Principles of Communicable Diseases Epidemiology-1

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Objectives

- **Definition of communicable diseases**
- **Importance of studying communicable diseases epidemiology**
- **Terminology**
- **Dynamics of disease transmission (chain of infection):**
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  - **Human reservoir or source**
  - **Modes of transmission**
  - **Susceptible host**

Importance of Studying Communicable Diseases Epidemiology

- **Changes of the pattern of infectious diseases**
- **Discovery of new infections**
- **The possibility that some chronic diseases have an infective origin.**

Why Communicable Diseases are important to any health system?

1- Continuous presence
2- Eradicated
3- Re-Emerging
4- Emerging (New)

Infection

- **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 inapparent infection (polio)

– Latent infection (virus of herpes simplex)

– Manifest or clinical infection

What are the factors influence the development of several levels of infection ?

AGENT FACTORS

HOST FACTORS

AGENT FACTORS

Are related to the:

NUMBER (DOSE OF INFECTION)

Infectious dose (ID) is the amount of pathogen (measured in number of microorganisms) required to cause an infection in the host

Usually it varies according to the pathogenic agent and the consumer's age and overall health.

Infectious doses for some known microorganisms

Vibrio cholera relatively large (10_4 - 10_6 organisms)

Ebola virus 1 – 10 aerosolized organisms are sufficient to cause infection in humans

Salmonella typhi 100,000 organisms

PATHOGEN CITY

Which is the property of an infectious agent that determines the extent to which obvious disease is produced in an infected population, or the power of organism to produce disease.

The ability to induce clinically apparent illness.

VIRULENCE

Means the speed with which an infectious agent kills the host.

The case fatality rate is one way of measuring virulence.

Case fatality rate for infectious diseases: is the proportion of infected individuals who die of the infection.

This is a function of the severity of the infection and is heavily influenced by how many mild cases are not diagnosed.

INVASIVENESS & TOXICITY

INVASIVENESS is the power of the organism to penetrate into the body fluids and tissues of the host to live and multiply.

Toxicity

Could be defined as measure of ability of organism to affect clinical reaction by chemical substances which it produces.

Toxins produce by pathogens are either retained within their bodies and liberated after degeneration of the organisms, and are called ENDOTOXIN; or are released during the life of the organisms and are called EXOTOXIN.

TISSUE SELECTIVITY (TROPISM)

It is the inherent capacity of pathogens to invade some particular tissues.

This is the factor that give each disease its characteristics symptoms & signs.

ANTIGENIC CHARACTER AND ANTIGENICITY

Antigenicity is measure of ability of organism to stimulate an immunologic response in the host.

Viability

The viability of pathogen is the ability to live and the period of living outside the body.

SUSCEPTIBILITY TO CHEMOTHERAPY AND ANTIBIOTICS

Host Factors In Causation Of Disease

The HOST is defined as " Any susceptible man or animal potentially exposed to be parasitized by infective organisms".

The host factors in causation of diseases are factors , specific for the host , important For :

- **Occurrence**
- **Type**
- **Spread**
- **Severity of infection**

THEY INCLUDE :

- Resistance & immunity
- Genetic factors
- Social & habitual factors
- Physiological factors
- Age factors
- Sex factors

CONTAGIOUS DISEASE

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

COMMUNICABLE DISEASES

- **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.**

LATENT INFECTION

- **The host doesn’t shed the infectious agent which lies dormant within the host without symptoms. Ex., latent infection occurs in herpes simplex.**

IN APPARENT INFECTION

The presence of infection in a host without recognizable clinical signs or symptoms.

In apparent infections are identifiable only by laboratory means such as a blood test or by the development of positive reactivity to specific skin tests.

contamination

- **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.**

Incubation and Latent periods

- **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).

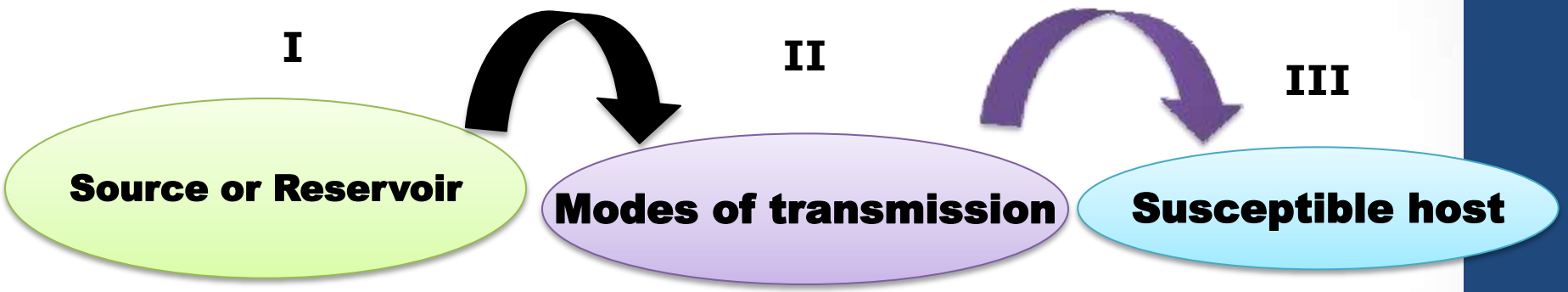
Median incubation period:

The time required for 50% of the cases to occur following exposure.

The factors which determine the incubation period

- **The generation time of the pathogen**
- **Infective dose**
- **Portal of entry**
- **Individual Susceptibility**

Dynamics of disease Transmission (Chain of Infection)



Factors for development or spread of infectious disease

- An etiological **AGENT** responsible for the disease should be present.
- There should be a **RESERVOIR** or carrier for the etiological agent to survive (**SOURCE**)
- The infecting agent should be able to **ESCAPE** from the reservoir of infection through the **PORTAL OF EXIT**

- **There should be a possible source of ENTRY to transmit the agent to a new SUSCEPTIBLE HOST**
- **The agent should be able to INVADE the new host**
- **The host should be susceptible**

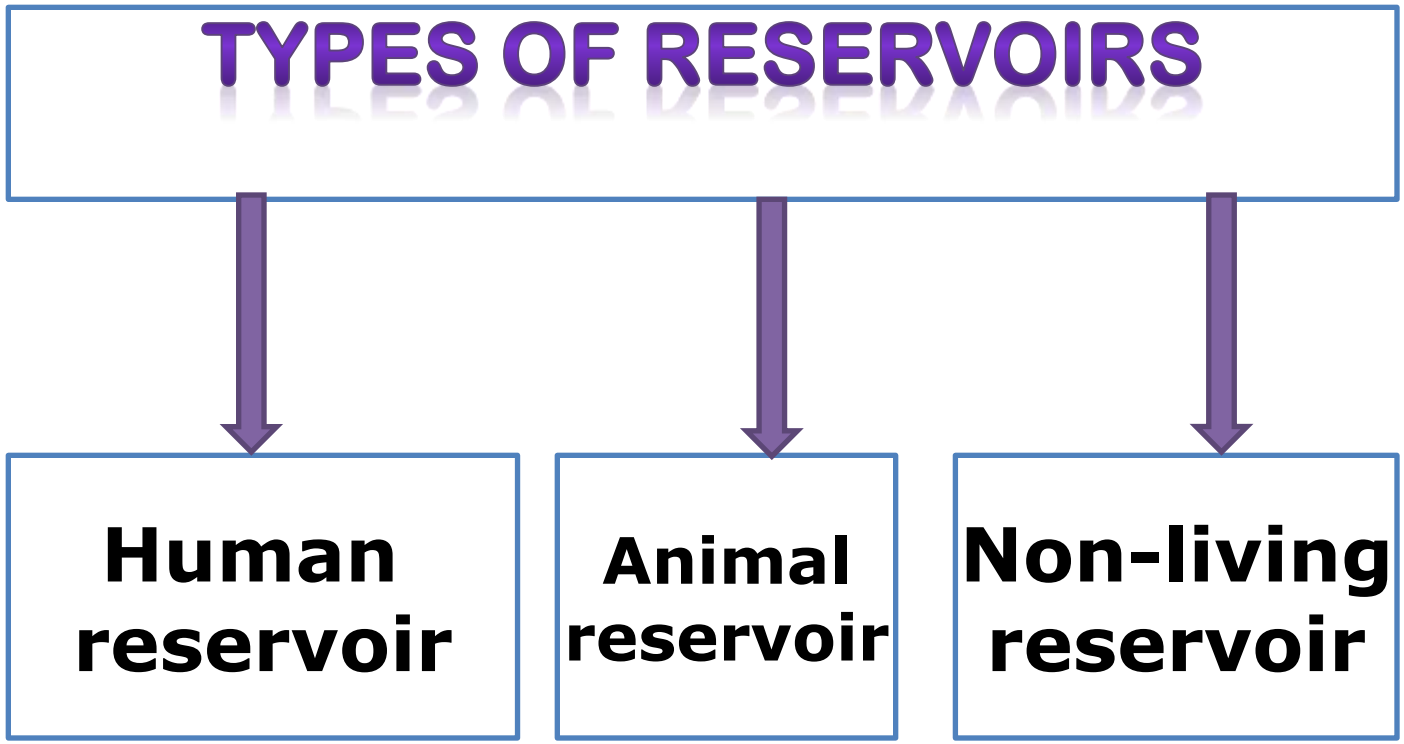
SOURCE & RESERVOIR

The starting point for the occurrence of a communicable disease is the existence of a reservoir or source of infection.

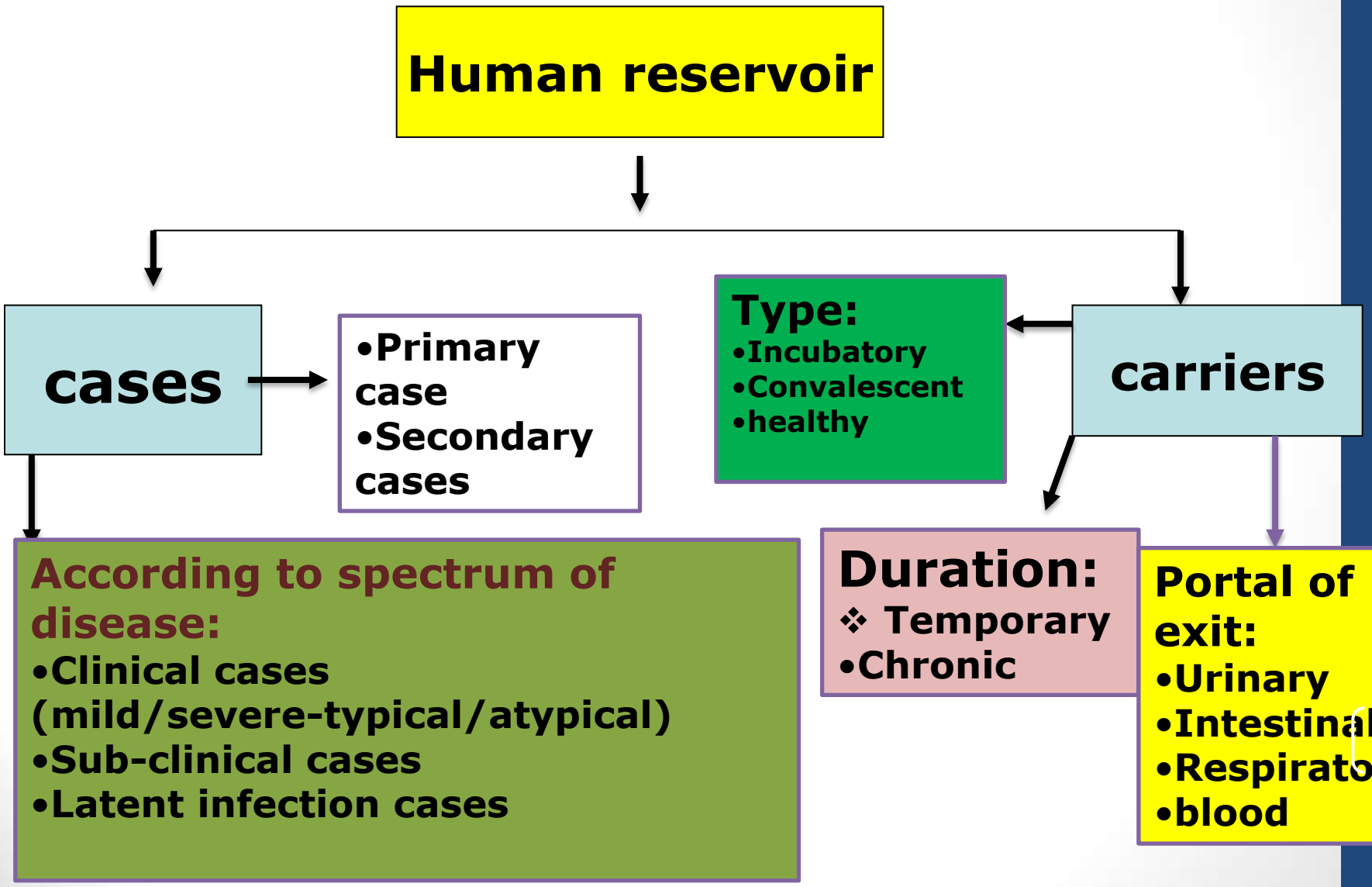
The source of infection is defined as "the person, animal, object or substance from which an infectious agent passes or is disseminated to the host (immediate source).

- **Reservoir is defined as "any person, animal, arthropod, plant, soil, or substance (or combination of these) in which an infectious agent lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such manner that it can be transmitted to a susceptible host".**

- **In short, it is the natural habitat of the organism.**


TYPES OF RESERVOIRS
Human reservoir
Animal reservoir
Non-living reservoir

HUMAN RESERVOIR



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". The case may be clinical, subclinical, or latent.**

cases shows manifestation of disease, are infectious for varied period of time, according to the nature of disease, and whether specific therapy available and given or not.

Some days only – Influenza, common cold, measles.

Some weeks or few months – Pertussis, viral hepatitis (all types)

Long period of infectivity – chronic infectious diseases as syphilis, AIDS, TB, B, C hepatitis.

INDEX CASE

PRIMARY CASE

- Refers to the first case of a communicable disease introduced into the population.

SECONDARY CASES

- Are those developing from contact with primary case.

CARRIERS:

A carrier is an apparently healthy person who is infected and harbors a pathogenic organism in his body, with out showing the manifestations of disease, but can spread infection.

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

Three elements have to occur to form a carrier state:

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

Why carriers are important from epidemiology point of view ?

ANIMAL RESERVOIRS

- **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 carried from animal to man.**

RESERVOIR IN NON-LIVING THINGS

Many of the agents are basically saprophytes living in soil and fully adapted to live freely in nature.
Biologically, they are usually equipped to withstand marked environmental changes in temperature and humidity.

RESERVOIR IN NON-LIVING THINGS

- **Clostridium botulinum etiologic agent of Botulism.**
- **Clostridium tetani etiologic agent of Tetanus.**

- **Clostridium welchi etiologic agent of gas gangrene.**