

# Epidemiology

## L III

16-10-2023

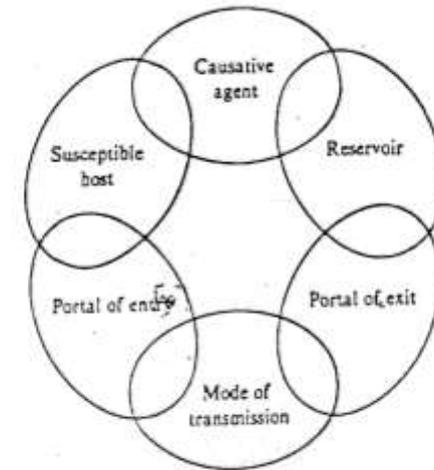


FIGURE 1.2 The chain of infection. Components of the infectious disease process.

# Infectious process

*Sources and reservoir*

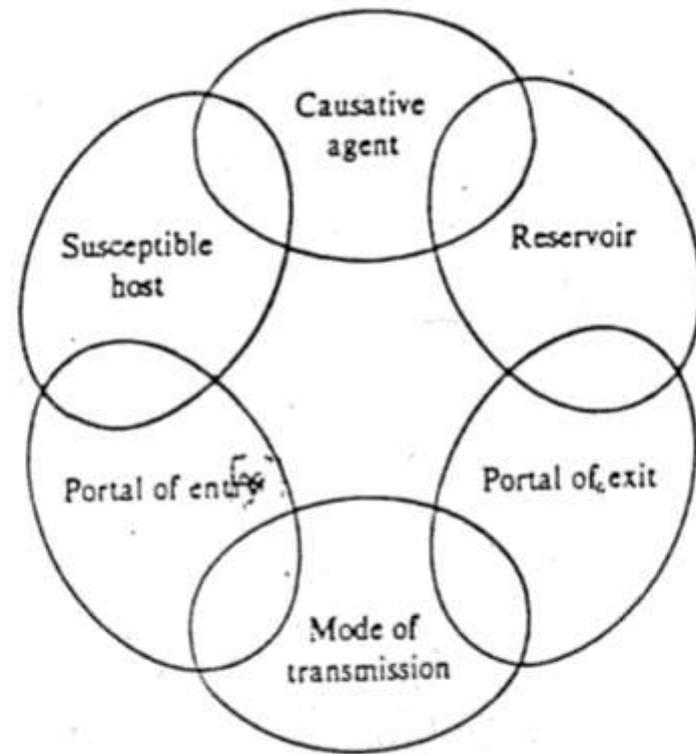


FIGURE 1.2 The chain of infection. Components of the infectious disease process.

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## **(2) RESERVOIR OF INFECTION**

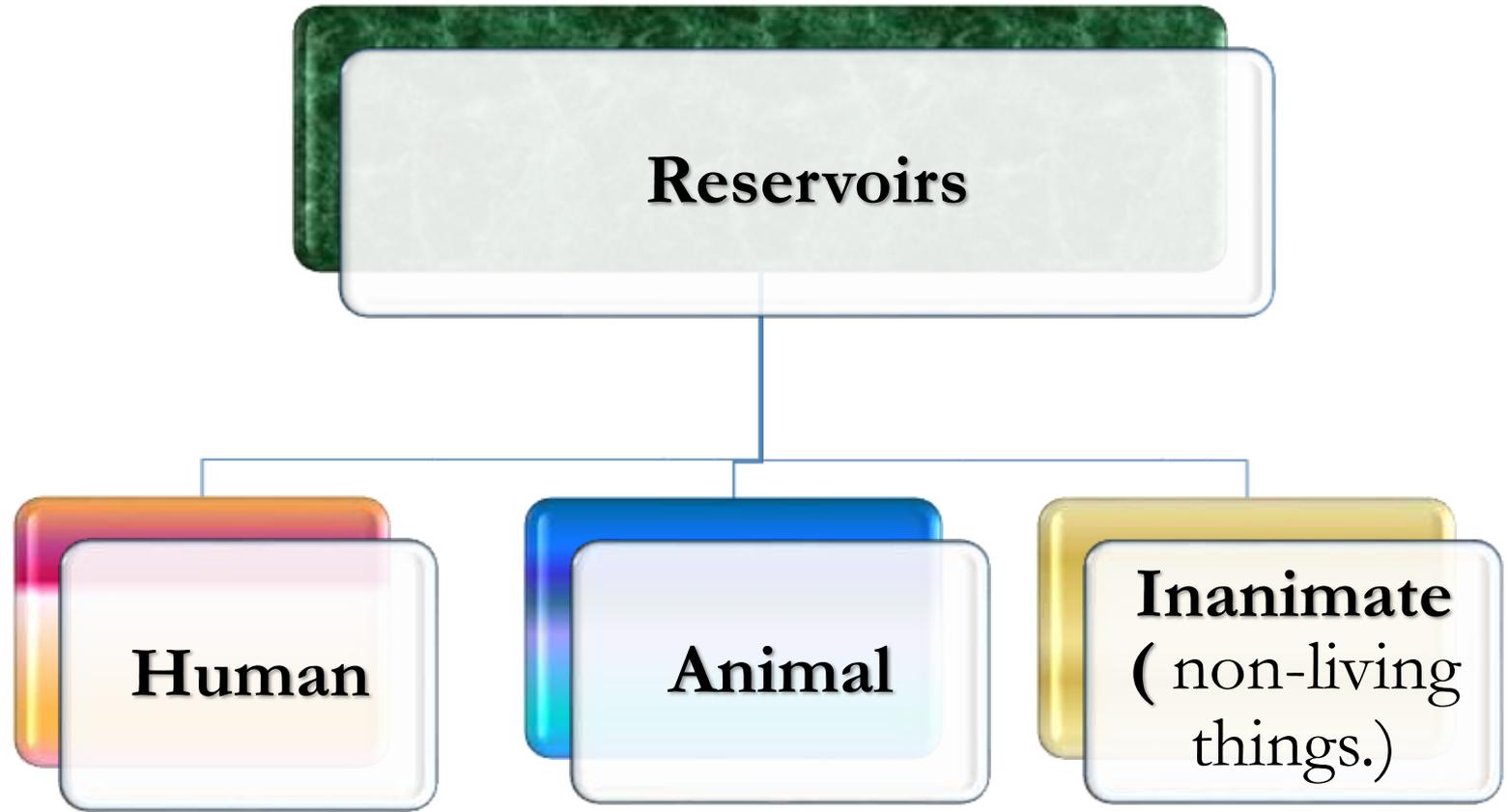
## Sources and reservoir

- ❖ **Existence of a reservoir or source** of infection is the **starting point for** the occurrence of a communicable disease
- ❖ source of infection is **defined as** “  
the **person, animal, object or substance** from which an infectious **agent passes** or is *disseminated to the host*”
- ❖ A 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, the **reservoir** is the **natural habitat** in which the **organism metabolizes and replicates.**

The reservoir may be of **three types** :

1. **Human reservoir**
2. **Animal reservoir, and**
3. **Reservoir in non-living things**

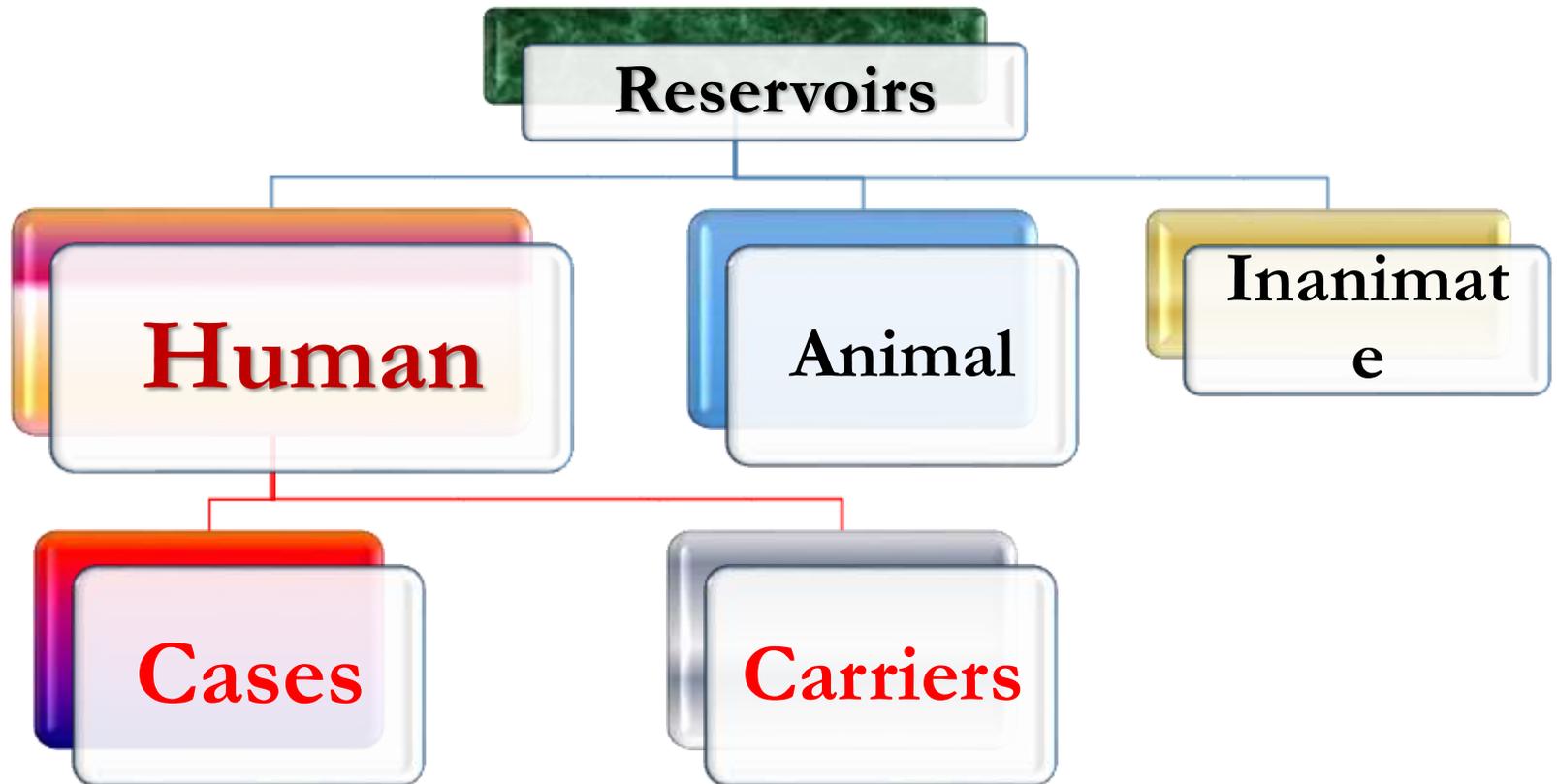


# 1. Human reservoir

Is the **most important source** or **reservoir** of infection for humans is man himself.

He may be a **case** or **carrier**.

Man is often described as his own enemy



# 1. Human reservoirs of infection:

## A. Cases:

defined as "a **person in the population or study group** identified as having the **particular disease, health disorder or condition under investigation**"

**A variety of criteria** (e.g., clinical, biochemical, laboratory) may be **used to identify cases**.

Broadly, the presence of infection in a host **may be**

- **Clinical,**
  - **Subclinical or**
  - **Latent.**
- are potential sources of infection,**

Whatever may be the "gradient of infection", all infected persons, whether clinical or subclinical, **are potential sources** of infection, because the disease agent is leaving the body through frequent stools, vomiting, coughing, sneezing or other means and is potentially available for transfer to a new host.

## The clinical illness

- may be mild or moderate,
  - typical or atypical,
  - severe or fatal.
- Epidemiologically, **mild cases** may be **more important sources of infection** than **severe cases** because they are
- ambulant and spread the infection wherever they go,
  - ✓ **whereas** severe cases are usually confined to bed

## The subclinical cases

unapparent, covert, missed or abortive cases.

- The disease **agent may multiply** in the host **but**
- **does not manifest** itself by **signs and symptoms**.
- The **disease agent is, contaminates** the environment in the same way as clinical cases.
- **contribute more** than **symptomatic patients** to the transmission of infection to others
- The persons **unbeknown to themselves & others**
- Subclinical cases play **a dominant role in maintaining the chain of infection in the community (endemicity)**.
- **detected** only by **laboratory tests**, e.g., **organism, antibody response, biochemical**



## *latent infection*

- ❑ must be **distinguished** from subclinical infection.
- ❖ In **latent** infection, the host does **not shed** the infectious agent which lies **dormant** within the host
- **without symptoms** (and often **without** demonstrable **presence in blood, tissues or bodily secretions** of the host). *For example, latent infection occurs in herpes simplex,*
- latent infection play **great role** in the **perpetuation** of **certain infectious**

cases in epidemiological e havdifferent terminology

In epidemiological terminology,

□ **Primary case:**

is the **first case** of a **communicable disease introduced into the population unit** being studied.

□ **index case**

Is the **first case** to **come to the attention of the investigator;**  
it is not always the primary case.

□ **Secondary cases**

are those **developing from contact with primary case.**

□ **A suspect case**

- is an **individual** (or a group of individuals) who **has** all of
- the **signs and symptoms** of a disease ,**yet has**
- **not been diagnosed** as having the disease or had the cause of the symptoms connected to the suspected pathogen

## b. Carriers

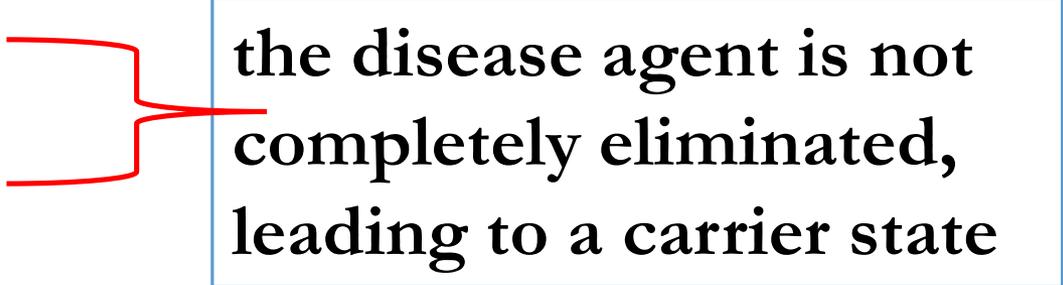
"an infected **person** or **animal** that **harbours** a specific infectious agent in the **absence** of discernible **clinical disease** and **serves as a potential source** of infection for others"

- ❖ As a rule carriers are **less infectious** than cases, but
- ❖ **epidemiologically**, they **are more dangerous** than cases
  - because they **escape recognition**, and
  - continuing as they do to live a normal life among the population or community, and **infect the susceptible individuals over a wider area and longer period** of time, under favourable conditions.

**The elements in a carrier state are :**

- (a) the **presence** in the body of the **disease agent**
- {b) the **absence of** recognizable **symptoms** and signs of disease, and
- (c) the **shedding** of the disease **agent** in the discharges or excretions, **thus acting as a source of infection** for other

In some diseases, either **due to**  
**inadequate treatment** or  
**immune response,**



the disease agent is not completely eliminated, leading to a carrier state



## Carriers may be classified as below

### **A. Type Chronologically**

- (a) incubatory
- (b) Convalescent
- (c) Healthy

### **C. Portal of exit**

- (a) Urinary
- (b) Intestinal
- (c) Respiratory
- (d) Others

### **B. Duration**

- (a) Temporary
- (b) Chronic

## Carriers classified

### A. Type Chronologically

- (a) incubatory
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### (a) Incubatory Carriers :

- those who **shed** the infectious **agent** during the
- **incubation period** of disease.
- **infecting others** before the onset of illness.
- usually occurs **during the last few days** of the IP

e.g., *measles, mumps, polio, pertussis, influenza, diphtheria, HAV and HBV*

### (b) Convalescent Carriers :

- ❖ those who **continue** to **shed the disease agent** during the **period of convalescence**, e.g., *typhoid fever, dysentery cholera, diphtheria and whooping cough*.
- ❖ **In these diseases, clinical recovery does not coincide** with bacteriological recovery.

*a serious threat to the unprotected household members and those in the*





Con. ...., Convalescent Carriers

*a serious threat to the unprotected household members and those in the immediate environment, as in the case of a typhoid fever patient who may excrete the bacilli for 6-8 weeks.*

➤ *This highlights the importance of bacteriological surveillance of carriers, after clinical recovery*

**C. Contact carrier:**

with an infected persons like doctors or nurses, usually transient type (common in cholera, typhoid)

## (D) Healthy Carriers :

Healthy carriers **emerge from subclinical cases**.

They are **victims of subclinical infection** who have developed carrier state **without suffering from overt disease**,

but are nevertheless **shedding** the disease agent,

e.g., *poliomyelitis, cholera, meningococcal meningitis, salmonellosis, and diphtheria*.

❑ **subclinical infected person may or may not be a carrier.**

❖ e. g in **polio the infection** may remain subclinical and the person may **act as a temporary carrier** by virtue of **shedding** the organism.

❖ On the other hand, in **tuberculosis**, most persons with **positive tuberculin test** do not actively disseminate tubercle bacilli and therefore are not labelled as carrier.

- B. Duration**  
(a) Temporary  
(b) Chronic

## According to duration of carriage:

### **A. Transient carriers:**

persons harbor and excrete the organisms **up to weeks**)

### **B. Temporary carriers;**

Shed the infectious agent for **short periods** of time. (**<3 months**),  
included the **incubatory, convalescent and healthy carriers**

### **C. Chronic carriers:**

A chronic carrier is one who **excretes** the infectious agent  
**for indefinite periods.** (>3 months, .>one year )

The duration of the carrier state varies with the disease.

*In typhoid fever and hepatitis B, the chronic carrier state  
may last for several years;*

The longer the carrier 

- ❖ The longer the carrier state, the greater the risk to the community
- ❖ Some carriers excrete the infectious agent only **intermittently** and some **continuously**.  
Chronic carriers are **far more important sources of infection than cases**
- ❖ Therefore their **early detection** and **treatment** are essential to limit the spread of infection

**D. Permanent carriers: (for life)**

### C. Portal of exit

- (a) Urinary
- (b) Intestinal
- (c) Respiratory
- (d) Others

### C. Portal of exit :

- urinary carriers,
- intestinal carriers,
- respiratory carriers,
- nasal carriers, etc.
- Skin eruptions, open wounds and blood are also portals of exit.

*portal of exit and the occupational status of the carrier are important epidemiological considerations.* In **typhoid fever**

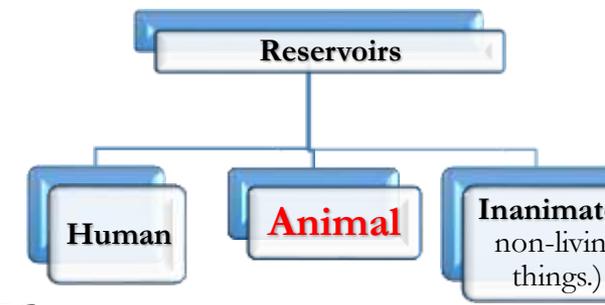
### Carriers are dangerous because:

1. They do not show any clinical manifestation
2. The carrier and his contacts are not aware of their conditions
3. It is difficult to discover them
4. It is not always possible to deal with them
5. The long period of carriage in some diseases.

## 2. Animal reservoir

Animal can act as reservoirs whether as **diseased** or **carriers**.

*examples are rabies, yellow fever and influenza.*



*The role of pigs and ducks in the spread of epidemic and pandemic influenza both as reservoirs, carriers a*

**Zoonosis:** infectious disease transmissible under normal conditions from **vertebrate animate to man**.

**Examples:**

*Cattle in Bovine T.B.*

*Goats in Brucellosis.*

*Dogs in Rabies*

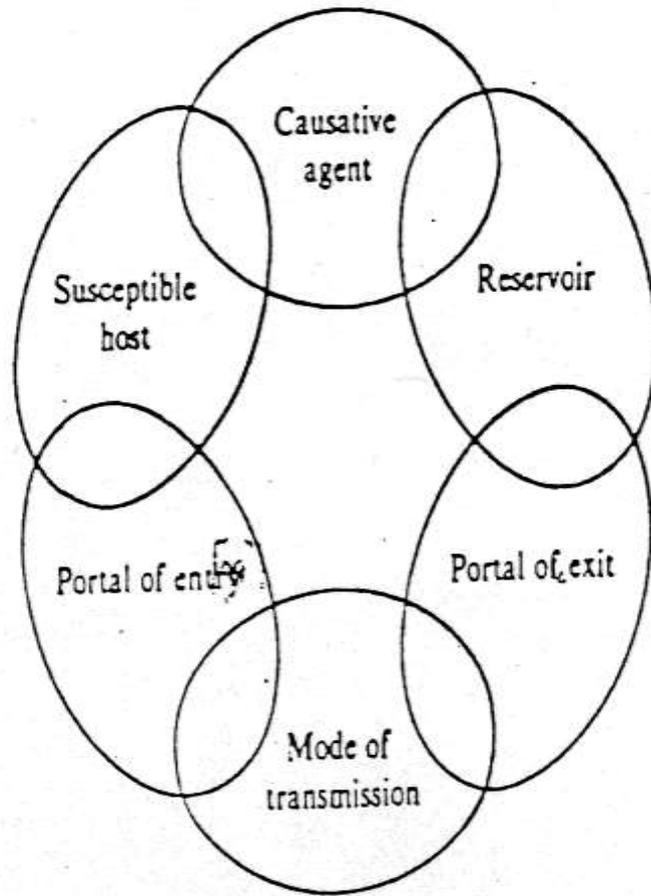
*Rats in plague*

*Mice, rodents, ducks and cows  
in Salmonella*

*Monkeys in :Yellow fever*

## 3. Reservoir in non-living things

**Soil and inanimate** matter can also act as reservoirs of infection. *example, soil may harbour agents that cause tetanus, anthrax,*



**(3) PORTAL OF EXIT**

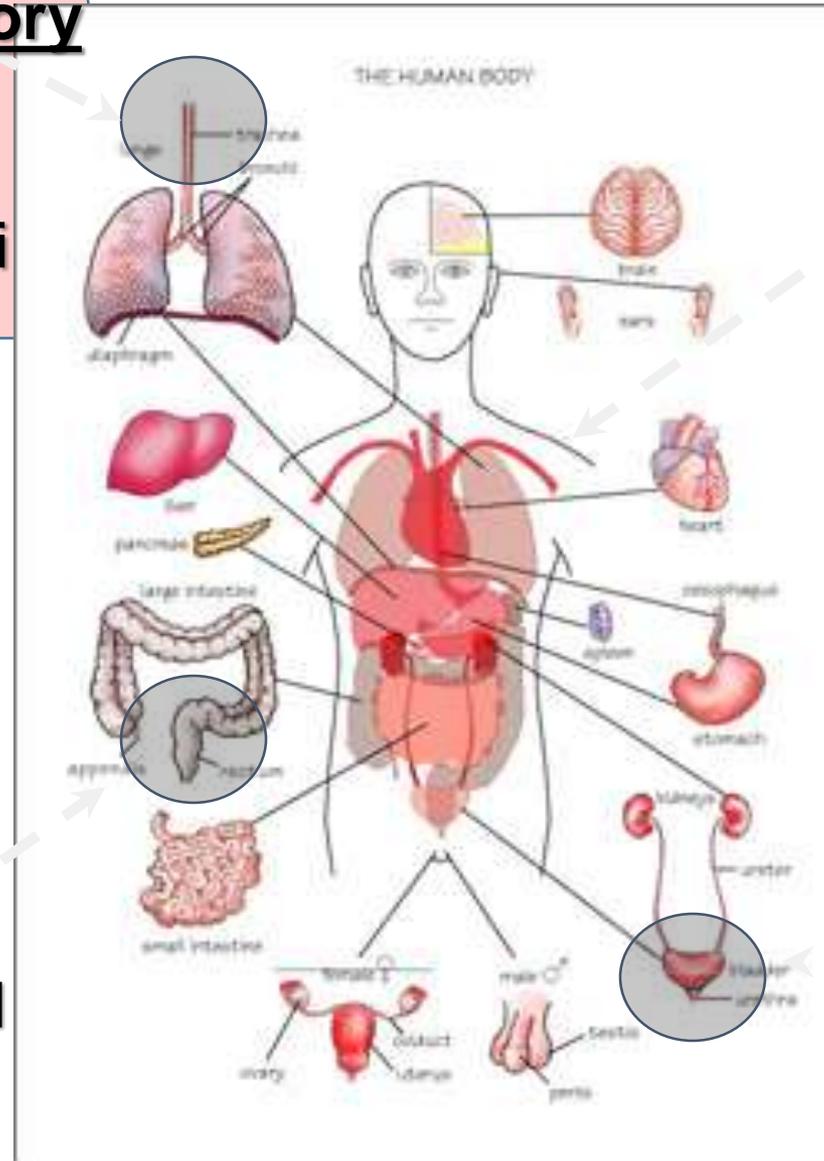
FIGURE 1.2 The chain of infection. Components of the infectious disease process.

## Upper respiratory

- Diphtheria
- Streptococci
- Meningococci

## Skin & mucous membrane

- Staphylococci



## Feecal

- Typhoid
- Paratyphoid
- Cholera
- Hepatitis

## Urinary

- Typhoid
- Paratyphoid

# Portal Of Exit

The modes of exit from reservoirs are:

## 1. Alimentary canal:

- In **feces** as typhoid, paratyphoid, cholera,
- In **vomit** as in cholera

*In certain diseases where the primary sites of infection is the bowel, the organisms will pass through the feces e.g.. polio (affects CNS) and hepatitis A.*



## 2. Respiratory tract:

- organisms will leave the body **via the mouth and nose** in
- **coughing, sneezing, laughing or even talking.**

*Examples: in measles. Whooping cough, diphtheria, streptococcal sore throat, influenza, common cold, mumps, etc.*

### 3. Urinary tract:

- ✓ This occurs in some diseases where infection is general
- ✓ and organisms are found in blood.

*Examples: typhoid, bilharziasis ,genito-urinary tract*

### 4. Discharges from skin & mucous lesions

Discharges from mucous membrane as in

- purulent conjunctivitis and
- venereal diseases.

### 5. Insect bites

- Mosquitoes: malaria.
- Lice; typhus
- Fleas: plague.

6. Syringes and taking blood from donors; viral hepatitis & AIDS.

7. In-utero passage (trans-placental): as in AIDS, Syphilis and German measles.

Thank You

*Thank You*

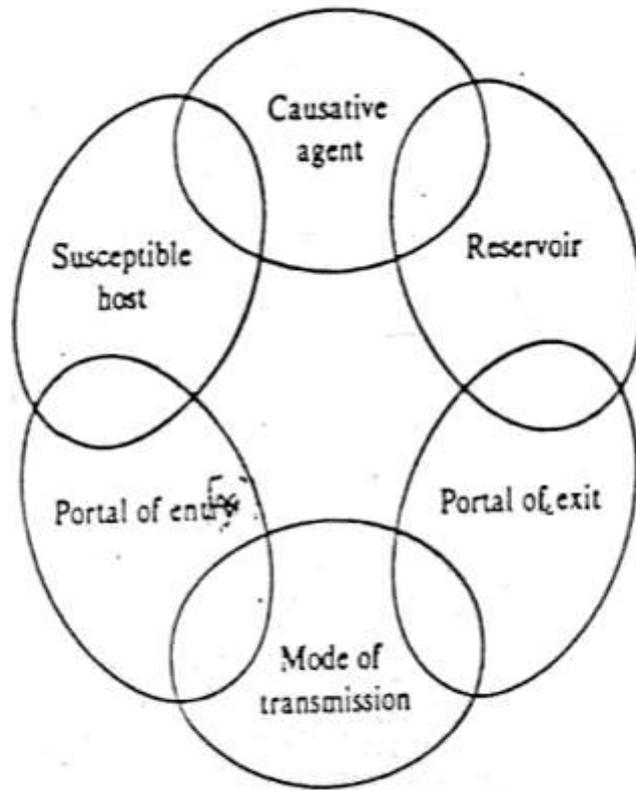


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## **(4) MODES OF TRANSMISSION**