Epidemiology: An Overview

Mahmoud Al Hussami, MPH, PhD., DSc.

Professor of Epidemiology& Healthcare Leadership

Epidemiology

1. Study of distribution of health and illness within a population.
2. Study factors that determine population's health.
3. Use knowledge generated to control development of health problems

Epidemiology: Definition

Dynamic study of the

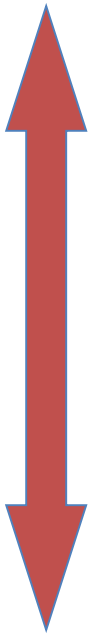
Determinants

Occurrence

Distribution

Pattern

Control



of health and disease in a population

Epidemiology

EPI **DEMO** **LOGOS**

Upon, on, befall **People, population, man** **the Study of**

The study of anything that happens to people

“That which befalls man”

What is Epidemiology

The word epidemiology comes from the Greek words epi, meaning “on or upon,” demos, meaning “people,” and logos, meaning “the study of.”

What is Epidemiology

Many definitions have been proposed, but the following definition captures the underlying principles and the public health spirit of epidemiology:

frequency, distribution and ***determinants*** of diseases and other health related conditions in human populations, and the application of this study to the promotion of health, and to the prevention and control of health problems.

What is Epidemiology

The product of [epidemiology] is research and information and not public health action and implementation

What are the components of epidemiology?

I- Frequency measures

a. Numbers
b. Rates
c. Ratios

Disease measurements

2- Distribution of disease

a. Person……..who?
b. Place……..where?
c. Time….when?

Descriptive Epidemiology

3- Determinants of disease

Causes or Factors:

a. Host
b. Agent
c. Environment

Analytic Epidemiology

Major Components of the Definition

- ***Population.*** The main focus of epidemiology is on the effect of disease on the population rather than individuals. For example malaria affects many people in Ethiopia but lung cancer is rare. If an individual develops lung cancer, it is more likely that he/she will die. Even though lung cancer is more killer, epidemiology gives more emphasis to malaria since it affects many people.

Major Components of the Definition

- ***Frequency.*** This shows that epidemiology is mainly a quantitative science. Epidemiology is concerned with the frequency (occurrence) of diseases and other health related conditions. Frequency of diseases is measured by morbidity and mortality rates.
- ***Health related conditions.*** Epidemiology is concerned not only with disease but also with other health related conditions. Health related conditions are conditions which directly or indirectly affect or influence health. These may be injuries, births, health related behaviors like smoking, unemployment, poverty etc.

Major Components of the Definition

- ***Distribution.*** Distribution refers to the geographical distribution of diseases, the distribution in time, and distribution by type of persons affected.
- ***Determinants.*** Determinants are factors which determine whether or not a person will get a disease.
- ***Application of the studies to the promotion of health and to the prevention and control of health problems.*** This means the whole aim in studying the frequency, distribution, and determinants of disease is to identify effective disease prevention and control strategies.

Distribution

Includes frequency and pattern

Frequency: the number of health events (e.g. number of cases of diabetes in a population), also the relationship of that number to the size of the population

Pattern: the occurrence of health-related events by **time**, **place**, and **person**

Time patterns : annual, seasonal, weekly, daily, hourly, weekday versus weekend,

Place patterns: geographic variation, urban/rural differences, and location of work sites or schools

Personal characteristics: demographic factors (age, sex, marital status, and socioeconomic status), as well as behaviors and environmental exposures

Determinants

Causes and other factors that influence the occurrence of disease and other health-related events

Illness does not occur randomly in a population, but happens only when the right accumulation of risk factors or determinants exists in an individual

Determinants of Health Vs. Risk Factors

- **Determinants of Health** refer to underlying characteristics of society that ultimately shape the health of individuals and communities. Determinants of health are the interconnected factors that determine an individual's health status. Examples of health determinants include personal and inborn features, socioeconomic status, culture, environment, educational attainment, health behaviors, childhood development, access to care, and government policy.
- **A risk factor** is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury. Some examples of the more important risk factors are underweight, high blood pressure, tobacco and alcohol consumption, and unsafe water, sanitation and hygiene.

Three Broad Types of Epidemiology

DESCRIPTIVE EPIDEMIOLOGY

Examining the distribution of a disease in a population, and observing the basic features of its distribution in terms of time, place, and person

Typical study design:

community health survey (approximate synonyms - cross-sectional study, descriptive study)

ANALYTIC EPIDEMIOLOGY

Testing a specific hypothesis about the relationship of a disease to a putative cause, by conducting an epidemiologic study that relates the exposure of interest to the disease of interest

Typical study designs: cohort, case-control

Types of Epidemiology

Experimental

Deliberate manipulation of the cause is predictably followed by an alteration in the effect not due to chance

Typical study designs:

True clinical trials and quasi clinical trials

Epidemiologic Approaches (Types)

DESCRIPTIVE

What?	Who?	When?	Where?
What are the health problems of the community?	How many people are affected?	Over what period of time?	Where do the affected people live, work or spend leisure time?
What are the attributes of these illnesses?	What are the attributes of affected persons?		

Examining the distribution of disease in a population, and observing the basic features of its distribution in terms of time, place, and person.
Distribution means a frequency of health event by person, time and place.
Typical study design: community health survey (synonyms: cross-sectional study, descriptive study).

The 4W's of descriptive epidemiology

- What = health issue of concern
- Who = person
- Where = place
- When = time

Analytic Epidemiology

Etiology, prognosis and program evaluation

Tests hypotheses about:

- Why: **What are the causal agents? What factors affect outcome?**
- How: **By what mechanism do they operate?**

Comparing groups with different rates of disease occurrence and with differences in demographic characteristics, *genetic* or immunologic make-up, behaviors, environmental exposures, and other potential risk factors

Analytic Epidemiology

- Examining the Determinants of disease in a population. Search for causes or risk factors.
- Investigating a hypothesis about the cause of disease by studying how exposures relate to disease.
- Analytical epidemiology studies require information to:
  - know where to look
  - know what to control for
  - develop viable hypotheses.

Experimental Epidemiology

It is a type of epidemiological investigation that uses an experimental model to confirm a causal relationship

Types of Clinical Trials

- Treatment trials test experimental treatments, behavioral therapies, new combinations of drugs, or new approaches to surgery or radiation therapy
- Prevention trials look for better ways to prevent disease in people who have never had the disease or to prevent a disease from returning
  - *These approaches may include medicines, vitamins, vaccines, minerals, or lifestyle changes*

Types of Clinical Trials

- Diagnostic trials are conducted to find better tests or procedures for diagnosing a particular disease or condition
- Screening trials test the best way to detect certain diseases or health conditions
- Quality of life trials (also called supportive care trials) explore ways to improve comfort and the quality of life for individuals with a chronic illness

Purposes of Epidemiology

- Discover the agent, host, and environmental factors that affect health
- Determine the relative importance of causes of illness, disability, and death
- Identify those segments of the population that have the greatest risk from specific causes of ill health
- Evaluate the effectiveness of health programs and services in improving population health

Knowledge Check

All of the following illustrate the purpose of epidemiology in public health, except

A. identifying populations who are at risk for certain diseases.

B. assessing the effectiveness of interventions.

✓ C. providing treatment for patients in clinical settings.

D. determining the importance of causes of illness

Knowledge Check

Epidemiologists use a model for studying infectious disease and its spread that involves the microbe that causes the disease, the organism that harbors the disease, and the external factors that cause or allow disease transmission. This is also known as

A. host, vector, and transmission.

B. transmission, host, and environment.

✓ C. host, agent, and environment.

D. organism, transmission, and environment.

Objectives of Epidemiology

- Investigate the etiology of disease and modes of transmission.
- Determine the extent of disease problems in the community.
- Study the natural history and prognosis of disease.
- Evaluate both existing and new preventive and therapeutic measures and modes of health care delivery.
- Provide a foundation for developing public policy and regulatory decisions.

Uses of Epidemiology

- To study the cause (or etiology) of disease(s), or conditions, disorders, disabilities, etc.
- To determine the primary agent responsible or ascertain causative factors.
- To determine the characteristics of the agent or causative factors.
- To determine the mode of transmission
- To determine contributing factors.
- To identify and determine geographic patterns

Uses of Epidemiology

- To estimate the individual's chances and risks of disease.
- To help complete the clinical picture of diseases
- To determine, describe, and report on the natural course of disease, disability, injury, and death.
- To aid in the planning and development of health services and programs.
- To provide administrative and planning data.

Forms of Epidemiology

- Clinical Epidemiology
- Descriptive Epidemiology
- Predictive Epidemiology
- Etiologic Epidemiology
- Genetic Epidemiology
- Occupational Epidemiology
- Social Epidemiology
- Chronic Disease Epidemiology
- Infectious Disease Epidemiology
- Surveillance

etc…

Terminology

- Endemic: A disease that has established itself **permanently** in a certain locality or community all the time, e.g. Bilharziasis in Egypt.
- Sporadic: means **scattered** about,the cases occur irregularly, haphazardly from time to time and generally infrequently. Cases are few and separated widely in space and time showing no connection to each other.
- Outbreak:: A more or less **localized epidemic** affecting certain large number of a group, in the community, e.g. outbreak of food poisoning in an institution.
- Epidemic: Is the occurrence in a community or a region of a group of illness of similar nature, clearly in **excess** of its normal **expectancy**.
- Pandemic: The appearance of a disease in an epidemic form affecting **countries** sequentially (at the same time).

- Infections: It is the **entry**, development and multiplication of an **infectious agent** in the body of man or animal. Infection is not synonymous with infectious disease; the result of infection may be unapparent or manifest infectious disease.
- Contamination: The presence of living infectious agents on the **exterior** surface of the body or on the clothes or articles of the person or on any inanimate object in the environment including water and food.
- Incubation period: the time between **entrance** of infectious agent and **appearance** of manifestation
- Infectious disease: A clinically **manifest** disease of man or animal resulting from infection.
- Contagious disease: A disease that is **transmitted** through **contact**. e.g. scabies, trachoma and leprosy.

- Period of communicability: The time during which the infectious agent could be **transmitted** directly or indirectly from the reservoir to a susceptible host.
- Communicable diseases: It is an illness caused by an **infectious** agent or its toxic product which can be **transmitted directly or indirectly** or through vector from the reservoir to a susceptible host.
- Non- communicable disease: It is an infectious disease which **cannot be transmitted** from the reservoir to a susceptible host.

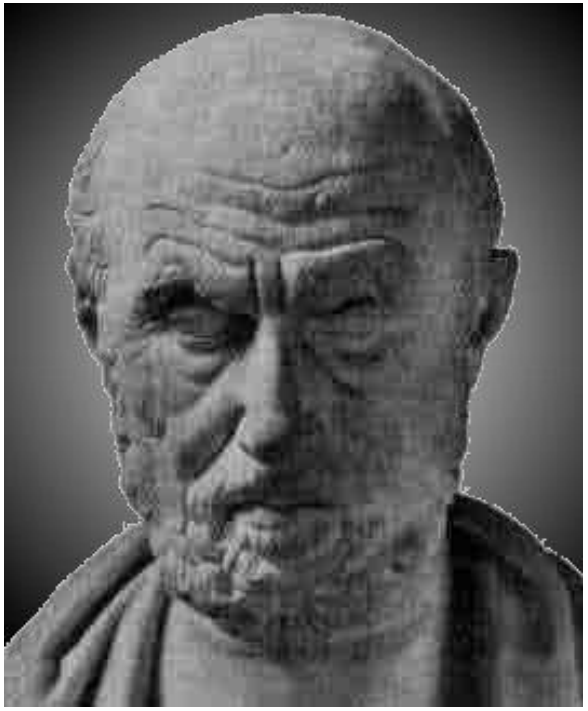
- Opportunistic infection : This is infection by an organism that takes the opportunity provided by a **defect** in the host defense mechanism e.g. AIDS, Toxoplasmosis.
- Eradication: **Termination** of all transmission of infection by extermination of the infectious agent. (Termination of infection from the whole world) e.g. Smallpox
- Nosocomial infection: (Hospital acquired infection). They are infections acquired by the patients during or **associated** with delivery of health care which are **not present** or incubating at admission.

History of Epidemiology

Hippocrates (460-377 B.C.)

On Airs, Waters, and Places

- ✓ **Idea that disease might be associated with physical environment**



Thomas Sydenham (1624-1689)

- ✓ **Recognized as a founder of clinical medicine and epidemiology**
- ✓ **Emphasized detailed observations of patients & accurate recordkeeping**

James Lind (1700's)

- ✓ **Designed first experiments to use a concurrently treated control group**

Edward Jenner (1749-1823)

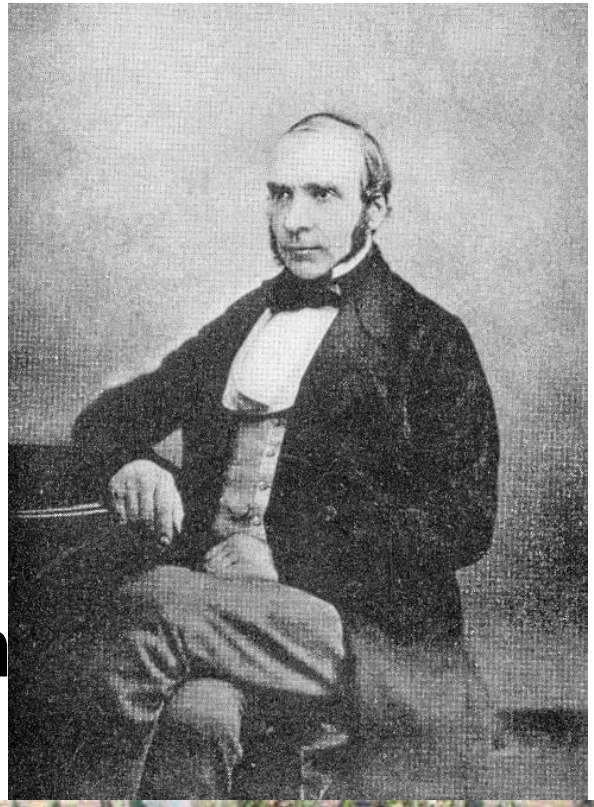
- ✓ **Pioneered clinical trials for vaccination to control spread of smallpox**
- ✓ **Jenner's work influenced many others, including Louis Pasteur who developed vaccines against rabies and other infectious diseases**

Ignas Semmelweis (1840's)

- ✓ **Pioneered handwashing to help prevent the spread of septic infections in mothers following birth**

John Snow (1813-1858)

- ✓ Father of epidemiology
- ✓ Careful mapping of cholera cases in East London during cholera epidemic of 1854
- ✓ Traced source to a single well on Broad Street that had been contaminated by sewage



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