

# Practical: Measures of risk , incidence , prevalence



RESEARCH TEAM  
438

Keep It simple, Keep It focused



Our Team:

Lama AlAssiri

Aued Alanazi

**Editing file**



Black: in male AND female slides

Red : important

Gray: extra information

# measuring risk, incidence and prevalence

- 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 pre-existing) at a specified point in time	Population at the same specified point in time
Period prevalence	Number of current cases (new and pre-existing) 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 Usually in intoxication outbreaks		Population at risk at the period

## Calculating 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 :** 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 =  $50/1000 \times 100 = 5\%$**

# measuring risk, incidence and prevalence

**Practical exercise 1:** Calculate the prevalence of cataract in a 15000 population aged between 60 to 70 years in the time period of summer months from June to August in city X, where 300 people were diagnosed to have cataract.

**Solution:**  $300 / 15000 \times 100 = 2\%$

**Practical exercise 2:** 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:**  $15 / 100 \times 100 = 15\%$

## Calculating Incidence Rate

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

**EXAMPLE 2 :** 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 =  $(500 / 30000) \times 100 = 1.6 \%$**

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

**Practical exercise 3:** 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:**  $150 / 2000 \times 100 = 7.5\%$

## Calculating Attack Rate

**EXAMPLE 3 :** 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 = Numerator = 30 persons who ate Salad and developed gastroenteritis.
- Denominator = 99 persons who ate salad.

**Food-specific attack rate =  $(30 / 99) \times 100 = 30.3\%$**

# measuring risk, incidence and prevalence

**Practical exercise 4:** 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:**  $22 / 200 \times 100 = 11\%$

## Calculating Attributable risk

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

### EXAMPLE 4:

- 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.

**Practical exercise 5:** 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 leukoplakia among non tobacco users = 5%.

**Solution:**  $19 - 5 = 14\%$

## 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

# measuring risk, incidence and prevalence

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: **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 5:** 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

$$\begin{aligned}\text{Relative Risk} &= (A / (A+B)) / (C / (C+D)) \\ (A / (A+B)) &= (400 / (400+200)) \\ (C / (C+D)) &= (100 / (100+300)) \\ (400 / 600) / (100 / 400) &= (0.667/0.25) = 2.67\end{aligned}$$

**Interpretation:** the relative risk of 2.7 indicates that the risk of disease among the exposed group is 2.7 times that of the control group

# measuring risk, incidence and prevalence

**Practical exercise 6 (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	160
No vaccination	5	7	12
Total	25	147	172

**Solution:**  $20 / 160 \div 5 / 12 = 0.3 \times 100 = 30\%$  , protective effect due to vaccination.

**Practical exercise 6 (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.

Table extra from 438

	Lung disease +	Lung disease -	Total
Wroker (In asbestos factory)	107	193	300
Non-Wroker (In asbestos factory)	24	226	250
Total	131	419	550

**Solution:** Risk of exposure =  $107/300 \times 100 = 35.6\%$ .

$$\begin{aligned} \text{Relative Risk} &= (A / (A+B)) / (C / (C+D)) \\ (A / (A+B)) &= (400 / (400+200)) \\ (C / (C+D)) &= (100 / (100+300)) \\ (400 / 600) / (100 / 400) &= (0.667/0.25) = 2.67 \end{aligned}$$

# Lecture notes 439 ...

Table of questions relevant for epidemiological enquiry: may help you to develop your question (just have a look)

- the most important step in conducting research is how to convert numbers into interpretable meaning
- Proportions =  $\frac{\text{numerator (البسط)}}{\text{Denominator (المقام)}} \times 100$
- Proportions Always lie between 0 and 1 إذا ما ضربنا في ١٠٠ وحولناها إلى نسبة 1
- Rates: Denominator is measured in time units e.g. speed
- In the Ratio the numerator is totally different from the denominator
- Example of prevalence: prevalence of oral cancer in 2020/total population
- Point Prevalence is done in a short period and it's what we usually do
- Period Prevalence is done in national studies
- Period Prevalence: average شرح مقام من شهر ١ إلى ١٢ (في السنة) ١٢ / ٦  
Mid-interval إلى شهر ٦ / ٦
- Prevalence example:
  - Calculation of prevalence is important
  - Prevalence of asthma is 70 (total number of asthmatics) / 600 (total population)
- Incidence Proportion follow-up study:
  - 10 patients that have been followed up for a period of time.
  - D= developed disease
  - Prevalence of disease = 6/10
  - Incidence at 2Y= 1/10
  - Incidence at 4Y= 1/9
  - Incidence at 5Y= 1/8
- Incidence Rate
  - person-time is usually given info in studies and exams
  - Calculation of person-time from previous example (follow-up study): 2+5+4+6+6+6+6+6+6
- The incidence is calculated in a cohort study (which is sometimes called incidence study) because it needs follow-up over time
- Measures of Effect: How does a risk factor affect the development of disease. e.g. does smoking increase the risk of lung cancer?
- Outcome = disease of interest
- Odds: focus is on outcome → usually calculated in case-control study (best measure of association)
- be careful in the exam if the question is about odds or odds ratio
- Odds Ratio example, interpretation of result: swimmers are 12.7 times more likely to get ear infection than non-swimmers
- Relative Risk example, interpretation of result: swimmers have 8 times greater risk of ear infection compared to non-swimmers
- Absolute Risk Reduction
  - not important.
  - Only know that it tells the magnitude of benefit.
  - interpretation of ARR is important in RCT
- Relative Risk Reduction
  - not important
  - Only know that it is one of the measures of association between risk and outcome
- NNT is used in RCT
- Attributable Risk (measure of impact)
  - how frequent is a disease as a result of a risk factor?



## Leaders



**Rania Almutiri**



**Homoud algadib**

**39 members:**

**Abdulrhman Alsuhaibany**

**Shahid almezel - note taker**

**Done by:**

**Taif Alshammari**

**Reviewed by:**

**Lama AlAssiri**