having IGT was 2000 who were followed for a period of time. At the end of the follow up period 150 women were found to have been diagnosed as type 2 diabetes patients. Calculate the incidence rate.

Solution:

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.

EXAMPLE 3: Attack Rate

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 = $(30/99) \times 100 =$

$0.303 \times 100 = 30.3\%$

Practical exercise:

A. The 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:

EXAMPLE 4: Attributable risk

Attributable Risk (AR) is the difference in the disease rates in exposed and unexposed individuals.

Practical exercise;

A. Users of tobacco were surveyed for development of leukoplakia. Incidence of leukoplakia is given among the exposure group and the control group Calculate the attributable risk of the following:

Incidence of leukoplakia among tobacco users = 19%

Incidence of development of endometrial cancer
in HRT group of women = 15%
Incidence of development of endometrial cancer in
non HRT group = 5%
Attributable risk = 15-5 = 10%
Therefore 10% of endometrial cancer is attributed to
the
HRT and can be prevented if the exposure factor is
removed.

Incidence of leukoplakia among non
tobacco users = 5%.

Solution:

Measures of association – relative risk

Relative risk 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:

(i)   Relative risk = A/(A+B)/C/(C+D)

Relative risk 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 relative risk:

If the relative risk = 1, then there is no difference in risk between the two groups.
If the relative risk is less than 1, then there is less risk in the exposed group relative to the
unexposed group. (may have protective effect)

If the relative risk 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 relative risk and determine the association between the exposure and the disease.

	Inflammation/fever Yes	Inflammation/fever No	Total
Wasp Bite Yes	400 (A)	200 (B)	600
Wasp Bite No	100 (C)	300(D)	400
Total	500	500	1000

Relative Risk = (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 relative risk of 2.7 indicates that the disease is 2.7 times higher among the group exposed to wasp bites when compared to the control group.

Practical exercise:

A: 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:

B: 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 of exposure.