

Introduction to Epidemiology

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Contents:

- Definition
- Historical evolution
- Epidemiologic functions
- Epidemiologic approach
- Basic measurements in Epidemiology




Epi\demio\logy

- Greek: **Epi**-on or upon, **Demos**-people, **Logos**-study
- **Epidemiology is the study of the distribution and determinants of disease and health-related states or events in specified populations and the application of this study to the control of health problems.**

توزيع

محددات

يهدف علم الأوبئة إلى فهم كيفية انتشار الأمراض والعوامل التي تؤثر عليها في المجتمع، مما يساعد على اتخاذ الإجراءات اللازمة للوقاية والتحكم في الأمراض والحفاظ على الصحة العامة



Epidemiology

- Providing the **foundation for directing** practical and appropriate public health action.
- **Relies on a systematic and unbiased** approach to the collection, analysis, and interpretation of data.
- Based on **careful observation** of health events

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Distribution of disease

This part of epidemiology is called as 'Descriptive epidemiology'

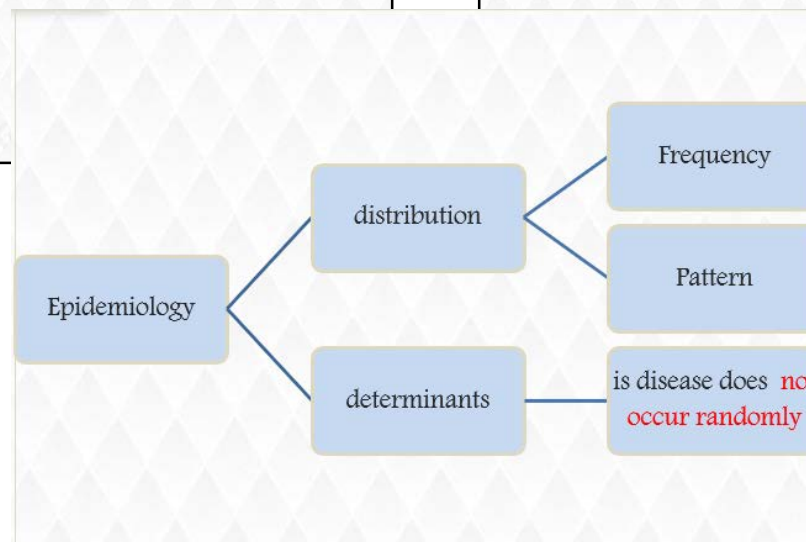
- Frequency (number/rate)
- Pattern (time, place and person)

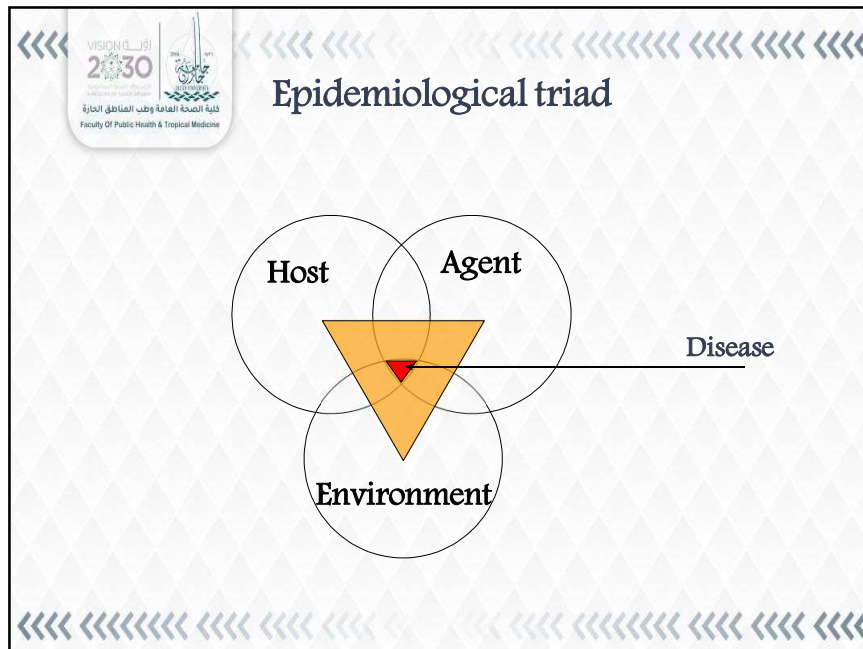
علم الأوبئة الوصفي
 التكرار
 النمط

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Determinants

- What is the cause of these health related event?
- One basic concept of Epidemiology is disease does not occur randomly. It occurs when certain factors come together.





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Health related events

- Epidemiologists initially focused only on **communicable** diseases
 الأمراض المعدية
- Epidemiology now deals with chronic diseases, injuries, birth defects, occupational health, accidents etc.

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Specified populations

- Epidemiologist normally does not deal with individual patients but an entire population
- Epidemiologist also deals with applying the knowledge gained through the study of disease

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History of epidemiology

- 400 BC – Hippocrates in the article ‘On Airs, Waters and Places’ suggested that environmental and host factors like behavior might be the cause of disease
- 1662 – John Graunt published analysis of mortality data of London
- 1854 – John Snow – Father of modern Epidemiology – conducted studies on Cholera epidemic in London and published the historic findings.

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Epidemiological approach

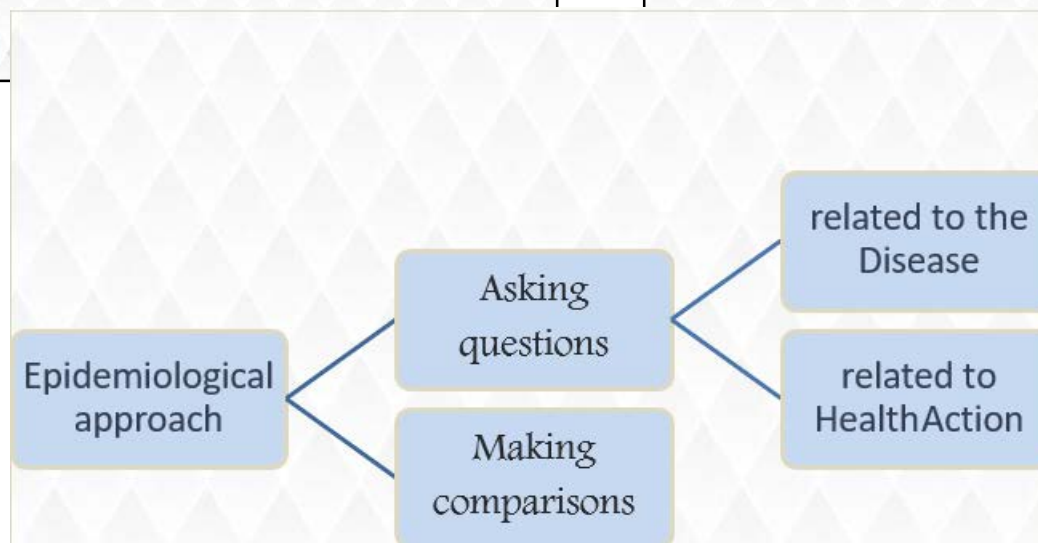
التنهج الوبائي

- The epidemiological approach to problems of health and disease is based on two major foundations:
 - Asking questions
 - Making comparisons

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Questions related to the Disease

- What is the problem? ما هي المشكلة؟
- What is its magnitude? ما هو حجم المشكلة؟
- Where did it happen? أين حدث ذلك؟
- When did it happen? متى حدث ذلك؟
- Who are affected? من هم المتأثرون؟
- Why did it happen? لماذا حدث ذلك؟



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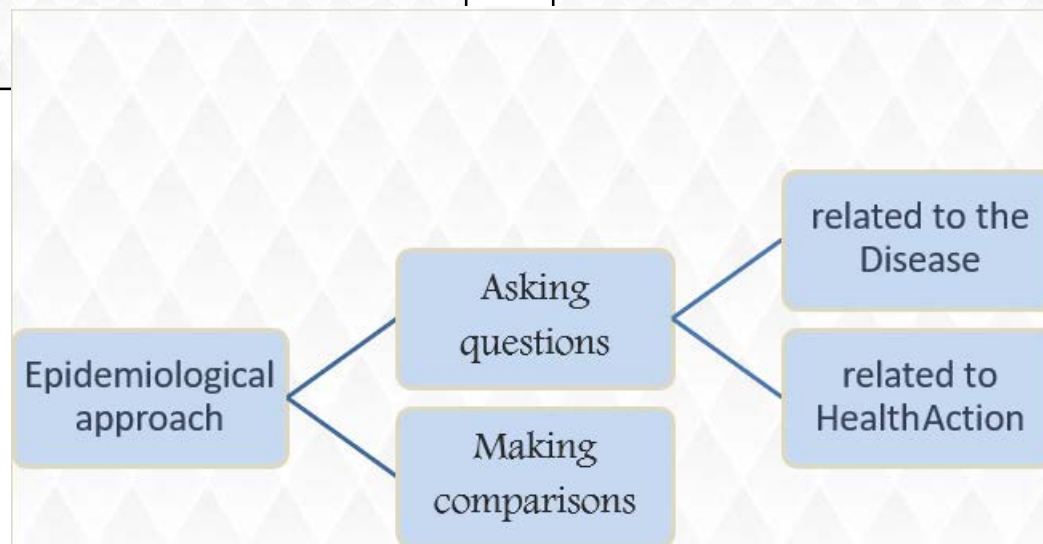
Questions related to Health Action

- What can be done to reduce the problem?
 ماذا يمكن فعله لتقليل المشكلة؟
- How can it be prevented in future?
 كيف يمكن الوقاية منها في المستقبل؟
- What action should be taken by community?
 ما الإجراءات التي يجب أن يتخذها المجتمع؟
- What resources are required?
 ما الموارد المطلوبة؟
- What difficulties may arise?
 ما الصعوبات التي قد تنشأ؟

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Comparison

- Basic approach to epidemiology is to make comparisons and draw inferences.
- Comparisons between two (or more) groups
- One group having the disease and other not having disease



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Uses of Epidemiology

- Assessing the community's health **تقييم صحة المجتمع**
 - Magnitude of disease and spread
- Making individual decisions **اتخاذ القرارات الفردية**
 - Quit smoking
- Completing the clinical picture **إكمال الصورة السريرية**
 - Eosinophilia-myalgia syndrome, SARS
- Searching for causes **البحث عن الأسباب**
 - Cholera epidemic in London

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Uses of Epidemiology...

- To study historically the rise and fall of disease population
دراسة تاريخية لارتفاع وانخفاض الأمراض في السكان
- Planning & Evaluation
التخطيط والتقييم
- Syndrome identification
تحديد المتلازمات

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Epidemiologic functions

- Public Health Surveillance. **مراقبة الصحة العامة**
 - Collection, analysis and dissemination of health related data for public health action.
- Field investigation. **التحقيق الميداني**
 - Investigation of outbreak.
- Analytic studies. **الدراسات التحليلية**
 - Lung cancer, Framingham study for cardiac diseases
- Evaluation of Health programmes. **تقييم البرامج الصحية**
 - Immunization programme.

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Basic measurements in Epidemiology

- Tools of measurements
 - Rates **المعدلات**
 - Ratios **النسب**
 - Proportions **النسب المئوية**
- Measurements of Epidemiology
 - Morbidity **المرضية**
 - Mortality **الوفيات**



Basic measurements in Epidemiology

- Ⓐ Rates
- Ⓑ Ratios
- Ⓒ Proportions



Rate

- Rate measures the occurrence of some health related event in a population during a given time period.
- It is a measure of the risk of developing a disease.
 - E.g. Incidence rate of Lung cancer among smokers is 8 per 1000. There is 8 per 1000 chance of developing Lung cancer among smokers

Rate

Rate has 4 elements

- Numerator,
- Denominator,
- Time specification
- Multiplier(1000 or 10n to make round figure).

Rate

Death rate = $\frac{\text{Number of deaths in One Year}}{\text{Mid- year population}} \times 1000$

Numerator

Time period

Denominator

Multiplier

When we say "the incidence rate of diabetes among adults aged 40 to 60 years is 15 per 1000 people per year," it means that every year, there are 15 new cases of diabetes for every 1000 people in that age group.

$$1000 \times \frac{\text{Number of new diabetes cases}}{\text{Total population at risk}} = \text{Incidence Rate}$$

مثال رقمي:

إذا كان هناك 15 حالة جديدة من مرض السكري بين 1000 شخص، ستكون المعادلة كالتالي:

$$\text{per 1000 people } 15 = 1000 \times \frac{15}{1000} = \text{Incidence Rate}$$

Ratio

- Ratio expresses the relation in size between two random quantities.
- The numerator is **not** a component of the denominator
- The numerator and denominator represent two different entities/ things

Ratio

Numerator

Number of Females in a population

Sex ratio = $\frac{\text{Number of Females in a population}}{\text{Number of Males in a population}}$

Denominator

Number of Males in a population

Suppose that out of the 15 new cases of diabetes, 10 cases are male and 5 cases are female.

To calculate the male-to-female ratio, we use the formula:

$$\text{Male-to-Female Ratio} = \frac{\text{Number of Males}}{\text{Number of Females}}$$

In this case:

$$\text{Male-to-Female Ratio} = \frac{10}{5} = 2$$

This means that there are 2 males for every female diagnosed with diabetes in this group.

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Proportion

- Is a measure which indicates the relation of part to the whole/full.
- The numerator is always part of denominator
- Usually expressed as a percentage

The formula to calculate the percentage is:

$$\text{Percentage} = \left(\frac{\text{Number of cases}}{\text{Total number of cases}} \right) \times 100$$

For males:

$$\text{Percentage of males} = \left(\frac{10}{15} \right) \times 100 = 66.67\%$$

For females:

$$\text{Percentage of females} = \left(\frac{5}{15} \right) \times 100 = 33.33\%$$

So:

- 66.67% of the cases are male.
- 33.33% of the cases are female.

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Proportion

Proportion of children having scabies in a village in year 2008 =

$$\frac{\text{Number of children with scabies (in 2008)}}{\text{Total number of children in the village (in 2008)}} \times 100$$

Numerator

Denominator

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Tools of measurement

- This helps in comparison of rates with different places and different times
 - Incidence rate of Diabetes in Delhi and UP
 - Incidence rate of Diabetes in 1970 and 2010 in India
 - Incidence rate of Obesity in India and America
 - Sex ratio of India and US

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Measurement of morbidity


- Incidence الحالات الجديدة
- Prevalence الانتشار



Incidence

- Incidence is defined as “the number of **NEW cases** occurring in a defined population during a **specified period of time**”.

$$\text{Incidence} = \frac{\text{Number of new cases of specific disease during a given period of time}}{\text{Population at risk during that period}} \times 1000$$



Incidence

- There are 500 new cases of Hepatitis in a city with a population of 30,000 in 2008

$$\text{Incidence of hepatitis} = \frac{500}{30,000} \times 1000 = 16.7 \text{ per } 1000 \text{ per year}$$

- The **Incidence rate** **MUST** contain the time period

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Incidence


- Incidence includes **new cases** recurring in the **same person**
- If a person suffers from Common cold **two times** in a year it has to be counted as **two new cases**
- Special incidence rates are:
 - Attack rate هو قياس سرعة انتشار المرض بين الأشخاص المعرضين
 - Secondary attack rate

يقيس مدى انتقال العدوى بين الأشخاص المعرضين بعد تعرضهم لشخص مصاب.

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Prevalence

- **Prevalence is defined as ALL cases (old and new) present at a given point of time or a period of time in a given population.**
- Prevalence is of two types:
 - Point prevalence الانتشار النقائى
 - Period prevalence الانتشار الفترى



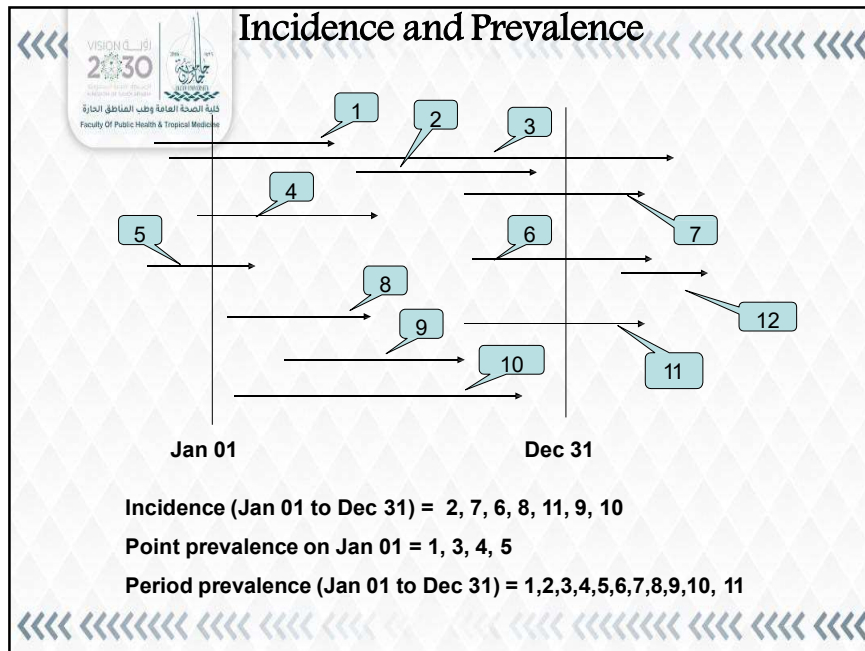
Point Prevalence

- Point prevalence refers to the total number of cases (old and new) present at given point of time, usually a day.
- Prevalence of Leishmaniasis in Bihar on 5th May, 2009
- Normally when we say prevalence it is Point Prevalence




Period Prevalence

- Is the total number of cases (old and new) existing during a defined period of time in a defined population.
- Prevalence of Pulmonary Tuberculosis Greater Noida in year 2008



Relationship between Incidence and Prevalence

- If the total population remains same and the **incidence** and duration of the disease remains the same then
- **Prevalence = Incidence x mean duration**
- **Incidence = Prevalence/duration**



Summary

- Epidemiology is the scientific study of diseases (number and spread) occurring in the community and its causative factors and application of the knowledge to prevent disease and promote health in the community.
- Important functions of Epidemiology include – Surveillance, Outbreak Investigation, Analytic studies, Evaluation of health programs



Summary

- Rate, Ratio and Proportion are important tools of measurement
- Incidence and Prevalence are important measurement of disease