


# EPIDEMIOLOGY

# Definition of epidemiology

Epidemiology is the study of the distribution of disease or physiological condition in human populations and of the factors affecting their distribution. It is important to understand that epidemiology is concerned with the study of populations (i.e. groups of people) not the individual.



**Pandemic: an epidemic (a sudden outbreak) that becomes very widespread and affects a whole region, a continent, or the world due to a susceptible population. By definition, a true pandemic causes a high degree of mortality (death).**

# Objectives of epidemiology:

- ▶ 1-To describe the distribution and size of disease problems in human populations.
- ▶ 2-To identify etiological factors.
- ▶ 3-To provide the data essential to the planning, implementation, evaluation of services for the prevention, control, treatment, and to the setting up priorities among those services.

# Uses of Epidemiology

- ▶ • To study historically the rise and fall of disease in the population
- ▶ • To identify and quantify the health problems in a community
- ▶ • The epidemiological data is used for planning, developing and evaluation of the health services

# Uses of Epidemiology

- ▶ To evaluate the degree of individual's risk for the disease
- ▶ • Syndrome identification
- ▶ • To study the disease pattern in the community
- ▶ • To identify the cause and the risk factors of the disease.
- ▶ • It provides a foundation for public policy and for making regulatory decisions relating to environmental problems.

# Epidemiological Concept

The concept which is sometimes called the ecological concept of disease or the concept of multiple causations is based on the three premises:

1. Disease results from an imbalance between the disease agent and the host.
2. The nature and the extent of the imbalance depends upon the nature and characteristics of the agent and the host.
3. The characteristics of the agent and the host and their interactions are directly related to and largely dependent on the nature of the physical, biological and social environment.

# Epidemiologic triad

- ▶ The epidemiologic triangle is a model that scientists have developed for studying health problems. It can help to understand infectious diseases and how they spread.

The triangle has three corners:

- ▶ Human Host—“who”.
- ▶ The factors which influence the exposure of response include:
  - ▶ • Age
  - ▶ • Sex
  - ▶ • Family size
  - ▶ • Marital status
  - ▶ • Religion
  - ▶ • Occupation
  - ▶ • Ethnic or racial factors
  - ▶ • Habits and customs
  - ▶ • Inherent immunity or non specific immunity
  - ▶ • Immunity – passive immunity, active immunity.

# Epidemiologic triad

## ▶ Agents — “what”

The agent has been defined as an element, a substance or a force either animate or inanimate, the presence or the absence of which may, following effective contact with the susceptible human host and under proper environmental conditions, serve as a stimulus to initiate or perpetuate a disease process.

### **The classifications of agents are:**

- ▶ • Biological agents – due to living agents. Viruses, bacteria, fungi, protozoa
- ▶ • Nutritional factors – both excess and deficiencies such as calories, proteins, vitamins
- ▶ • Chemical agents – e.g. lead, solvents
- ▶ • Physical agents – humidity, vibration, heat, light, cold, radiation, etc
- ▶ • Mechanical agents – explosives, bullets, knives, etc
- ▶ • Social and psychological stressors – poverty, smoking, drug abuse, work stress, etc.

# Environment —“where”.

- ▶ The environment is the sum total of all external conditions and influences that affect the life and development of an organism. It thus influences both the agent and the host.
- ▶ • Biological environment – infectious agents of disease, reservoirs of infection, vectors that transmit disease, plants and animals.
- ▶ • Social environment – the overall economic and political organization of a society and of the institutions by which individuals are integrated into the society at various stages in their lives.
- ▶ • Physical environment – heat, light, air, water, radiation, gravity, chemical agents.

# Epidemiological Approach

## 1. Asking questions:

a. Related to health events—what is the event, what is its magnitude, where did it occur, when did it occur, who are affected, why did it happen?

b. Related to health action—what can be done to reduce this problem, to prevent it, what action has to be taken by the community, health services, other sectors, where and for whom, what resources are required, how are the activities to be organized, what difficulties will arise and how to overcome them?

# Epidemiological Approach

2. Making comparison: The basic approach in epidemiology is to make comparisons and draw inferences. This may be comparison of exposed and not exposed, or those having and not having the disease.

# Epidemiological studies components:

Epidemiology is the study of :

**Frequency of disease:** Measuring the frequency, disability or death summarizing this information in form of rates & ratios. Rates are essential for comparing disease frequency in different populations or sub groups of the same population in relation to suspected causal factor.

# Epidemiological studies components:

**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).

**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.

## Hypothesis:

It is a supposition arrived at 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 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.

## The null hypothesis:


is the proposition that implies no effect or no relationship between phenomena. It is a hypothesis that the researcher tries to disprove, reject, or nullify, whereas the alternative hypothesis is what the researcher really thinks is the cause of a phenomenon.

## Measuring health:

There is a need for accurate information on illness (morbidity) and death (mortality) because of the high economic loss, social disturbances as well as the cost of medical care associated with them and to enable comparison within and between societies at a given point in time or over different time periods. Health is measured by morbidity and mortality statistics.

## Numerator and Denominator:

Epidemiology is concerned with either the presence of health problems in a population or the occurrence of new health events in a population. In both the cases an epidemiological measure (or expression) has at least two components: a numerator and a denominator. The numerator in a disease ratio or rate for example is either existing (prevalent) cases as with measures of prevalence or new (incidence) cases as with incidence. The denominator is the population at risk or the population in which cases exist or have occurred.




**Ratio, Proportion and Rate: There are three basic classes of mathematical quantity used to measure health status and the occurrence of health events on populations.**

**Ratio** –A ratio is obtained by dividing one quantity by another without implying any specific relationship between the numerator and the denominator. The value of a ratio can range from minus to plus infinity.

**As example:**     *Number of students with dental caries*

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*Number of students with periodontitis*

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- Proportion – is a type of ratio in which those who are included in the numerator must also be included in the denominator i.e. the numerator is a subset of the denominator. The magnitude of proportions is usually expressed as a percentage.

As example: *Number of students with dental caries*

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*Number of students of 3rd year in certain time*

- **Rate** – Measures the occurrence of some particular events in a population during a given time period.

As example: Death rate = 
$$\frac{\text{Number of deaths in one year}}{\text{Mid-year population}} \times 100$$