Epidemiology

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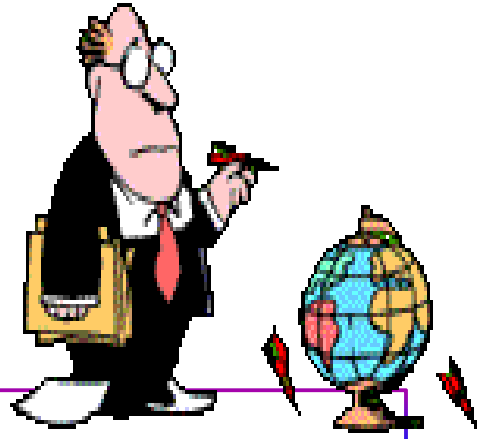

MEASURES OF DISEASE FREQUENCY

Part 1

Prof DR. Waqar Al – Kubaisy

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Epidemiology: Definition

"The study of **distribution** and **determinants** of health-related states or events in specified populations, and **the application** of this study to **control health problems**"

Study: includes surveillance, observation, hypothesis testing, analytic research, and experiments.

Distribution: Refers to analysis by time, place, and classes of persons affected.

Determinants: All the physical, biological, social, cultural, and behavioral factors that influence health.

Aims of epidemiological study:-

1 Controlling or preventing the spread of disease. preventing re-occurrence of disease.

2- Preventing the introduction of disease not present in the community.

3- Eradicating disease already present.

4- Detecting means for promoting health & efficiency of the population in a community

Uses of Epidemiology:-

1-To Describe the distribution & size of diseases in human population. Age, sex social class…..

2- To Identify etiological factors in the pathogenesis of disease

3- To Provide the data essential for management.

4- To Evaluation and planning of services for the prevention & control and treatment of disease

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MEASURES OF DISEASE FREQUENCY

A prerequisite for any epidemiologic investigation is quantify the occurrence of disease.

The most basic & simplest method of expressing disease frequency simple count. ♀ 25 ♂ 10

However

count data alone have very limited utility for epidemiologists.

No. of student with Tuberculosis(TB)

=20 school A

= 30 school B ????????

- To know distributions and determinants of disease

it is also necessary to know

- The size of the population

TB=20 school A
TB= 30 school B

- 100 School A
  200 School B

♀ 25 ♂ 10

♀ 200 ♂ 50

- The time period during which the data were collected

- Such measures allows direct comparisons of disease frequencies in two or more groups of individuals.

Rate
Ratios
Proportion
percentage

Rate

Is the measure of an event, condition (disease, disability or death) with a unit population and within a time period.

20 /100 school A
30/200 school B

♀ 25/200 ♂ 10/50

$$\frac{a}{a+b}$$

❑ Basic factors needed to develop rate are 3

1- Numerator (No. of individual affected, diseased

20 school A 30 school B

2-Denominator ;the total population of the study, the total No. of group among which the affected (diseased) persons are derived

♀ 200 ♂ 50

3- Time period usually year

100 School A
200 School B

Rate derived by

- Dividing the number of cases (the numerator) 20,or 30 by the
- total number capable of experiencing the event (denominator, or population at risk) 100 or 200 20/ 100 or 30/200 and

$$\frac{a}{a+b}$$

- multiplying the result by 100,1000,or 10000 (constant)

$$\text{Rate} = \frac{\text{Number of cases}}{\text{Population of the area in specific time period}} \times 100$$

A .TB = 20/ 100 X 100 = or B.TB= 30/200X 100=

♂ = 10 / 50X100=20% ♀ = 25/200X100= =12.5%

- in order to know how many cases accrued for that unit of population

$$\text{Rate} = \frac{\text{Number of cases}}{\text{Population of the area in specific time period}} \times 100$$

$$\frac{a}{a+b}$$

In Rate the №. of cases in numerator is subset of the population №. in denominator

$$\text{Rate} = \frac{\text{Number of TB cases in Jordan 2020}}{\text{Population of the Jordan in specific time period(2020}} \times 100000$$

- Rates are expressed in term of population, also
- are expressed in term of subgroups.♀ or ♂.

$$\text{Rate} = \frac{\text{№ of TB cases among ♂ in Jordan 2020}}{\text{♂ Population in Jordan in specific time period(2020}} \times 100000$$

Rate is defined as the number of cases defined / unit of population / unit of time

4.7/100000/year

There are 3 types of rates

- Crud Rates
- Adjusted Rates
- **Specific Rates** For subset or subgroup of total population

❑ **High rates as well as low rates provide useful information**

- spread,
- transmission.
- cause,
- control measurements

$$\frac{a}{a+b}$$

♀ = 25/200X100= =12.5%

Example ♂ = 10 / 50X100=20%

TB is higher in males than females population in the same community so TB occurrence in males may related to Smoking, HIV ,drug abuse or any other factors

In Rate the No. of cases in numerator is subset of the population No. In denominator

Ratio

General definition of Ratio

is the relation in: number degree, or quantity existing between two independent groups

$$\frac{a}{b}$$

Ratio is the result of one quantity divided by another of a same kind

TB ratio school A/school B
20/30= 0.66: 1

No. of student with (TB)
20 school A
30 school B

TB ♂ ratio to ♀
10/25 =0.4 ♂/♀

In Ratio the numerator is not part of the denominator population

Ratio

Is a relative No. that express the magnitude of one occurrence in relation to the other.

(2 independents Groups)

$$\frac{a}{b}$$

Ratio is less useful than rates in epidemiology ????

as the time element is missing, making the result more generalized finding

- In Ratio the numerator is not included in the population defined by the denominator
- 20/30 10/25

$$\frac{a}{b}$$

In Ratio the numerator is not part of the denominator population

Rate
Ratios
Proportion
percentage

Proportion & percentage

The proportion

Is a relation between the amount, No., size or degree of one thing and the amount, size, No., or degree of another.

- In epidemiology
  - a proportion is a ratio in which the numerator is included as part of denominator. ????
- In strict definition the proportion
- must fall within the range of 0.0 to 1.0.

- The impotent difference between a ratio and proportion is that

the numerator of a proportion is included in the population defined by the denominator.

Epidemiological Measures of Health Status
Measurements of disease frequency

There are two types of rates:

- Rates of morbidity (frequency of illness)
- Rates of mortality (frequency of deaths)

Sickness -Morbidity rates
Death -Mortality rates

are used as H. status indicator

Morbidity

MEASURES OF DISEASE FREQUENCY

Morbidity Rate

Morbidity is the extend of illness, injuries, or disability in a defined population during specific period of time

In epidemiology three key morbidity

- **1 Incidence**
- **2-Prevalence**
- **3- Attack Rate**

- **The measures of disease frequency used most frequently in epidemiology fall into two broad categories: prevalence and incidence.**

morbidity
- Incidence
- Prevalence
- Attack Rate

Incidence

Incidence is the No. of new cases of disease which came into existence within a certain period of time per specific unit of population.

it is the No. of new cases of a disease occurring in a specific population in a specified time period

Incidence rate = number of persons developing a disease (new cases) in a specific time and locality X1000
Total number of population at risk

- Incidence of disease is the number of new cases that occur in a defined population in a specific period of time

* The rate at which new cases of a disease arise

Incidence =

- **NO. of new cases of a disease occurring in the population during a specified period of time** $\times 1000$

Number of persons exposed to the risk of developing the disease during that period of time

- **The incidence of a particular disease could therefore be expressed as, say, 5 per 1000 person per year**

- **The incidence of a disease quantifies the *rate* of *new* events or cases of a disease that develop in a population at risk during the specified time interval.**

- **It permits to calculate the probability (risk) of each individuals to become ill in a set period of time.**

Example

A study done on 1500 school children during 2022 found 20 with TB. By follow up the school children during 2023 the number of students with TB was 28

New cases were 8 = 28-20= 8

Incidence new cases only 2023 = 8/1500 X 1000

Incidence = 5.33/1000 population/year

Incidence rate =

$$\frac{\text{№ of new cases of a disease within a population in a given time period}}{\text{№ of persons exposed to risk of developing the disease in the same time period}} \times 1000$$

Incidence rate:

- The rate of developing the disease
- It is of value for searching for the causes of the disease.

1-An incidence rate can be used to

- **Estimate the probability of or risk of developing a disease during a specific time period**

Incidence = 5.33/1000 population/year

2-As incidence goes up the risk possibility or probability goes up

Time- Place - Person

Higher Incidence existence of or potential for an epidemic become known and predictable

Incidence rate=absolute risk

Probability of developing a disease

A study done on 1500 school children during 2022 found 20 with TB.
By follow up during 2023 the number of students with TB 28

Numerator & Denominator in incidence

Numerator

Is the No. of new cases within a time period. 8 cases

Denominator

the number of population at risk .or under study in the group or population. 1500

New cases were 8 = 28-20= 8

Incidence new cases only 2023 = 8/1500x 1000

Incidence =5.33/1000 population/year

Country, Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	Active Cases	Serious, Critical	Tot Cases/ 1M pop	Deaths/ 1M pop	Total Tests	Tests/ 1M pop	Population
Morocco	327,528		5,396		275,158	46,974	1,007	8,832	146	3,814,442	102,861	37,083,615
Switzerland	304,593	+4,241	4,277	+55	211,500	88,816	524	35,092	493	2,592,950	298,735	8,679,774
Portugal	268,721	+3,919	4,056	+85	184,233	80,432	506	26,385	398	4,318,338	423,999	10,184,777
Austria	254,710	+4,377	2,577	+118	182,620	69,513	704	28,217	285	2,929,927	324,579	9,026,852
Sweden	225,560		6,500	+15	N/A	N/A	192	22,279	642	2,914,088	287,831	10,124,317
Nepal	224,078	+1,790	1,361	+24	204,858	17,859		7,637	46	1,681,299	57,299	29,342,758
Jordan	192,996	+4,586	2,380	+78	125,433	65,183	460	18,841	232	2,408,242	235,105	10,243,280
Ecuador	185,944		13,225		164,009	8,710	365	10,477	745	622,833	35,092	17,748,657
Hungary	181,881	+3,929	4,008	+117	44,020	133,853	638	18,847	415	1,528,302	158,365	9,650,510
UAE	161,365	+1,310	559	+5	150,261	10,545		16,238	56	15,960,104	1,606,023	9,937,659
Panama	155,658		2,973		137,004	15,681	146	35,853	685	838,981	193,246	4,341,525
Bolivia	144,034	+56	8,916	+9	119,548	15,570	71	12,273	760	353,955	30,160	11,735,888
Kuwait	140,795	+402	870	+2	133,407	6,518	75	32,778	203	1,062,076	247,254	4,295,477
Dominican Republic	139,111	+282	2,313	+2	113,134	23,664	172	12,773	212	687,292	63,106	10,891,021


THANK YOU ALL

- Population at risk be used as a denominator

The incidence of a disease quantifies the *rate* of *new* events or cases of a disease that develop in a population at risk during the specified time interval.

It permits to calculate the probability (risk) of each individuals to become ill in a set period of time.

- The midyear population could be used as a denominator in diseases affecting the whole community.(cholera, TB)
- In other diseases, not everyone in a study population may be at risk for developing diseases. (e.g. some diseases are lifelong immunity in duration, so that once a person has it, he will not develop it again;
- those persons are removed from the denominator)