

# PRINCIPLES OF DISEASE CONTROL AND USES OF EPIDEMIOLOGY

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# Epidemiology and its Uses

- Epidemiology is from the Greek roots
  - *epi* – upon
  - *demos* – the people
  - *logia* – ‘speaking of’ ‘the study of’
- Epidemiology is based on the word **epidemic**

# Uses of epidemiology

- There are various uses of epidemiology and information generated from epidemiological methods
- The uses are classified as follows
  - Population or community health assessment
  - Individual decisions
  - Completing the clinical picture
  - Search for causes

# Population or community health assessment

- Health assessment of the population or community is vital in setting policy and planning programs in public health
- It is important to determine whether health services are available, accessible, effective, and efficient
- Improved health for the population through informed decisions

# Individual decisions

- In the 1950s- epidemiologist recorded the increased risk of lung cancer among smokers
- 1960s and 1970s- epidemiologist documented the various benefits and risks associated with different methods of birth control
- Mid 1980s- increased risk of HIV infection associated with certain sexual and drug related behaviors

# Individual decisions

- Role of exercise and proper diet in reducing the risk of heart disease
- These documentations of the epidemiologists contributed to individual decision making

# Completing the clinical picture

- Epidemiologists develop on the works of clinical physicians and laboratory scientists to make proper diagnosis of individual patients
  - In 1989- there were three persons diagnosed of myalgias (severe muscle pains in chest or abdomen) and unexplained eosinophilia ( an increase in the number of one type of white blood cell)
  - The physician could not give a name to the disorder or identified the causes

# Completing the clinical picture

- Epidemiologists worked on it and found cases of eosinophilia-myalgia syndrome
- Conditions associated with cigarette smoking have been identified by the epidemiologists- pulmonary disease, heart disease, lung and cervical cancer



# Search for causes

- Search for causes and factors which influence one's risk of diseases is the major aspect of epidemiologic research
- Identification of causes of diseases is important to improve appropriate public health action

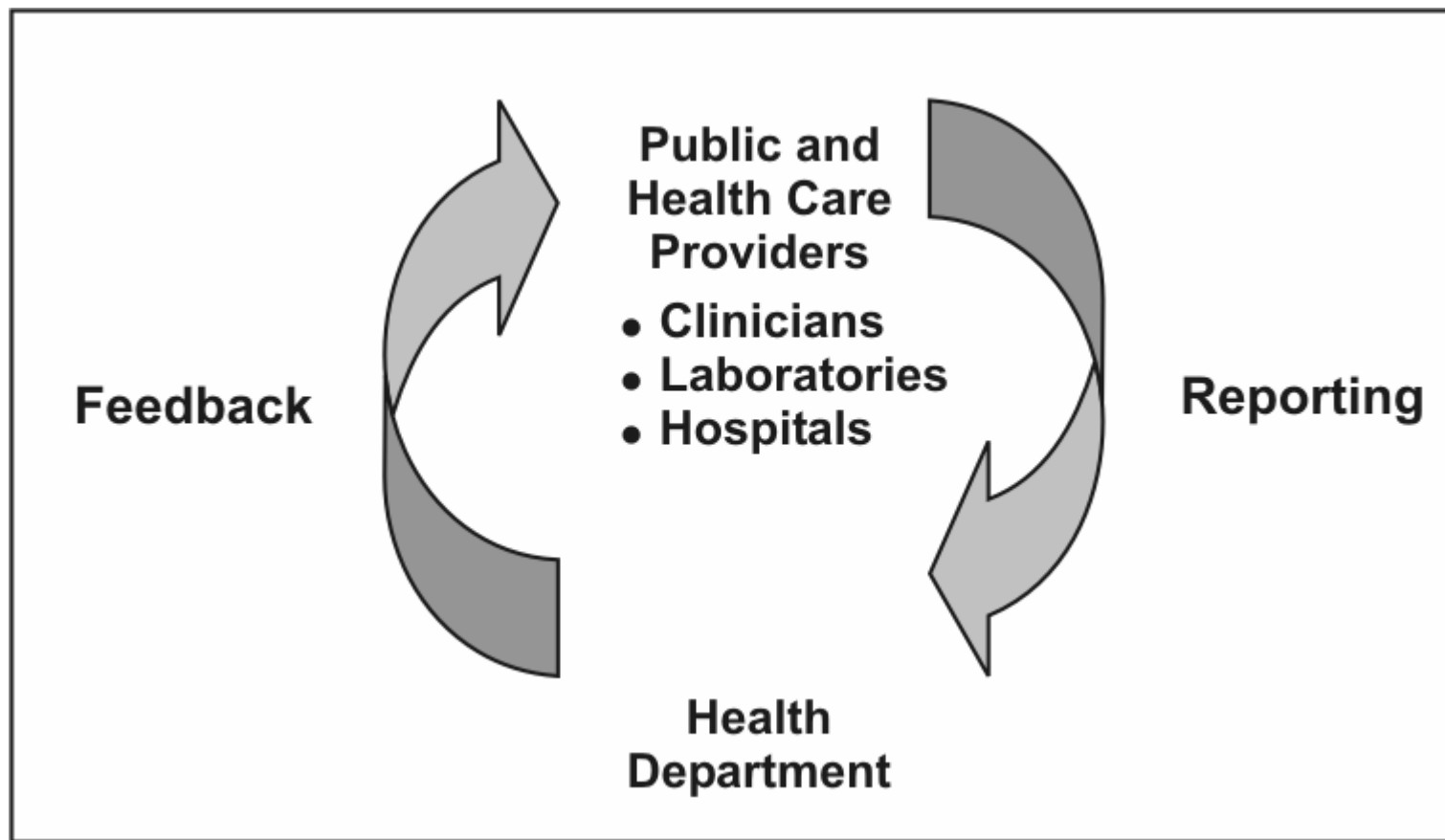
# CORE EPIDEMIOLOGIC FUNCTIONS

- The major tasks of epidemiology in public health practice were identified in the mid-1980s
  - Public health surveillance,
  - Field investigation,
  - Analytic studies,
  - Evaluation and
  - Linkages
  - Policy development (recently added)

# Public health surveillance

- Ongoing, systematic collection, analysis, interpretation, and dissemination of health data to help guide public health decision making and action.
- Sometimes called ‘information for action’
- Portrays the ongoing patterns of disease occurrence and disease potential for effective and efficient application of investigation, control and prevention measures

# Surveillance Cycle



# Surveillance

- Systematic collection and evaluation of morbidity and mortality reports
- Dissemination of the collected data and their interpretation to those involved in disease control and public health decision making
- Common sources of surveillance data- mortality and morbidity reports
- Reports are submitted by – health care providers, infection control practitioners, or laboratories

# Surveillance

- Reportable diseases such as pertussis, meningococcal meningitis, or AIDS
- Other sources of data- reports from investigations of individual cases and disease clusters, public health programs data like immunization coverage, disease registries and health surveys

# Surveillance

- Public health surveillance originally was focused on communicable disease
- The target is now on injuries, chronic diseases, genetic and birth defects, occupational and potentially environmentally-related diseases and health behaviors

# Field investigation

- The result of surveillance leads to investigation by the public health department
- Investigation may be call to the health care provider to confirm or clarify the circumstances of the reported cases
- Or may be field investigation



# Field Investigation

- Investigations usually lead to identification of additional unreported cases
- Identify source or vehicle of infection that can be controlled or eliminated
- To learn the natural history, clinical spectrum, risk factors of diseases etc.

# Analytic studies

- Analytic studies are conducted to test the hypothesis generated during case investigations
- Epidemiologist must be familiar with the aspect of analytic study
  - Study **design** – appropriate study design, writing justifications and protocols, calculating sample sizes, deciding questionnaires etc

- **Conduct** a study- securing appropriate clearances and approvals, abstracting records, tracking down interviewing subjects, collecting and handling specimens and managing data
- **Analysis**- describing the characteristics of the subjects to calculate rates, creating comparative tables, computing measures of association (e.g. risk ratios and odd ratios), test of statistical significance etc.

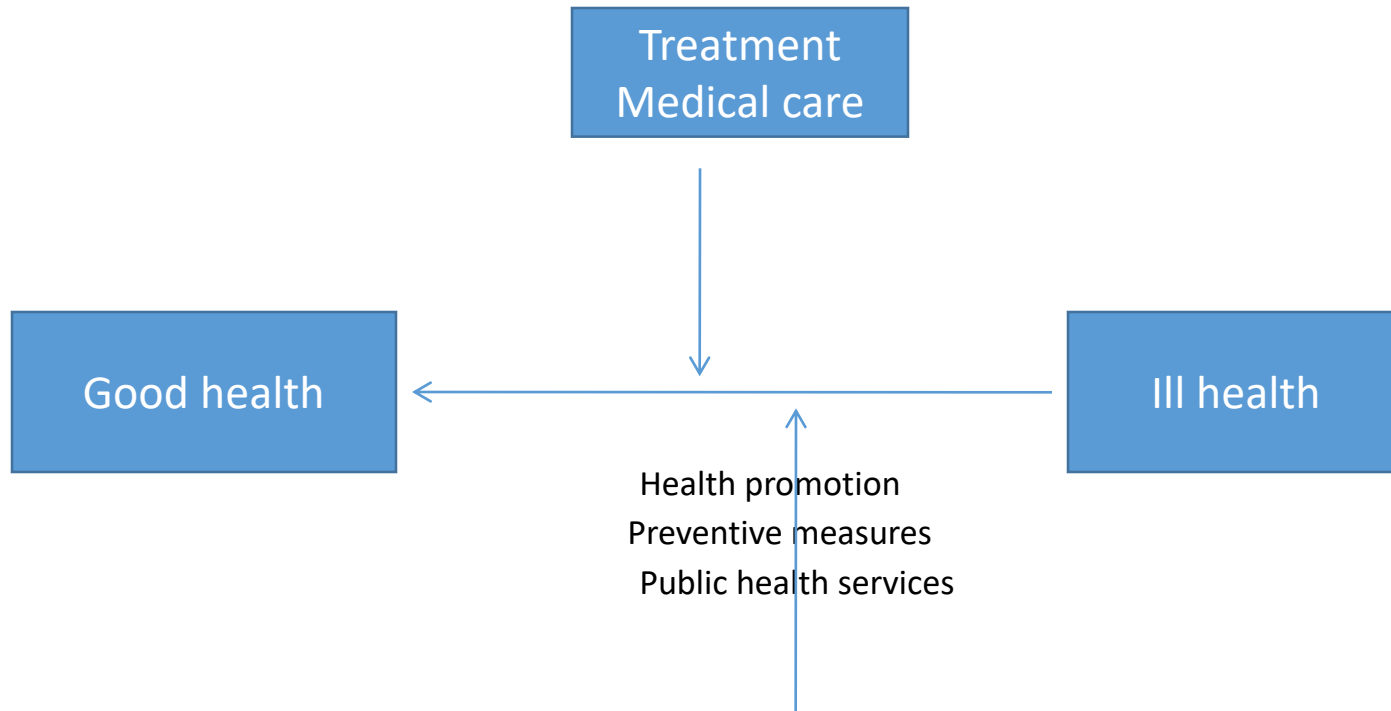
## Analytic studies

- **Interpretation-** putting the findings into perspective and making appropriate recommendation.

# Evaluation

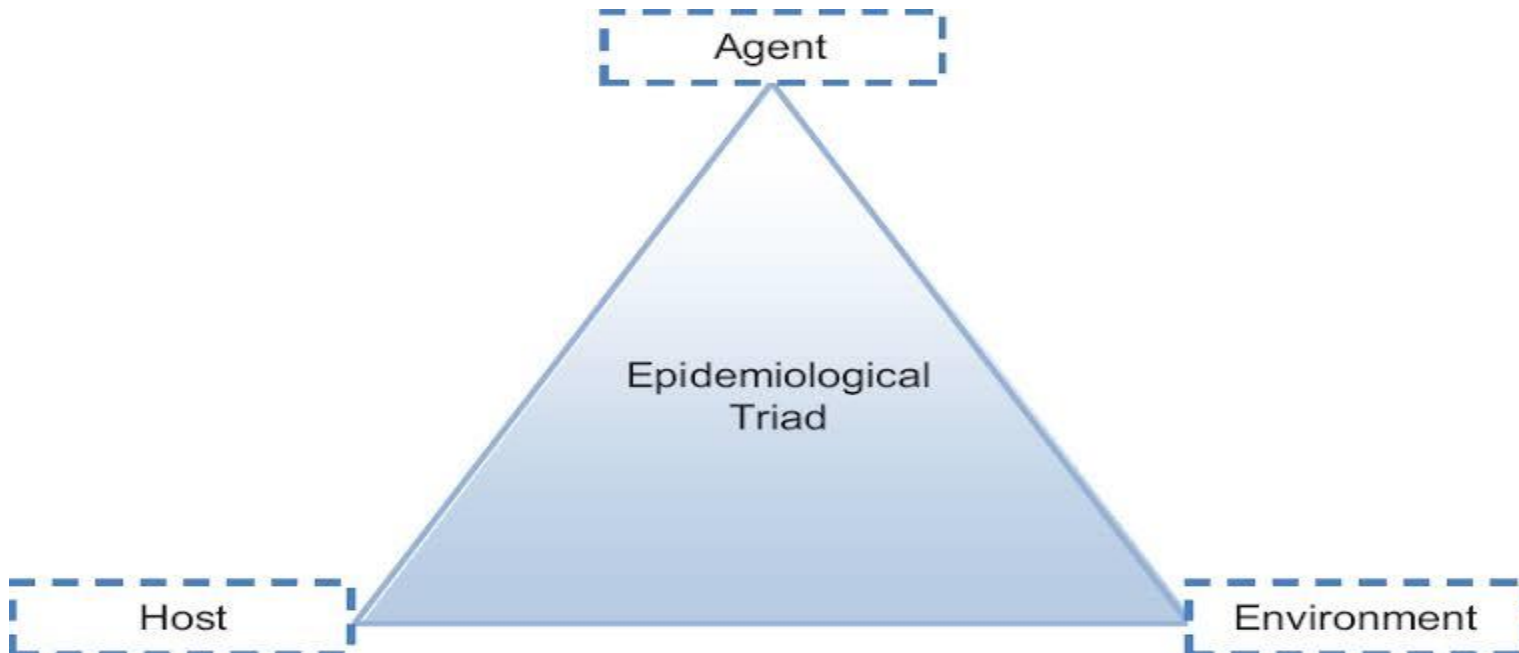
- **Effectiveness**- ability of a program to produce the intended or expected outcome or results in the field
- **Efficiency**- ability of a program to produce the intended results with a minimum expenditure of time and resources e.g. evaluation of immunization program

# Evaluation



# Epidemiologic triad

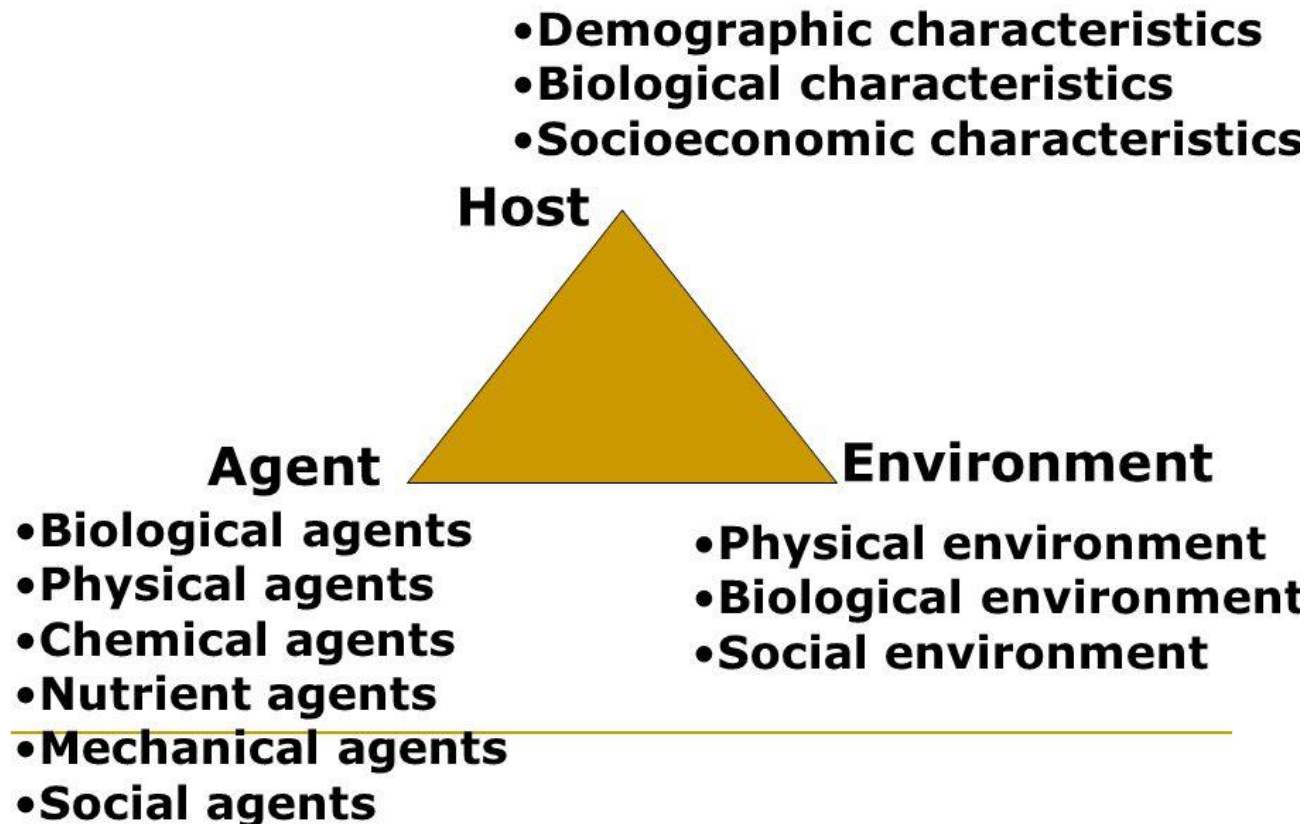
- Epidemiological triad model
  - An external **agent** ( the seed)
  - A susceptible **host** (the soil)
  - An **environment** ( the climate)



# Epidemiologic triad

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## Epidemiologic triad





# Epidemiologic triad

## HOST

Age, sex, race

Religion

Occupation

Education

Marital status

## AGENT

Biologic(bacteria)

Chemical(poison)

Physical(trauma)

Nutritional(lack)

Energy(thermal)

## ENVIRONMENT

Temperature

Overcrowding

Neighborhood

Housing

Radiation

# Agent

- 'what'
- An infectious microorganism or any causative factor contributing to a health problem or condition – bacteria, viruses, fungi etc.
- A 'necessary' factor
- Agent must be present for disease to occur
- Presence of agent may not always be 'sufficient' to cause disease
- Organism's **pathogenicity** and dose play important role in causing disease

# Host

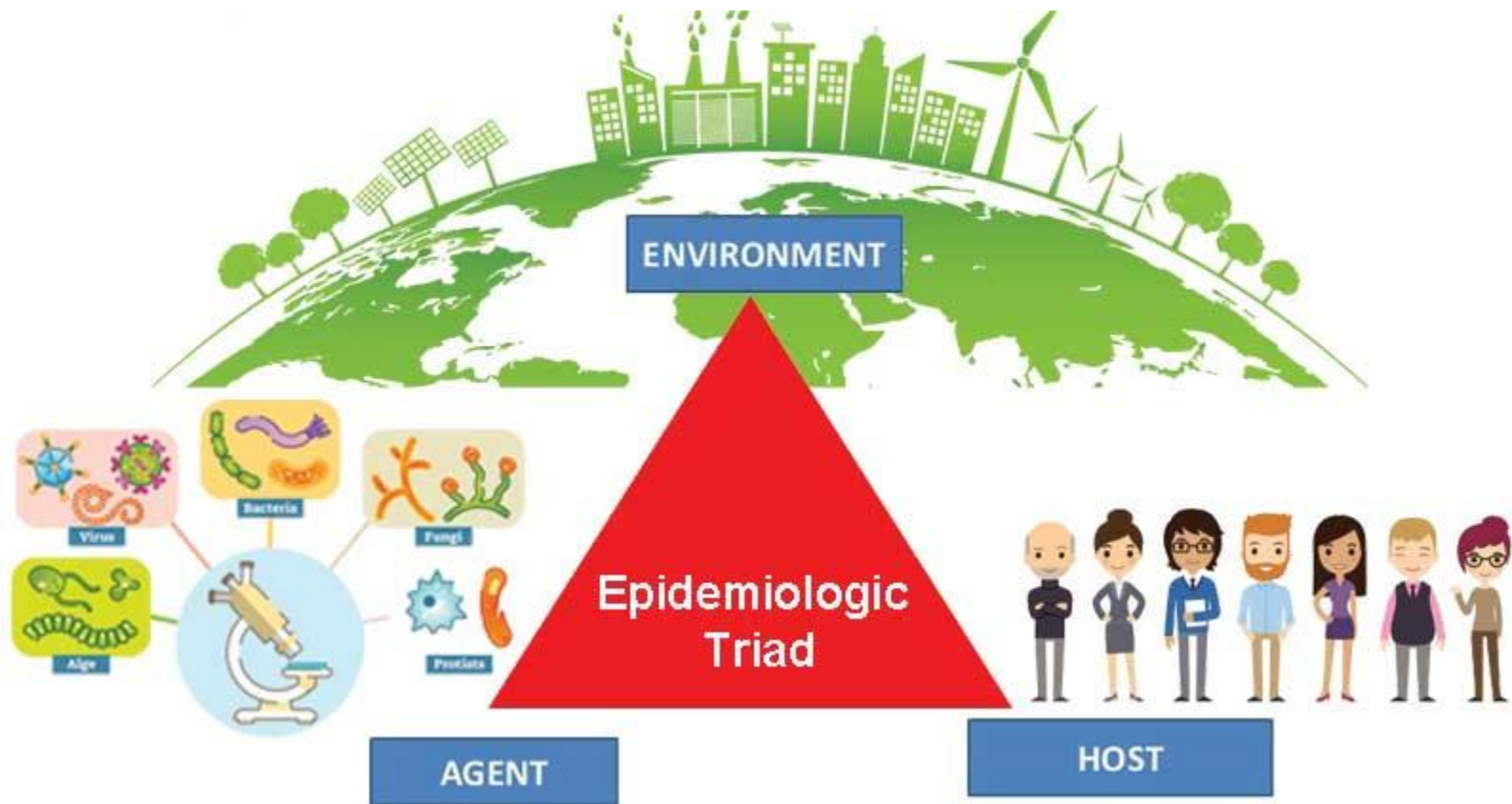
- **‘who’**
- Usually humans or animals
- Exposed to and harbor a disease
- Symptomatic or asymptomatic
- Symptoms of disease varies from person to person

- The effect of a disease organism on the host depends on the level of immunity, genetic makeup, level of exposure, state of health and overall fitness
- Behaviors like hygiene, sexual practices, age, gender and other personal choices could influence opportunities for exposure

# Environment

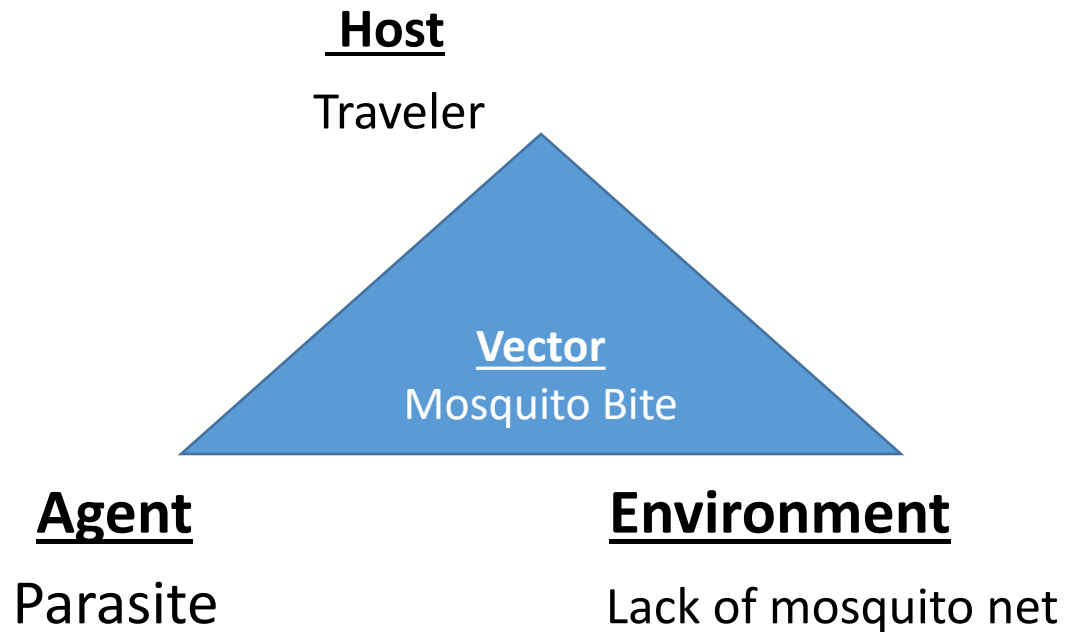
- **‘where’**
- External and favorable surroundings and conditions of the host that can cause or allow the disease to be transmitted
  - Dirty water
  - Human blood
  - Warm temperatures
  - Season of the year

- The environment can be both within a host or external to it in the community
  - Biological
  - Social
  - Cultural
  - physical



# Application to disease

- Malaria

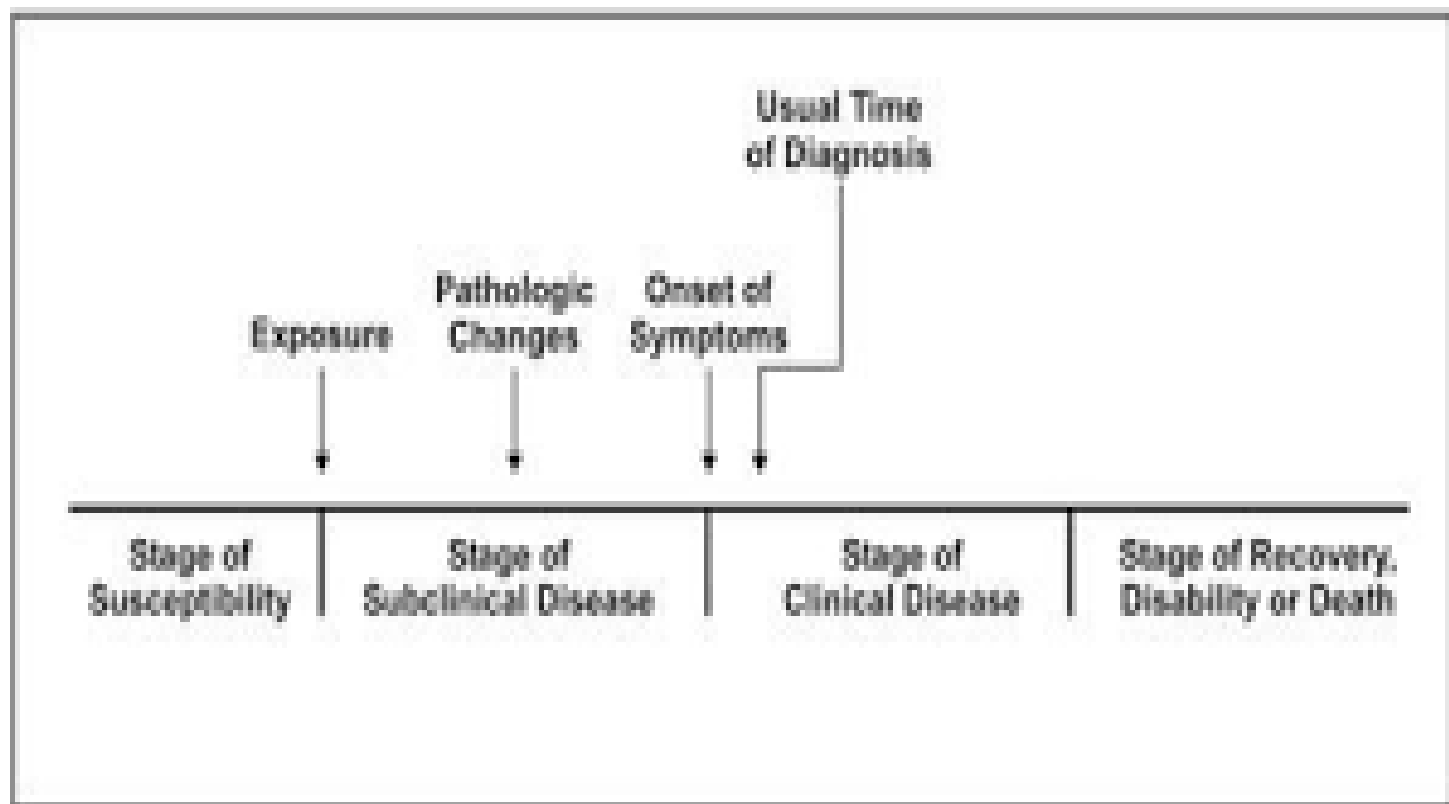




# NATURAL HISTORY AND SPECTRUM OF DISEASE

- This refers to the progress of a disease process in an individual over time when there is no intervention
- The process starts with exposure to causal factors causing disease
- The process ends with ***recovery, disability, or death*** without medical intervention

## Natural History of Disease Timeline



- Most disease are characterized by natural history, though time frame and manifestations of disease may vary from person to person
- Usual cause of a disease may come to an end at any time in the progression by preventive and therapeutic measures, host factors etc.

# Terms used in spectrum of disease

- **Infectivity**- the proportion of exposed persons who become infected
- **Pathogenicity**- the property of an organism that determines the extent to which overt disease is produced in an infected population, or the power of an organism to produce disease
- **Virulence**- the degree of pathogenicity; the disease-evoking power of a microorganism in a given host (proportion of persons with clinical disease who become severely ill or die)