AL MUSTAQBAL UNIVERSITY

College of Pharmacy / Fourth Stage

Public Health

(L 6) Epidemiology of Communicable Diseases

Dr. Abdulhusein Mizhir Almaamuri

Epidemiology

Epidemiology is defined as **"*the study of the distribution and determinants of health-related states or events in specified populations and the application of this study to the control of health problems*."** To put it more simply, epidemiology is the task of using data to answer **questions of**:

- Who is getting sick?
- What is making people sick? And,
- How can we use this information to reduce the risk of others getting sick?

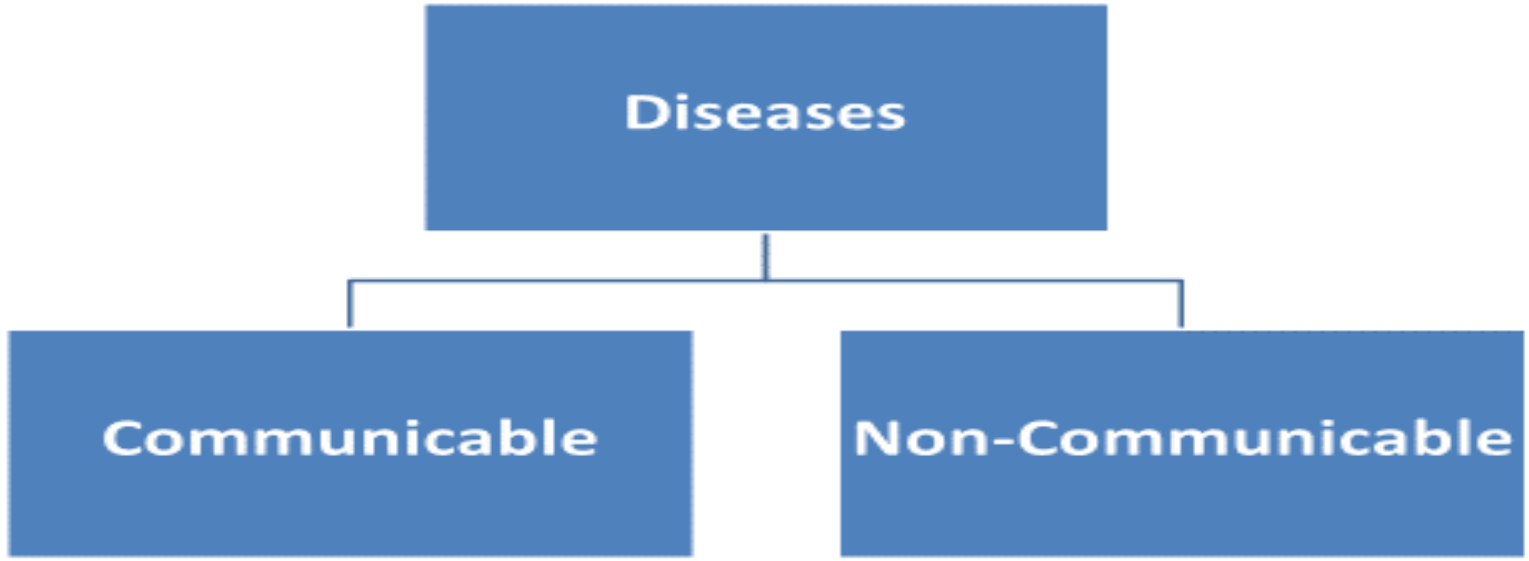
Without quality health data, it is very difficult to answer these questions. **A surveillance system** that serves to collect health data in a complete and timely manner is thus essential to the practice of epidemiology.

Surveillance is defined as "***the ongoing systematic collection, analysis, and interpretation of outcome-specific data*** *for use in planning, implementation, and evaluation of public health practice*."

Communicable Disease Surveillance

Communicable diseases are those that can be transmitted from person to person (or animal to human) via direct contact with body fluids, ingesting contaminated food or water, inhalation of contaminated air, or the bite of an infected insect.

Bacteria, viruses, and parasites are some of the organisms that can cause communicable diseases. Examples of communicable diseases are Hepatitis B, Salmonellosis, Measles.



Preventing and controlling communicable disease is a necessary and critical aspect of assuring community health, and is an affirmative duty of local public health departments.

The "Big Picture"

While health care providers are typically concerned with the health of an individual patient, the focus of public health nurses and epidemiologists is on the "big picture" of health in a community.

A single case of a disease may not cause alarm in a physician's office. However, timely and accurate reporting of communicable disease data allows health department personnel to determine whether this single case may be part of a larger problem in the community. With complete information, health department personnel can check if the disease is related to other cases as part of a cluster or is part of an outbreak (where the number of cases is greater than the number expected during a defined period).

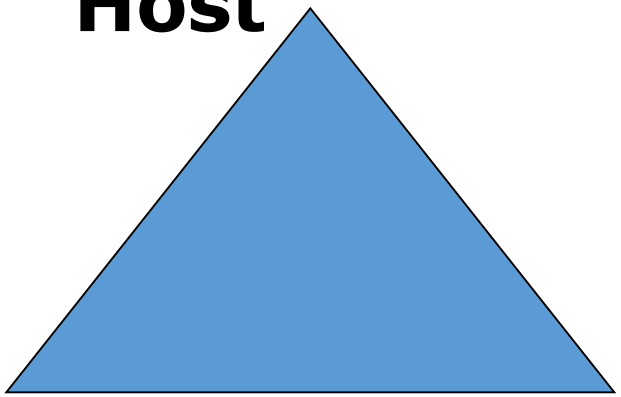
Disease Detectives

Public health nurses and epidemiologists act as detectives who try to connect pieces of a puzzle in solving disease mysteries. These public health professionals monitor disease information to determine if there are more cases of a particular disease than expected.

Epidemiologic triad

- Demographic characteristics
- Biological characteristics
- Socioeconomic characteristics

Host



Agent

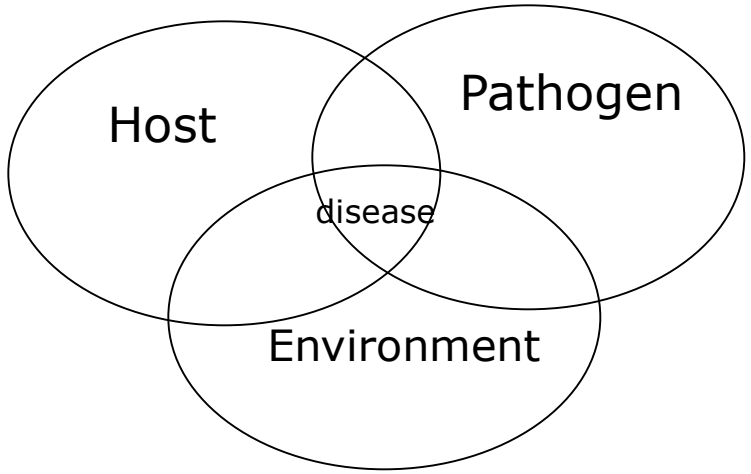
- Biological agents
- Physical agents
- Chemical agents
- Nutrient agents
- Mechanical agents
- Social agents

Environment

- Physical environment
- Biological environment
- Social environment

Communicable Disease Model

- A communicable disease is an illness due to a specific infectious (biological) agent or its toxic products capable of being directly or indirectly transmitted



from man to man, from animal to man, from animal to animal, or from the environment (through air, water, food, etc..) to man.

- **Infection** is the entry and development or multiplication of an infectious agent in the body of man or animals. An infection does not always cause illness.
- There are several levels of infection (**Gradients of infection**):
  - Colonization (S. aureus in skin and normal nasopharynx)
  - Subclinical or unapparent infection (polio)
  - Latent infection (virus of herpes simplex)
  - Manifest or clinical infection

  - **Contamination:** is the presence of an infectious agent on a body surface, on or in clothes, beddings, toys, surgical instruments or dressings, or other articles or substances including water and food.

  - **Infestation:** is the lodgment, development and reproduction of arthropods on the surface of the body or in the clothing, e.g. lice, itch mite. This term could be also used to describe the invasion of the gut by parasitic worms, e.g. ascariasis.

A contagious disease is the one that is transmitted through contact. Examples include scabies, trachoma, STD and leprosy.

Host: A person or an animal that affords subsistence or lodgment to an infectious agent under natural conditions. Types include: an obligate host, definitive (primary) host, intermediate host and a transport host.

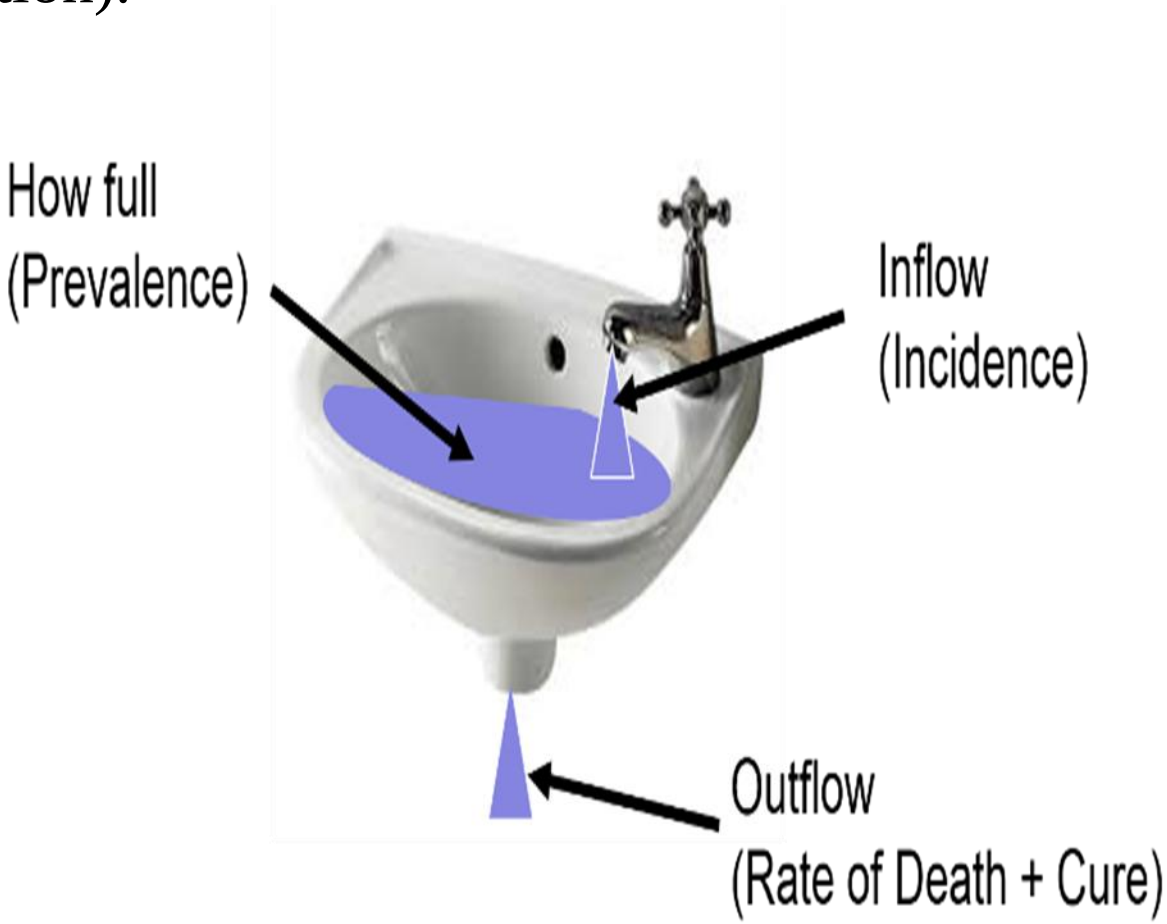
Vector of infection: an insect or any living carrier that transports an infectious agent from an infected individual or its wastes to a susceptible individual or its food or immediate surroundings. Both biological and mechanical transmissions are encountered.

Reservoir: any person, animal, arthropod, plant, soil, or substance, or a combination of these, in which an infectious agent normally lives and multiplies, on which it depends primarily for survival. It is the natural habitat of the infectious agent.

Incidence and prevalence of infectious diseases

Incidence of an infectious disease: number of new cases in a given time period expressed as percent infected per year (or per time of observation).

Prevalence of an infectious disease: number of cases at a given time. Prevalence Is a product of incidence x duration of disease, and is of little interest if an infectious disease is of short duration (i.e. measles), but may be of interest if an infectious disease is of long duration (i.e. chronic hepatitis B).



Epidemic: “The unusual occurrence in a community of disease, specific health related behavior, or other health related events clearly in excess of expected occurrence”
(epi= upon; demos= people). Epidemics can occur upon endemic states too.

Endemic: It refers to the constant presence of a disease or infectious agent within a given geographic area or population group. It is the usual or expected frequency of disease within a population. (En = in; demos = people)

Pandemic: is an epidemic that usually affecting a large proportion of the population, occurring over a wide geographic area such as a section of a nation, the entire nation, a continent or the world, e.g. Influenza or Covid-19 pandemics.

Sporadic: The word sporadic means “scattered about”. The cases occur irregularly, haphazardly from time to time, and generally infrequently. The cases are few and separated widely in time and place that they show no or little connection with each other, e.g. polio, meningococcal meningitis, tetanus…. However, a sporadic disease could be the starting point of an epidemic when the conditions are favorable for its spread.

Zoonosis is an infection that is transmissible under natural conditions from vertebrate animals to man, e.g. rabies, plague, bovine tuberculosis. There are over a 100 zoonotic diseases that can be conveyed from animal to man.

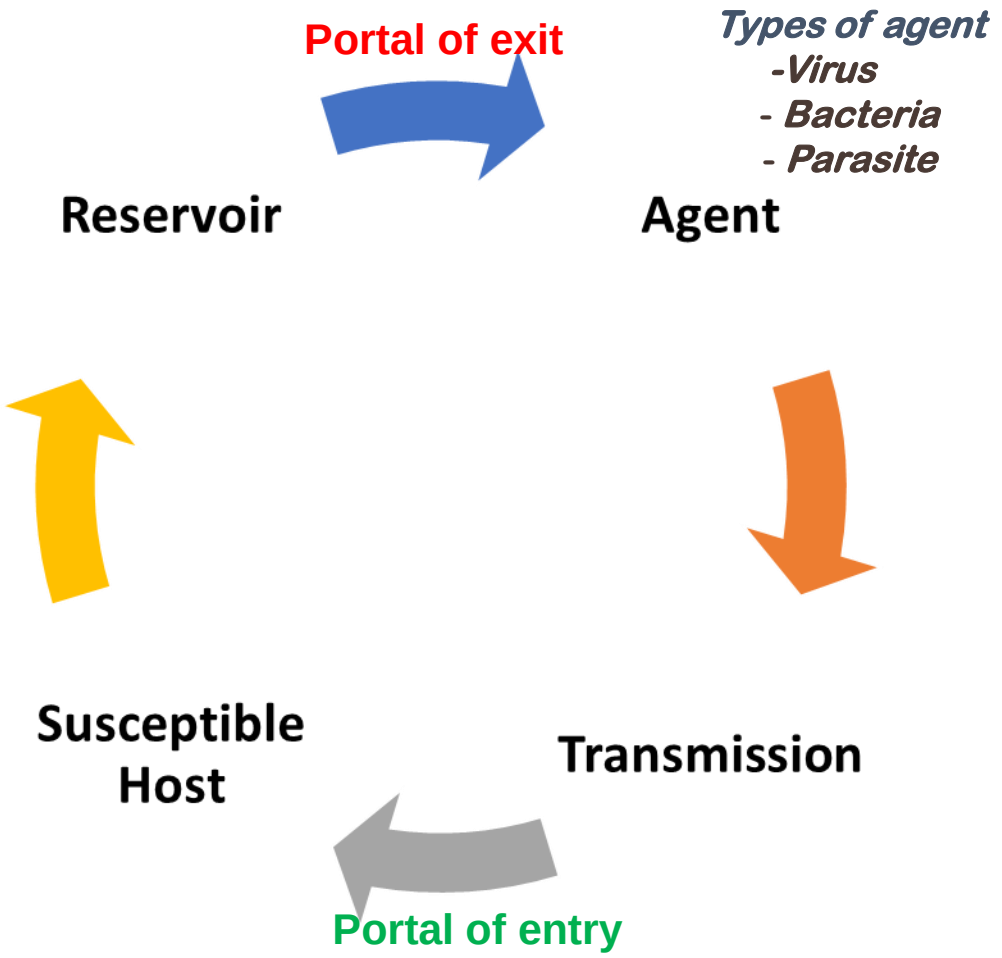
Nosocomial (hospital acquired) infection is an infection originating in a patient while in a hospital or another health care facility. It has to be a new disorder unrelated to the patient's primary condition. Examples include infection of surgical wounds, hepatitis B and urinary tract infections.

Opportunistic infection: is infection by organisms that take the opportunity provided by a defect in host defense (e.g. immunity) to infect the host and thus cause disease. For example, opportunistic infections are very common in AIDS. Organisms include Herpes simplex, Cytomegalovirus, M. tuberculosis.

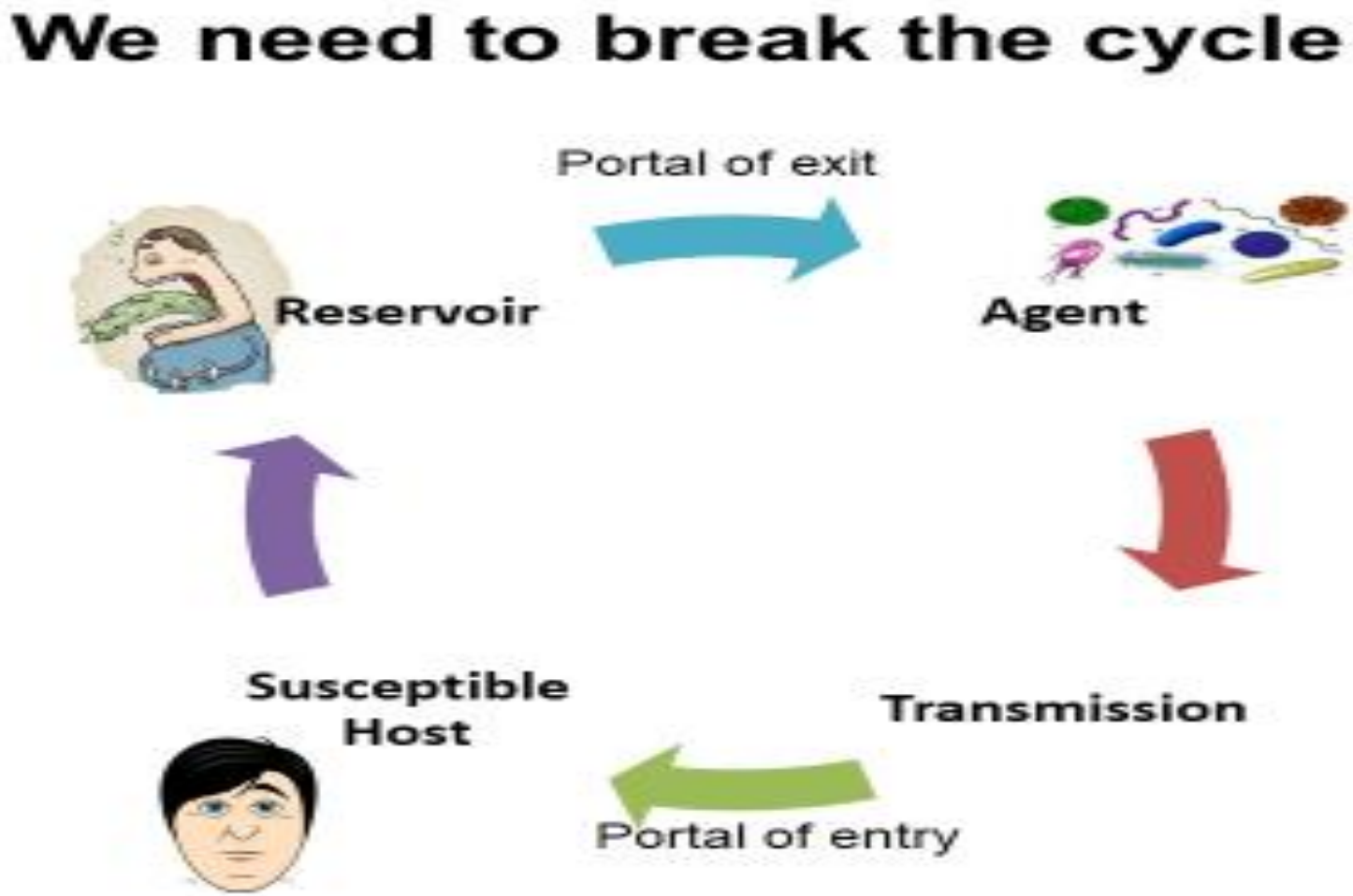
Pre-requisites for transmission of a communicable disease

The six pre-requisites for the transmission of communicable diseases are:

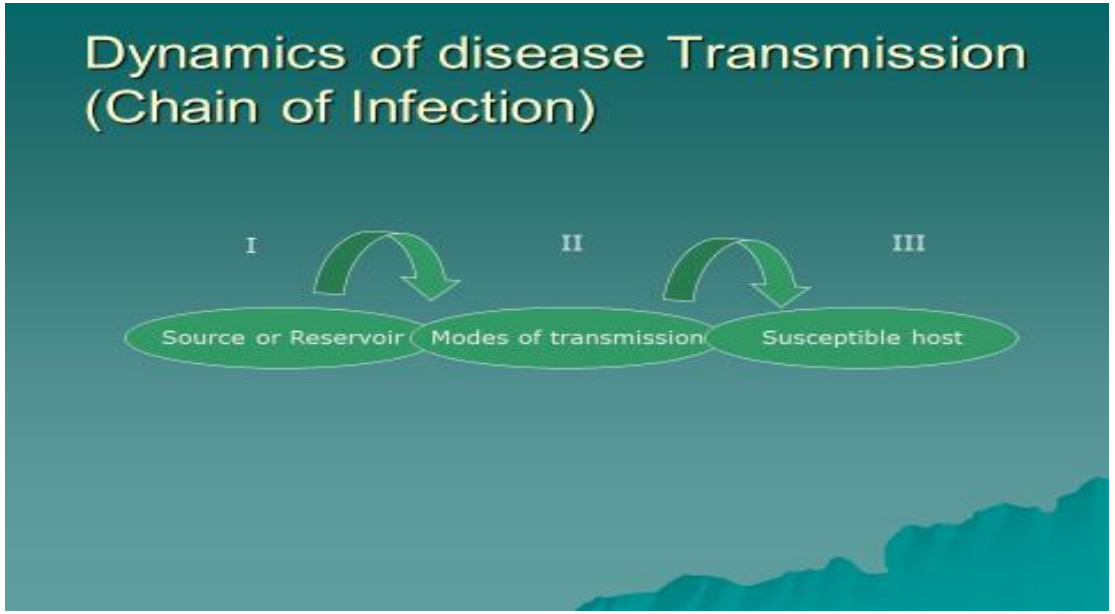
1. Presence of reservoir for infection
2. Presence of microbiological agent
3. Portal of exit through which the microbiological agent leaves the reservoir
4. Mode of transmission
5. Portal of entry (inlet) through which the microbiological enters the host
6. Presence of susceptible host



Prevention and Control of Communicable Diseases



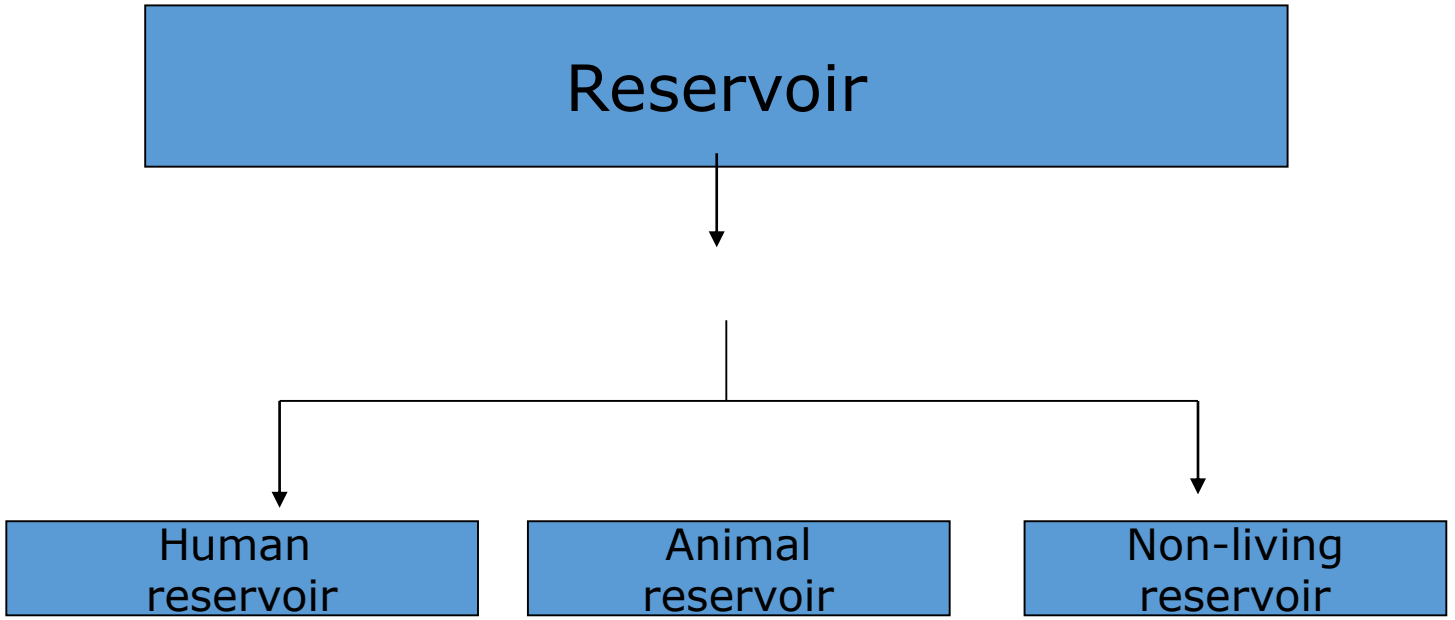
Control: Activities conducted to bring a disease or a health problem at a very low level till it becomes no longer a public health problem.



Elimination: Termination of all modes of transmission to a reduction of the incidence of the disease to the zero in a confined or specific geographic locality as a result of deliberate efforts yet, continued intervention methods are required.

Eradication: Termination of all modes of transmission of infection by extermination of the infectious agent. It is restricted to termination of infection from the whole world.

(I): **Source or Reservoir:** The starting point for the occurrence of a communicable disease is the existence of **a reservoir or source of infection**.



A reservoir is a host that does not experience the symptoms of disease when infected by the pathogen, whereas **A host** show symptoms of the disease. The pathogen still feeds, grows, and reproduces inside a reservoir host, but otherwise does not significantly affect its health; the relationship between pathogen and reservoir is more or less commensal.

(II) The Mode of Transmission

1. Direct Transmission

- Direct contact
  - skin-to-skin
  - e.g. STDs
- Droplet spread
  - spray with droplet over a few feet
  - e.g. pertussis,

2. Indirect Transmission

- Airborne
  - droplet nuclei or dust suspended in air
- Vehicle
  - food, water, biological products, fomites
- Vector
  - insects
  - may support growth or change to the agent

(III) A host is a person or other living animal, that affords living conditions suitable for the growth of an infectious agent

Susceptibility to infection is universal but susceptibility to disease depends on:
1-Immunity
2-Dietary and nutritional factors
3-Genetic factors

Infectious (communicable) period: length of time a person can transmit disease (sheds the infectious agent).

Incubation period: time from exposure to development of disease. In other words, the time interval between invasion by an infectious agent and the appearance of the first sign or symptom of the disease in question.

Latent period: the period between exposure and the onset of infectiousness (this may be shorter or longer than the incubation period).

Cases : A case is defined as “a person in the population or study group identified as having the particular disease, health disorder, or condition under investigation”.

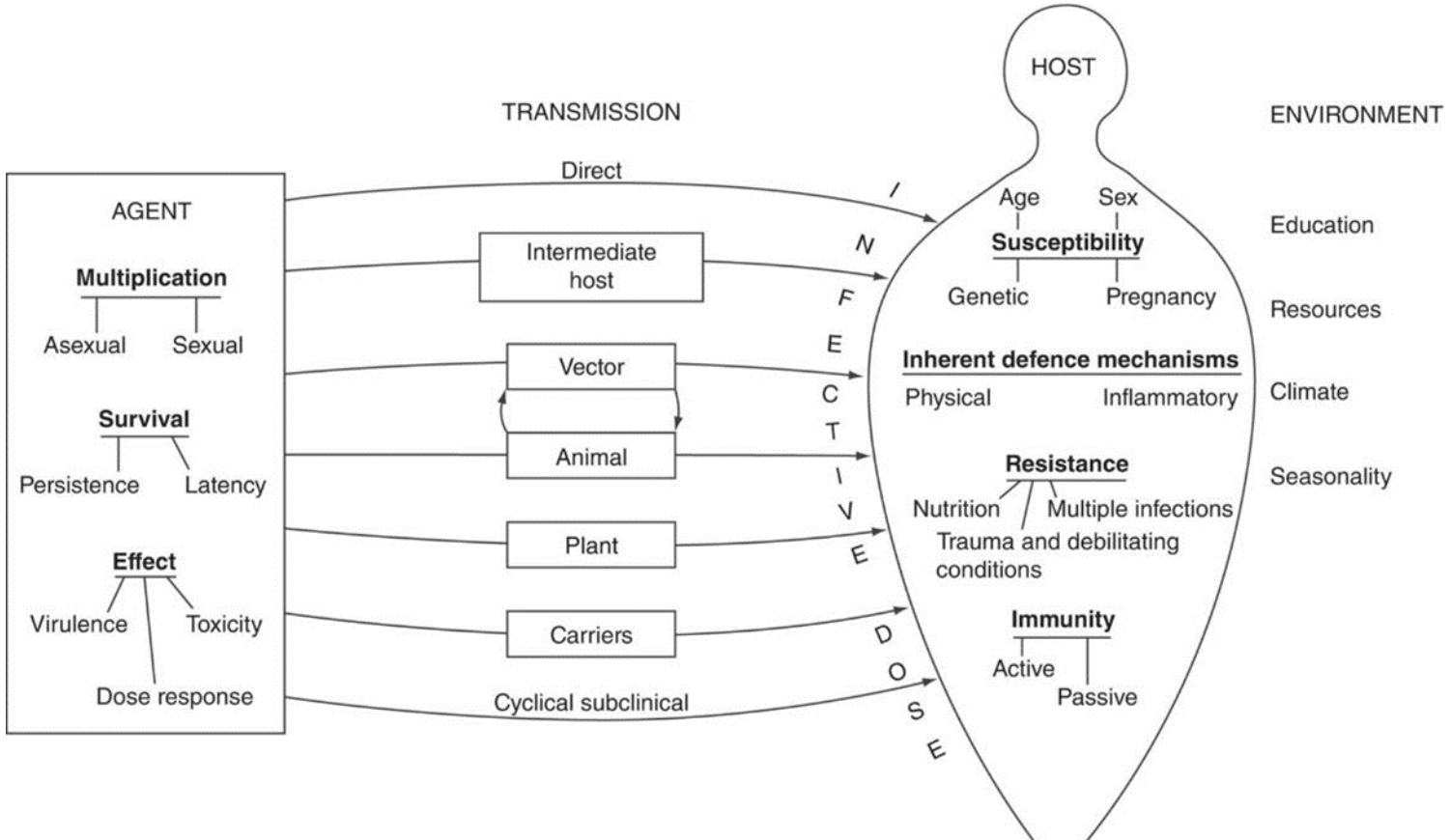
Carrier: It occurs either due to inadequate treatment or immune response, the disease agent is not completely eliminated, leading to a carrier state.

It is “an infected person or animal that harbors a specific infectious agent in the absence of visible clinical disease and serves as a potential source of infection to others.

Three elements have to occur to form a **carrier state**:

The presence in the body of the disease agent.
The absence of recognizable symptoms and signs of disease.
The shedding of disease agent in the discharge or excretions.

THANK YOU!


HOST
TRANSMISSION
ENVIRONMENT
AGENT
Multiplication
Asexual
Sexual
Survival
Persistence
Latency
Effect
Virulence
Toxicity
Dose response
Direct
Intermediate host
Vector
Animal
Plant
Carriers
Cyclical subclinical
INFECTIVE DOSE
Age
Sex
Susceptibility
Genetic
Pregnancy
Inherent defence mechanisms
Physical
Inflammatory
Resistance
Nutrition
Multiple infections
Trauma and debilitating conditions
Immunity
Active
Passive
Education
Resources
Climate
Seasonality