**Epidemiology**

The concepts of epidemiology were first suggested by Hippocrates in the fifth century B.C. that the development of human disease might be related to external and personnel environment of an individual. Epidemiology is the basic science of public health, because it is the science that describes the relationship of health or disease with other health-related factors in human populations, such as human pathogens. Furthermore, epidemiology has been used to generate much of the information required by public health professionals to develop, implement, and evaluate effective intervention programs for prevention of disease and promotion of health.

The word epidemiology is derived from Greek and means “Studies upon people”

Epi – Upon, Demos – People, Logia – Study

Epidemiology is defined as the study of the distribution and determinants of health related status or events in specified populations and the application of this study to control the health problems. **Or**

Epidemiology is that field of medical science which is concerned with the relationship of various factors and conditions which determine the frequencies and distributions of an infectious process, a disease, or a physiologic state in a human community.

**Applications of epidemiology:**

The epidemiology is useful in:

1. Search of cause/causes of disease/diseases.
2. Helps to describe the health status of population or groups.
3. Helps to discover and bridge gaps in natural history of diseases.
4. Helps in controlling the diseases. To break the weakest link in chain of transmission of communicable diseases and reducing non communicable diseases.
5. Helps in planning of health programs on evidence basis and setting up of health priorities.
6. Helps to evaluate health programs and interventions.
7. Helps to determine the chances or probability of occurrence of disease/deaths and disability
8. Helps in better management of health services and hospital services.
9. Helps to set-up cut-off levels between normal and abnormal population and establish trigger levels for action or intervention.

**Epidemiology includes:-**

1. The methods for measuring the health of groups and determining the attributes and exposures that influence health.
2. The study of the occurrence of disease in its natural habitat rather than in the controlled environment of the laboratory.
3. The methods for the quantitative study of the distribution, variation, and determinants of health related outcomes in specific groups (sub populations) of individuals, and the application of this study to the diagnosis, treatment, and prevention of disease status or events.

**Domain of Epidemiology:**

1. **Descriptive Epidemiology** is the most basic form of epidemiology. It is concerned with the description of the patterns of occurrence of health-related status or events in groups. The determination of frequency and distribution of disease, incidence, prevalence, and mortality rates are included in descriptive epidemiology.
2. **Analytical Epidemiology** is based on the observations made in the descriptive epidemiology. The design, execution and analysis of subjects between groups helps evaluate potential association between risk factors and health outcomes to answer the question “why?”.

**Epidemiological Measurements**

1. **Cross sectional surveys/prevalence surveys** establish the frequency of disease and other factors in a community. They require the collection of data. They are useful to estimate the number of people in a population who have disease and can also identify the difference in frequency of disease in different subpopulations. Cross-sectional studies can also be used to document the co-occurrence of disease and suspected risk factors not only in the population but also in specific individuals within the population. The cross-sectional study design is useful to study chronic diseases such as multiple sclerosis, which have a reasonably high prevalence. On the other hand, they are not useful for studying diseases that have a very low prevalence. The cross-sectional study design is used in two special types of studies:
2. **Field studies** are usually investigations of acute outbreaks which require immediate identification of the causative factors if effective public health interventions are to be implemented in a timely fashion.
3. **Surveillance** is the monitoring of disease or health-related factors over time and uses serial cross-sectional surveys to observe trends.
4. **The case-control study** compares the prevalence of suspected causal factors between individuals with disease and controls. If the prevalence of the factor is significantly different in cases than it is in controls, this factor may be associated with the disease. Although case-control studies can identify associations, they do not measure risk. An estimate of relative risk, however, can be derived by calculating the odds ratio. Case control studies are often the analytic study design used initially to investigate a suspected association. Cases can often be selected from hospital patients and controls either from hospitalized patients with other diseases or by using algorithms or formulas for selecting community (neighborhood) or other types of controls.
5. **Cohort studies** follow defined groups of people without disease to identify risk factors associated with disease occurrence. Cohort studies have the advantage of establishing the temporal relationship between an exposure and a health outcome, and, thus, they measure risk directly.
6. **Experimental studies** differ from cohort studies because it is the investigator who makes the decision about who will be exposed to the factor based on the specific design factors to be employed.
7. **Meta-analysis** Because individual epidemiologic studies rarely provide proof of causation and results of different studies can vary for a number of reasons, including small sample size, a recent trend has been to combine similar studies to increase the power of the analysis. This strategy for data synthesis is known as “meta-analysis”. It has been especially helpful in studying diseases with a low incidence or where similar studies have given conflicting results.

**Epidemiology of communicable diseases (CCD)**

**Definition of Communicable disease** a communicable or infectious disease is an illness caused by transmission of a specific infectious agent or its toxic products from an infected person or animal to a susceptible host, either directly or indirectly through an intermediate animal host, vector or inanimate environment.

**Methods of transmission:**

1. **Direct**

* Touching
* Kissing
* Sexual intercourse
* Child birth
* Breast-feeding
* Air borne, short distance via droplets (by coughing, Laughing, sneezing, spitting).
* Transfusion of blood
* Trans-placental from mother to fetus

1. **Indirect**

* Vehicle borne transmission (by contaminated food and water)
* Vector borne transmission (Vector-borne diseases are human illnesses caused by parasites, viruses and bacteria that are transmitted by mosquitoes, sandflies, triatomine bugs ( are large bloodsucking insects that occur mainly in Latin America and the southern USA), blackflies, ticks, tsetse flies, mites, snails and lice).
* Parenteral by unsafe injection
* Fomite transmission (refers to the **transmission** of infectious diseases by objects. More specifically, it refers to the **transmission** of infectious diseases by germs left on objects. One common example of this is how the cold virus can be spread by people sneezing and touching door handles).
* Unclean hands

**Control of communicable diseases**

1. **Control of infectious agents in the environments**

* Supply of safe drinking water by treatment and chlorination of water, pasteurization of milk.
* Safe disposal of human excreta and animal excreta by sewerage system and sanitary latrines, compost pits/manure pits.
* Control vectors of diseases – by source reduction and anti-larval and anti-adult measures.
* Animals – vaccinate dogs against rabies and eliminate street dogs.
* Rodent control measures-trapping and killing
* Hospital waste management
* Disinfections

1. Control of infectious agent in host

* Reservoir control
* Practice of chemoprophylaxis (refers to the administration of a medication for the purpose of preventing disease or infection)
* Surveillance (Public health surveillance is the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice).
* Notification (Notifiable diseases)

1. Group A (Cholera, Plague and Yellow fever)
2. Group B (Rubella, Diphtheria, Enteric fever, Food poisoning, Leptospirosis, Measles, tuberculosis, Whooping cough, Typhus fever, and Viral hepatitis etc.)

* Quarantine

1. Complete quarantine (restriction of the activities of healthy persons or animals who have been exposed to a communicable disease)
2. Modified quarantine (includes personal surveillance, medical supervision, and segregation of the individual or group; or the establishment of a cordon sanitaire (a boundary zone between uninfected and infected or exposed persons).

* Isolation
* Education and behavior

1. Control of outbreaks of CCD

* Communicable diseases like Malaria, Hepatitis E & A, and Hepatitis B and Diarrheal diseases quite often occur in epidemic proportion. Many local and focal outbreaks are being reported quite frequently; hence, control of outbreaks of these diseases is an essential requirement.

1. Other measures

* Legislation
* Observe international health regulations

1. Specific measures for control of HIV epidemic

**Pharmacoepidemiolog** is the study of the use and effects/side-effects of drugs in large numbers of people with the purpose of supporting the rational and cost-effective use of drugs in the population thereby improving health outcomes.

**Pharmacosurveillance and pharmacovigilance** are terms used to refer to the monitoring of drug safety.

Pharmacoepidemiology may be drug-oriented, emphasizing the safety and effectiveness of individual drugs or groups of drugs, or utilization-oriented aiming to improve the quality of drug therapy through pedagogic (educational) intervention.

Drug utilization research may also be divided into descriptive and analytical studies.

1. **Descriptive studies** describe patterns of drug utilization and to identify problems deserving more detailed studies.
2. **Analytical studies** try to link data on drug utilization to figures on morbidity, outcome of treatment and quality of care with the ultimate goal of assessing whether drug therapy is rational or not. Sophisticated utilization-oriented pharmacoepidemiology may focus on the drug (e.g. dose-effect and concentration-effect relationships), the prescriber (e.g. quality indices of the prescription),or the patient (e.g. selection of drug and dose, and comparisons of kidney function, drug metabolic phenotype/genotype, age, etc.

Drug utilization research and pharmacoepidemiology may provide insights into the following aspects of drug use and drug prescribing:

1. **Pattern of use** covers the extent and profiles of drug use and the trends in drug use and costs over time.
2. **Quality of use** determined using audits to compare actual use to national prescription guidelines or local drug formularies. The quality of drug use may include:
3. The choice of drug
4. Drug cost
5. Drug dosage
6. Awareness of drug interactions and adverse drug reactions
7. The proportion of patients who are aware of or unaware of the costs and benefits of the treatment.
8. **Determinants of use** include user characteristics (e.g. sociodemographic parameters and attitudes towards drugs), prescriber characteristics (e.g. specialty, education and factors influencing therapeutic decisions) and drug characteristics (e.g. therapeutic properties and affordability).
9. **Outcomes of use** are the health outcomes (i.e. the benefits and adverse effects) and the economic consequences.