EPIDEMIOLOGY

Introduction

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Course contents

- Introduction to Epidemiology
- Communicable disease Epidemiology
- Measures of frequency and Disease Occurrence
- Epidemiologic study design
- Measures of association
- Judgement of causality
- Public health surveillance
- Screening in public health
- Investigation of an Epidemics

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Introduction to Epidemiology

At the end of this section student will be able to:

- Define Epidemiology
- Differentiate descriptive and analytical Epidemiology
- Describe basic assumption of Epidemiology
- know application of Epidemiology in public health practice
- Understand concepts and theories of disease causation

Public health

The science & art of

- *Preventing disease,*
- *prolonging life,*
- *promoting health & efficiency through organized community effort* *(Winslow, 1920)*

Epidemiology and public health

- ✓ Epidemiology is a scientific discipline
- ✓ Also called the *basic science of public health*
- ✓ It has sound method of scientific inquiry at its foundation

Definition of Epidemiology

- Originates from three Greek words.



on or upon | peopl e | study

- Study upon populations

- *classical definition*.

Definition of Epidemiology

Modern definition

- The study of the **frequency**, **distribution** and **determinants** of disease and other health related events in specified human **populations**, and the **application** of this study to **prevention and control** of health problems.

Key terms taken from the definition

1. Frequency:

- ✓It quantify how often a disease or other health related events arises in a population (the magnitude of occurrence).

Example

- ✓Number of exposed people
- ✓Number of people with the outcome of interest
- ✓Proportion of exposed people
- ✓Proportion of people with the outcome of interest

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Key terms taken from the definition

Measures of frequency:

- Frequency of disease occurrence
  - measures of morbidity
- Frequency of death occurrence
  - measures of mortality

Key terms taken from the definition

2. Distribution:

- It is the occurrence of diseases and other health problems according to the characteristics of person, place, and time.

Attempts to answer who? Where? and when?

- who would be most likely to get the disease?
- where would the disease be most likely to occur?

Key terms taken from the definition

3. Determinants:

- Are factors that bring about a change in a person’s health.
- Both causal and preventive factors i.e. either cause a healthy individual to become sick or cause a sick person to recover.

Key terms taken from the definition

4. Population:

- Refers to a group of people with a common characteristic such as place of residence, gender, age, or use of certain medical services.
- Epidemiology studies the health of the groups, communities and whole or specific population.
- What is the difference between Epidemiology and clinical medicine????

History of Epidemiology

HIPPOCRATES (400 BC): “On Airs, Waters, and Places” –Hypothesized that disease might be associated with the physical environment, including seasonal variation in illness.

JOHN GRAUNT (1662): “Nature and Political Observations Made Upon the Bills of Mortality” – First to employ quantitative methods in describing population vital statistics.

History of Epidemiology

- The development and application of Epidemiologic methods advanced slowly during the late 1800s and early 1900s.

JOHN SNOW (1850): Formulated natural epidemiological experiment to test the hypothesis that cholera was transmitted by contaminated water.

History of Epidemiology

DOLL & HILL (1950): Used a case-control design to describe and test the association between smoking and lung cancer.

FRANCES at al. (1950): Used huge formal field trial of the Poliomyelitis vaccine in school children.

DAWBER et al. (1955): Used the cohort design to study risk factors for cardiovascular disease in the Framingham heart Study.

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Broad categories of Epidemiology

1. **Descriptive Epidemiology:** concerned with describing the frequency and distribution of disease and other health related events in relation to person, place and time.

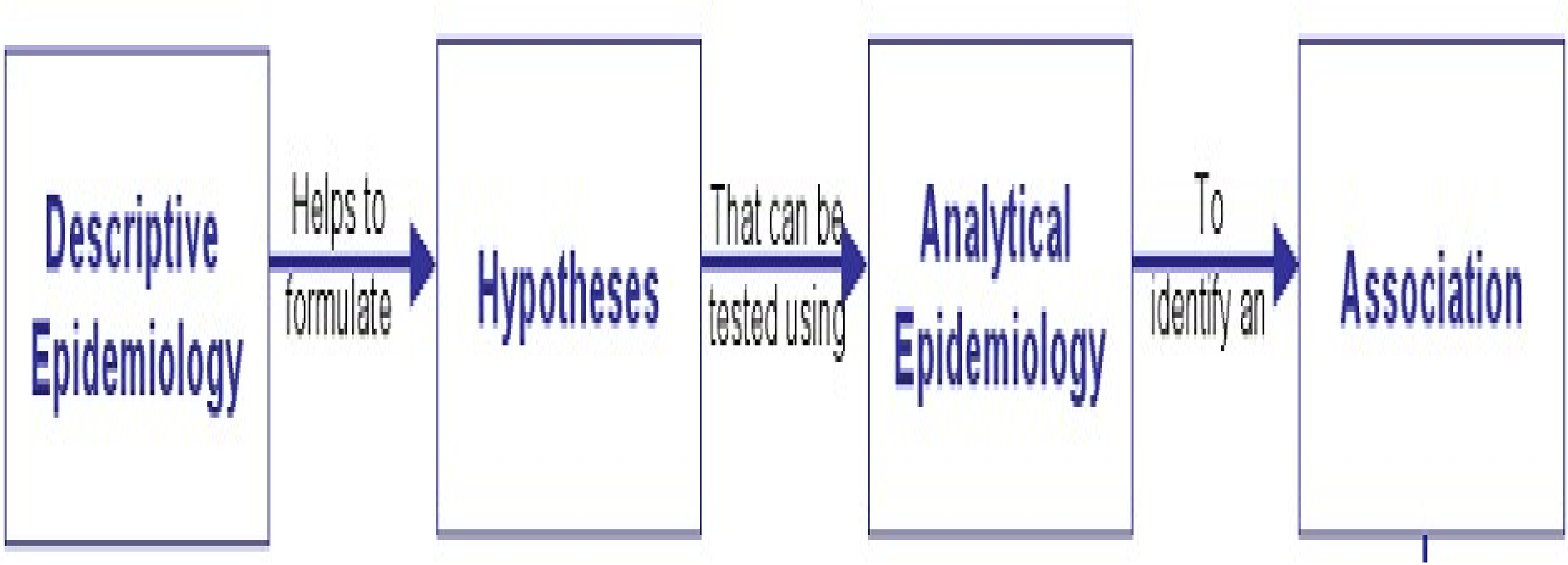
- Deals with the questions: *What, Who, When, and Where*
- Tell us the magnitude or burden of health problems
- Tells us the population at greatest risk of acquiring the disease
- Generate hypothesis

Broad categories of Epidemiology

2. Analytic Epidemiology: concerned with comparison of groups of individuals to identify determinants of diseases and other health related events

- Deals with the questions *WHY? and HOW?*
- Test the hypothesis

Descriptive Epidemiology is an ***antecedent*** of Analytic Epidemiology.



Scope of epidemiology

- In the past it was concerned with ***infectious diseases and mainly epidemics***
- Now Scope of Epidemiology has expanded to include both **infectious and non- infectious diseases**, such as
  - Nutritional deficiency states,
  - Mental disorders,
  - Hypertension,
  - Accidents, cancer,
  - Congenital anomalies
- Can be applied to all diseases and health related conditions

Purpose of Epidemiology

1. Diagnostic Purpose

- Epidemiological studies provide data for community diagnosis,
  - identification and detailed analysis of the
    - ✓ Health needs
    - ✓ Demands
    - ✓ Priorities and
    - ✓ Resources of a defined community.
- This would serve as basis for the planning and implementation of health intervention measures.

Purpose of Epidemiology

2. Identification of determinants of disease:

- One of the most important purposes of epidemiological studies is the identification of determinants of disease whose identification could lead to prevention and control of disease.

Purpose of Epidemiology

3. Evaluation of Methods of diseases Control.

- Any program of prevention and control of a disease must be accompanied by methods for assessing whether the measures are effective in reducing the frequency of the disease.
- E.g. the effectiveness of health education on infant feeding to mothers attending ANC is evaluated by measuring decline in the incidence of marasmus and kwashiorkor among children and the change of knowledge, attitude and behavior of mothers.

Purpose of Epidemiology

4. Observation of the natural history of diseases.

- Knowledge of the natural history of diseases is essential to make *prognosis or the likely outcome* of a patient's illness.
- The basis for *rational decision about treatment*

5. Classification of diseases.

- The epidemiological characteristics of diseases
- E.g. diseases can be classified based on modes of transmission , sexual , air borne, contagious , etc

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Features of Epidemiology

- Studies are conducted on **human population**
- Examines **Patterns** of events in groups of people
- Can establish ***cause and effect*** relationship

  without the knowledge of biologic mechanism

  - Smoking and lung cancer
- Covers a wide range of conditions

  - *From infectious to non-infectious*
  - *From simple survey to complex drug trial*

Basic assumptions of Epidemiology

1. Human disease *does not* occur at random
2. Human disease has a *causal* factors
3. These causal factors can be identified through systematic investigation of populations.
4. Human disease can be prevented (have preventive factors)

Theories of disease causation

How the disease is caused?

1. **Supernatural theory of disease**
2. **Ecological theory**
3. **Germ theory**
4. **Multifactorial causation theory**

Theories of disease causation

- There are people in both developed and developing countries still believe in supernatural origin
- Even today superstitions are becoming major obstacles in disease control
- Most of the literates view that disease is the result of microbes
- Most of the uneducated people believe that disease is due to bad physical environment

Theories of disease causation

1. Supernatural theory of disease

- In the early past, the disease was thought mainly due to either the curse of god or due to the evil force of the demons.
- Accordingly, people used to please the gods by prayers and offerings or used to resort to witchcraft to tame the devils.

Theories of disease causation

2. Ecological theory

- Due to **environmental influence** (“Airs, Waters and Places”)

Theories of disease causation

3. Germ theory



Robert Koch

- **Microbes (germs)** were found to be the cause for many known diseases.
- Pasteur, Henle, Koch were the strong proponents of microbial theory after they discovered the micro-organisms in the patients' secretions or excretion.

Theories of disease causation

Henle-Koch Postulates

Henle and Koch postulated that:

1. Each disease will be caused by a germ
2. Without that germ that disease will not be caused
3. By introducing that germ , that disease can be caused in animals experimentally,
4. And that germ can again be isolated from that sick animal experimented with.

cannot explain the etiology of all diseases

Theories of disease causation

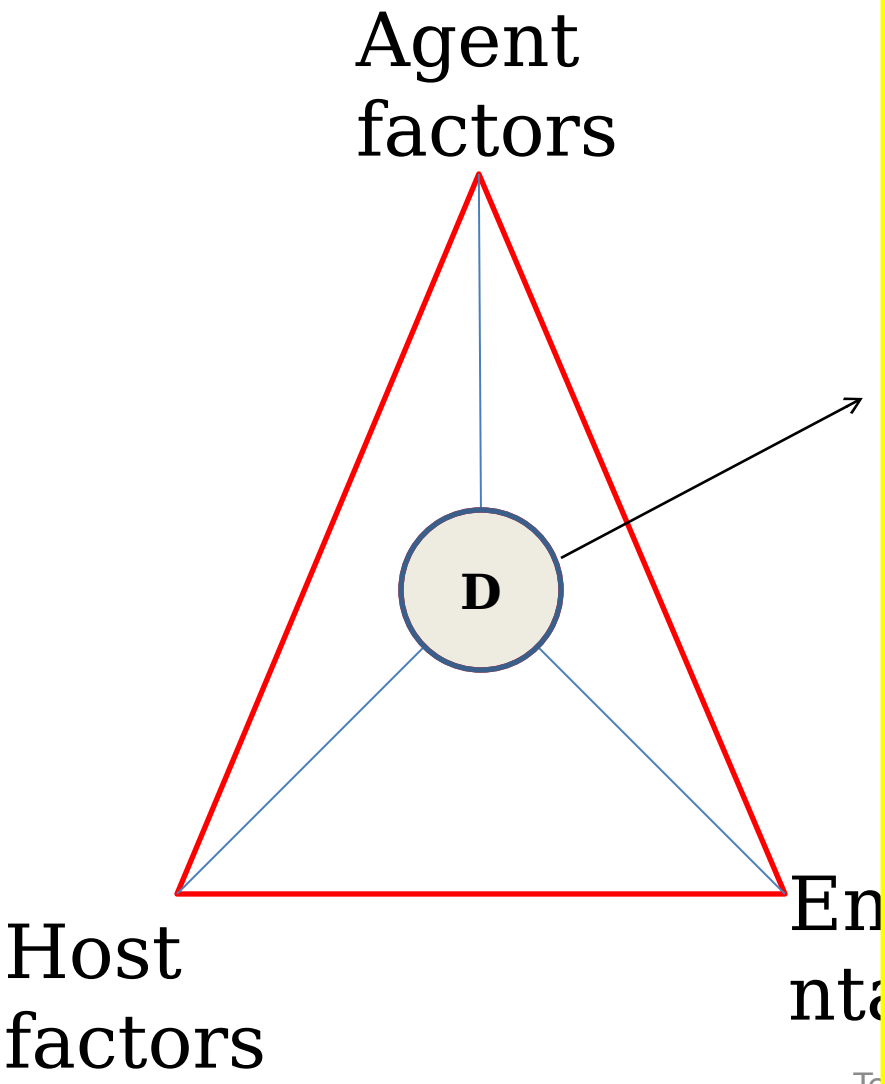
4. Multi-factorial causation theory



Pettenkoffer

- Pettenkoffer Stated that *agent, host and environmental* factors will act and interact synergistically and act as joint independent partners in causing the diseases.

Theories of disease causation



- Disease occurs only when host factors and environmental factors make the agent sufficient

enough to cause the

Necessary versus Sufficient cause

- **NECESSARY CAUSE**: A causal factor whose presence is required for the occurrence of the disease.
- **SUFFICIENT CAUSE**: A causal factor or collection of factors whose presence is always followed by the occurrence of the disease.

Necessary cause (e.g. the tubercle bacillus and tuberculosis)

	Get TB	Free of TB
Exposed	Yes	Yes
Don't exposed	No	Yes

Sufficient cause (e.g. Rabies infection and Death)

	Dead	Alive
Exposed	Yes	No
Not exposed	No	Yes