

## Epidemiology

Epidemiology derived from the Greek word ( Epi – upon, Demos – people, Logos – science.) Epidemiology is the study of disease distribution and causation among people.

Epidemiology is often described as the basic science of public health, it's the orderly study of diseases and conditions where the group and not the individual is the unit of interest.

JOHN M.LAST(1988) defined epidemiology as *"the study of distribution and determinant of health related states or events in specified populations, and application of this study to the control of health problems"* ,which is the most commonly used definition.

► In epidemiological studies the target →(human population), which can be define in geographical or other term e.g., (a specific group of hospital patients or factory workers ).

► Earial epidemiology meant study of epidemics and infectious disease, but in the last few decades, it has been used in the study of non-communicable disease also such as hypertension, coronary heart disease, diabetes mellitus, oral cancer, dental caries, periodontal disease, etc.

### **Epidemiological studies components:**

Epidemiology is the study (scientific, systematic, data-driven) of:

- Frequency of disease. Measuring the frequency, disability or death summarizing this information in form of rates & ratios. Rate are essential for comparing disease frequency in different populations or sub groups of the same population in relation to suspected causal factor.
- Distribution of disease. Study the distribution of disease occurs in patterns in community which may lead to generation of hypothesis about causative/risk factor (Descriptive dentistry).

Study distribution of disease by → **Time** .increase or decrease in time span , **Place**. more in geographical area, **Person**. more in particular area, sex/age group

- Determinant of disease. Epidemiology test etiological hypothesis and identify risk/cause factors of disease (Analytical epidemiology). To search for these determinants, epidemiologists use analytic epidemiology or epidemiologic studies to provide the “Why” and “How” of such events.

### **Aims of epidemiology:**

1. To minimize or eradicate the disease or health problem and its consequence.
2. To minimize the chances of its occurrence in the future.

▶ According to the IEA (International Epidemiological Association), there are three main Objectives of epidemiology:

1. To describe the distribution and magnitude of health and disease problems in human population.
2. To identify etiological /risk factor in pathogenesis of disease.
3. To provide data essential to planning, implementation and evaluation of service for the prevention, control to treatment of disease.

→**Hypothesis:** It is a supposition arrived of from an observation or reflection. The hypothesis could be tested using the techniques of analytical epidemiology after which it may be accepted or rejected. An epidemiological hypothesis should specify the following:

**Population at risk:** It is that part of a population which is susceptible to a disease. It can be defined on the basis of demographic or environmental factors .For instance , occupational injuries occur only among working people so the population at risk is the workforce.

- Epidemiological approach: Epidemiological method( study) is based on 2 concepts: A-Asking questions. B-Making comparisons.

A-Asking questions:

The questions which can be usually asked in relation to health events are:

- 1-What is the event ?-----to identify the problem or the disease.
- 2-What is the magnitude ? ----- to identify the severity of the disease(prevalence& incidence )
- 3-Where did it happen ?----- to identify the area or place where the disease occurred.
- 4-When did it happen ?----- to identify the time of occurrence of the disease.
- 5-Who are affected ?-----to identify the persons who are affected by the problem.
- 6-Why did it happen?-----to identify the possible reasons for the appearance of the problem.

B-Making comparisons.

Its the basic approach in epidemiology ,which leads to drawing Inferences .  
The comparisons can be made between two groups( or more) or between individuals.

--One group with the disease (exposed to risk factor) which is called study group

--The other group without disease (not exposed to risk factor) which is called control group ,comparison or reference group.

Making comparisons helps the epidemiologist to identify the major difference between the **host** and the **environmental** factors among those who have the disease and those do not have the disease.

The group selected should be **similar** ,the facts collected must be accurate and should be gathered in a **uniform way** in order to maintain "**comparability**" between the study and control.

**Matching:** it's the process by which we select control in such a way that they are **similar to cases** with regard to certain pertinent selected variables (e.g. age, gender) which are known to influence the outcome of the disease and which, if not adequately matched for comparability, could distort or **confound** the results

## **Epidemiological measurements :**

**Morbidity** is the term used to describe the percentage of a population which is suffering from a disease at a given point in time.

The principle measurements of morbidity used in epidemiology are incidence and prevalence.

Incidence rate → the number of new cases occurring in a defined population during a specified period of time.

### **Uses of incidence rate:**

1. To control disease.
2. For research in to etiology, and pathogenesis, distribution of disease and efficacy of preventive and therapeutic measure.

Prevalence→ all current cases (old and new) existing at a given point in time or over a period of time in a given population.

Uses of prevalence:

1. To estimate the magnitude and health/disease problems in community and identify potential high- risk population.
2. For administrative and planning purposes.

**Mortality** is the number of death per 1000 population per year in given community.

### **Tools measurement of epidemiology:**

The epidemiology usually express disease magnitude as basic tools include;

1. Rate →measure of some particular event (development of disease) in population during a given time period. E.g. , death rate is calculated as

Death rate= 
$$\frac{\text{Number of event (death or disease) in a specified period} \times 1000}{\text{population}}$$

In rate the numerator is a part of denominator as seen in above formula.

2. Ratio→ express a relation in size between two random quantities. The numerator is not the component of denominator. Ratio is the result of diving one quantity by another which is represented as this formula→

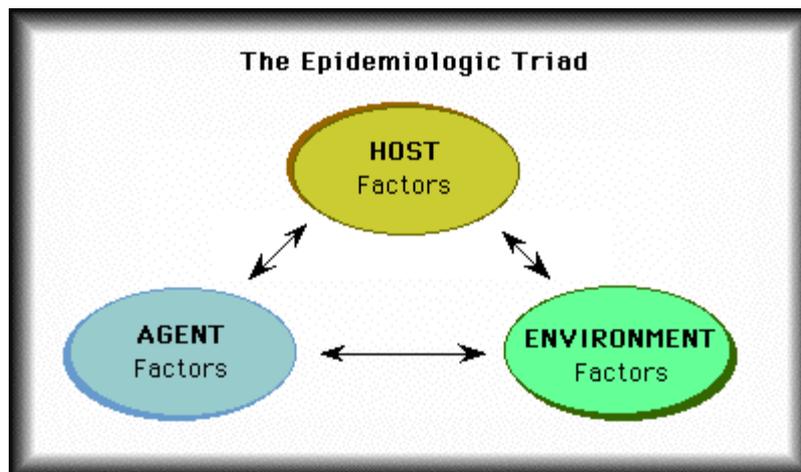
(x/y) ,e.g., the caries in boys is 90/1000, while in girls 80/1000 ,so the ratio of caries is 90:80 ► 9:8.

3. Proportion→ a ratio which indicates the relation in magnitude of a part of the whole. The numerator is always included in denominator. This is expressed in percentage.

$$= \frac{\text{No of children with caries of 1}^{\text{st}} \text{ molars at a certain time}}{\text{Total number of children at the same time}} \times 100$$

### **The Epidemiologic triad for Hypothesis formulation:**

The triad consists of an *external agent*(etiological agent or factor , reservoir of infection), *a host*(age ,gender, heredity ,habits ,occupation ,social factors) and an *environment* ( physical , biological and social)in which host and agent are brought together, causing the disease to occur in the host . *A vector*, an organism which transmits infection by conveying the pathogen from one host to another without causing disease itself, may be part of the infectious process.



### **Uses of epidemiology**

Epidemiology and the information generated by epidemiologic methods have been used in many ways:

#### **Assessing the community's health**

Public health officials responsible for policy development, implementation, and evaluation use epidemiologic information as a factual framework for decision making. To assess the health of a population or community, relevant sources of data must be identified and analyzed by person, place, and time (descriptive epidemiology)

- What are the actual and potential health problems in the community?

- Where are they occurring?
- Which populations are at increased risk?
- Which problems have declined over time?
- Which ones are increasing or have the potential to increase?

### **Making individual decisions**

Many individuals may not realize that they use epidemiologic information to make daily decisions affecting their health.

▶ E.g., In the mid-1980s, epidemiologists identified the increased risk of HIV infection associated with certain sexual and drug-related behaviors.

▶ These and hundreds of other epidemiologic findings are directly relevant to the choices people make every day, choices that affect their health over a lifetime.

### **Completing the clinical picture**

epidemiologists also contribute to physicians' understanding of the clinical picture and natural history of disease. E.g., epidemiologists, clinicians, and researchers around the world have collaborated to characterize SARS, a disease caused by a new type of coronavirus that emerged in China in late 2002.

### **Searching for causes**

Much epidemiologic research is devoted to searching for causal factors that influence one's risk of disease→ to prevent future outbreaks.