Dynamics Of Disease Transmission

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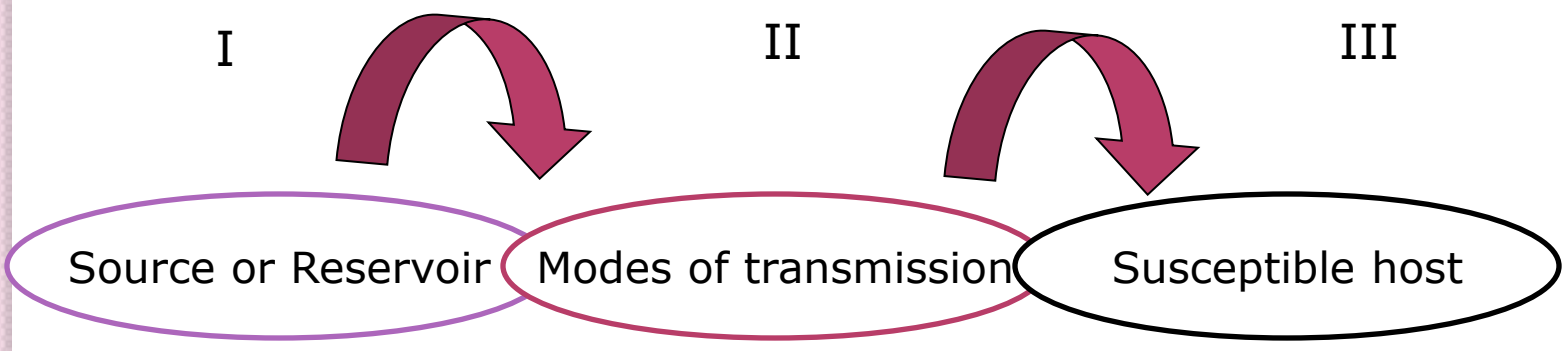
Introduction

- Communicable diseases are transmitted from the reservoir/source of infection to susceptible host.
- Basically there are three links in the chain of transmission,
- viz, the reservoir, modes of transmission and the susceptible host.

Dynamics of disease Transmission (Chain of Infection)



(I): Source or 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).

Sources or reservoir

- Starting point of communicable diseases

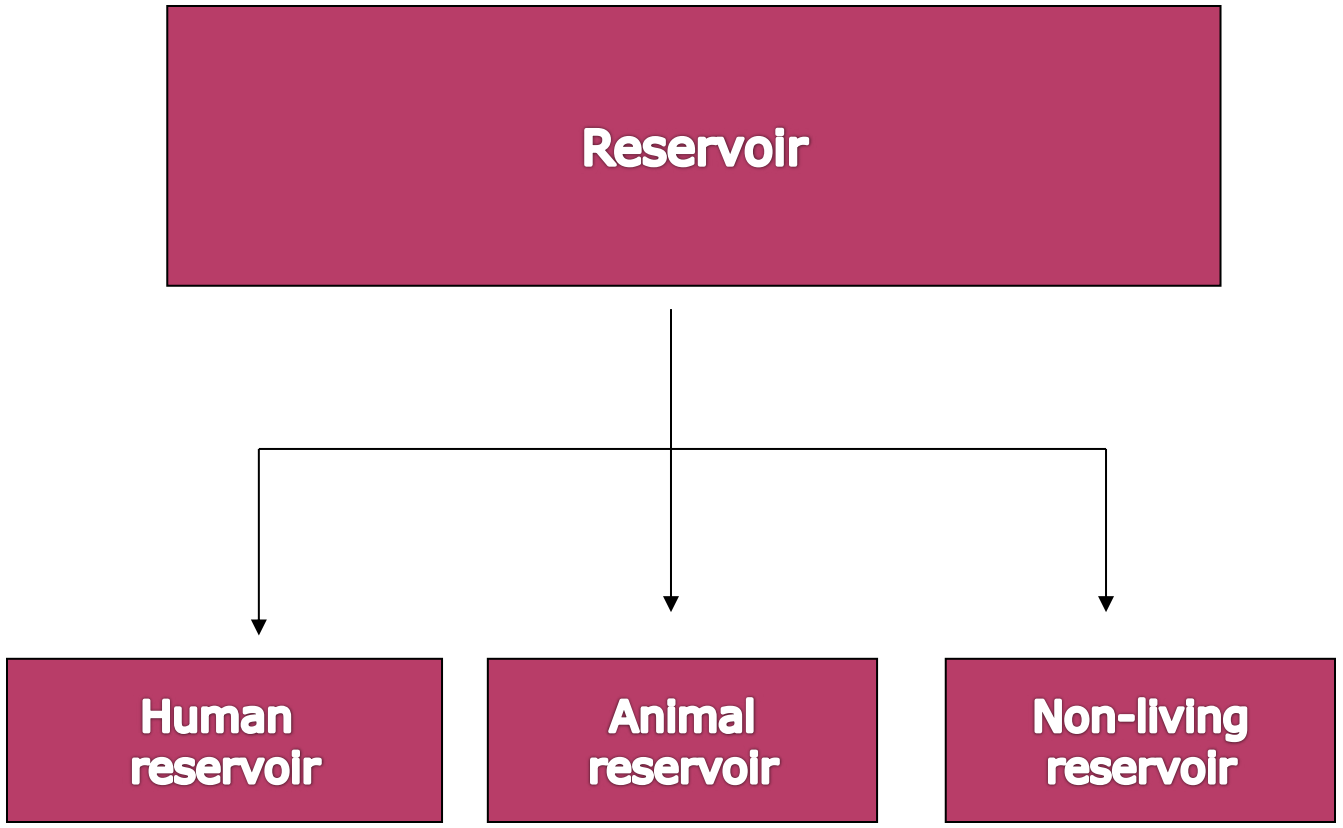
- The reservoir is “any person, animal, arthropod, plant, soil, or substance, or a combination of these, in which an infectious agent normally lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such a manner that it can be transmitted to a susceptible host. It is the natural habitat of the infectious agent.”

- The terms reservoir and source are not always synonymous.
- For example, in hookworm infection, the reservoir is man, but the source of infection is the soil contaminated with infective larvae.

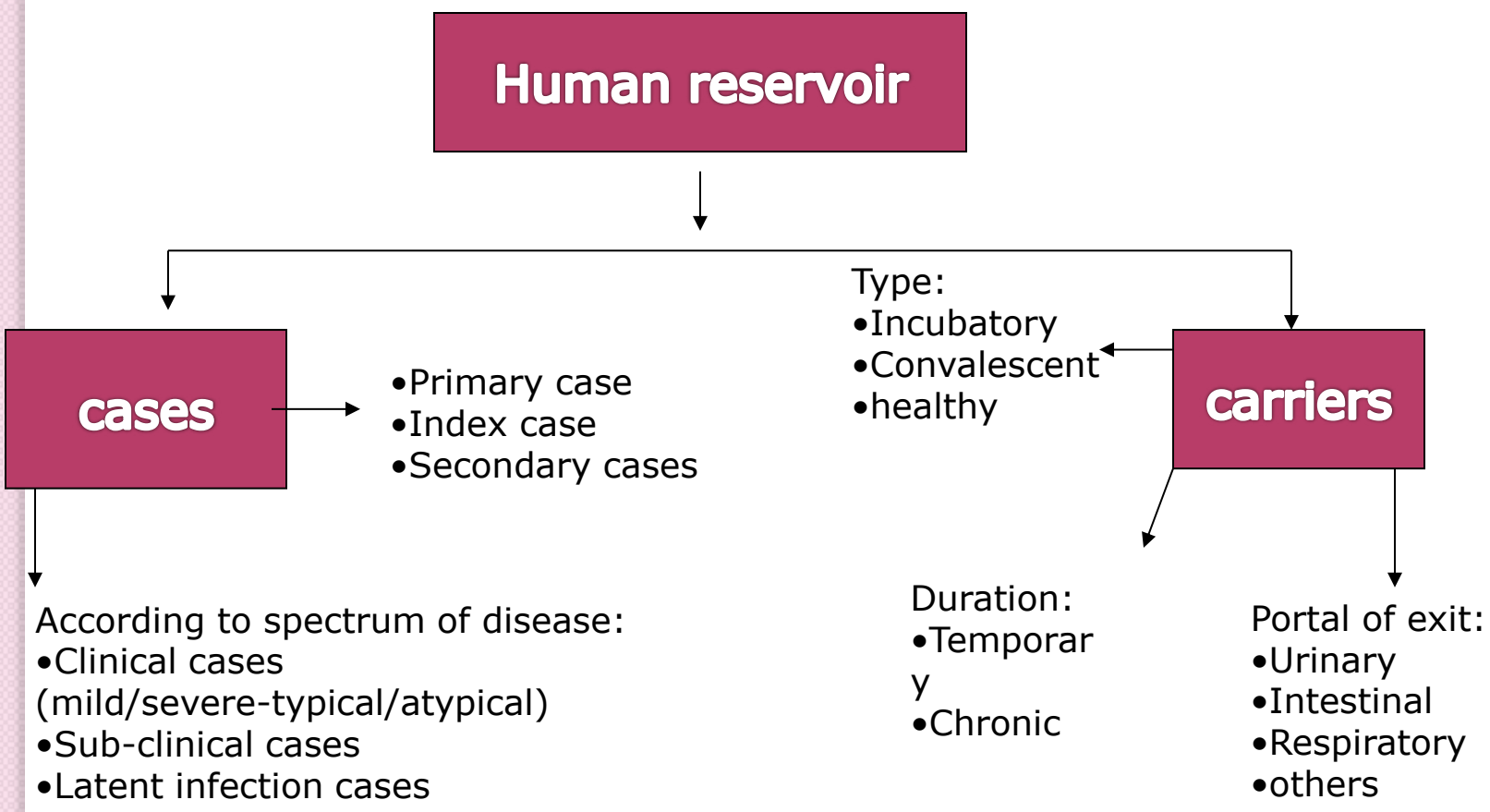
- In tetanus; the reservoir and source are the same, that is soil.

- The term *homologous reservoir* *is applied when another* member of the same species is the victim, as for example man is the principal reservoir for some enteric pathogens,
- e.g., *vibrio cholerae*.
- *The term heterologous is applied when* the infection is derived from a reservoir other than man, as for example animals and birds infected with salmonella.

Types of reservoirs



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 *clinical illness may be mild or moderate, typical* or atypical, severe or fatal depending upon the gradient of involvement.
- Epidemiologically, mild cases may be more important sources of infection than severe cases because they are ambulant and spread the infection wherever theygo, whereas severe cases are usually confined to bed.

- The *subclinical cases are variously referred to as* inapparent, covert, missed or abortive cases.
- They are equally important as sources of infection.
- The disease agent may multiply in the host but does not manifest itself by signs and symptoms.
- The disease agent is, eliminated and contaminates the environment in the same way as clinical cases..

- Persons who are thus sick (unbeknown to themselves and others) contribute more than symptomatic patients to the transmission of infection to others and what is more, they do not appear in any of the statistics.

- The term *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,

Carriers

- 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 discernible (visible) clinical disease and serves as a potential source of infection to others.

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

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

- (a) INCUBATORY CARRIERS : Incubatory carriers are those who shed the infectious agent during the incubation period of disease.
- That is, they are capable of infecting others before the onset of illness.
- This usually occurs during the last few days of the incubation period,
- e.g., measles, mumps, polio, pertussis, influenza, diphtheria and hepatitis

- (b) CONVALESCENT CARRIERS : That is, those who continue to shed the disease agent during the period of convalescence, e.g., typhoid fever, dysentery (bacillary and amoebic), cholera, diphtheria and whooping cough.
- In these diseases, clinical recovery does not coincide with bacteriological recovery.

- 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.

(a) TEMPORARY CARRIERS

- Temporary carriers are those who shed the infectious agent for short periods of time.
- In this category may be included the incubatory, convalescent and healthy carriers.

- **By portal of exit : Carriers may also be classified** according to the portal of exit of the infectious agent.
- Thus we have urinary carriers, intestinal carriers, respiratory carriers, nasal carriers, etc.
- Skin eruptions, open wounds and blood are also portals of exit. In typhoid fever, the urinary carrier is more dangerous than an intestinal carrier.
- A typhoid carrier working in a food establishment or water works is more dangerous than a typhoid carrier working in an office establishment.

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 conveyed from animal to man.

- There are over 100 zoonotic diseases which may be conveyed to man from animals and birds.
- The best known 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 and "amplifying hosts“ is now well established.

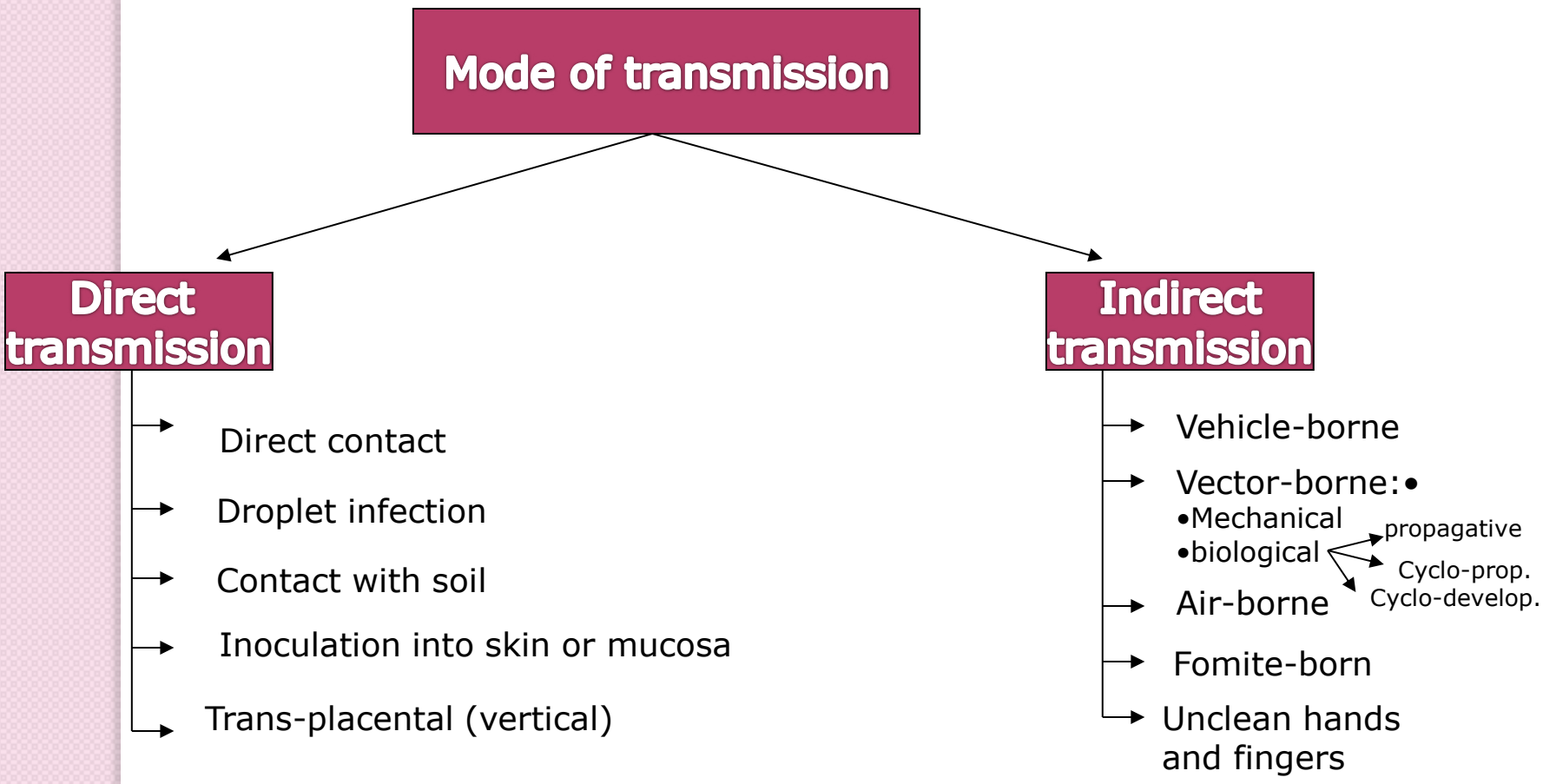
- Pigeons in cities can lead to infection with chlamydia; dust mites from them can cause allergy in man.
- Ornithosis and arboviruses can betransmitted to man from various birds.

Reservoir in non-living things

- Soil and inanimate matter can also act as reservoir of infection.

- For example, soil may harbor agents that causes tetanus, anthrax and coccidiodomycosis.

(II): Modes of transmission



(III): Susceptible host

- An infectious agent seeks a susceptible host aiming "successful parasitism".

- Four stages are required for successful parasitism:
  1. Portal of entry
  2. Site of election inside the body
  3. Portal of exit
  4. Survival in external environment

SUSCEPTIBLE 'HOST

- The infectious agent enters the susceptible host after finding a portal of entry such as respiratory tract, alimentary tract, skin etc. Inside the human host, on getting appropriate environment, it multiplies and sufficient density of the disease agent is built up to disturb the health equilibrium and the disease become overt.

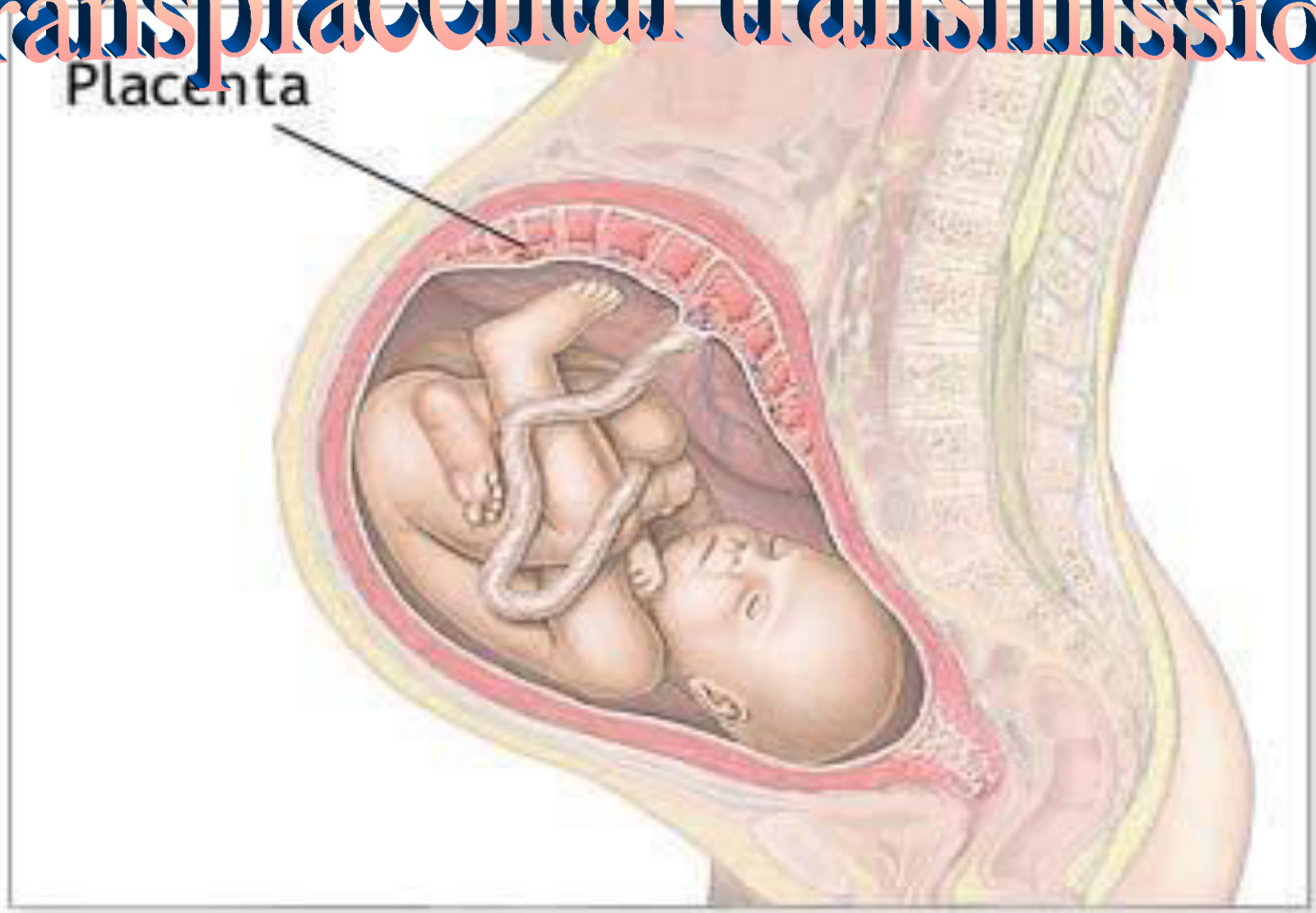

Direct contact


Droplet infection

Contact with soil

Inoculation into skin or mocosa

Transplacental transmission



INDIRECT TRANSMISSION

- Vehicle borne
- Vector borne
- Air borne
- Fomite borne
- Unclean hands & fingers

Vehicle borne

Vector borne

Air borne

Fomite borne


He Doesn't Even Bother
With Washing His Hands?
Unclean hands

LEVELS OF PREVENTION

- PRIMARY PREVENTION
- SECONDARY PREVENTION
- TERTIARY PREVENTION

Primary prevention

Secondary prevention

Tertiary prevention

IMPLICATIONS OF EPIDEMIOLOGY IN C.H.N PRACTICE

- An understanding of epidemiological concepts & principles are vital for nurses in the community as well as hospital setting.
- Knowledge of methods of epidemiology is useful to the C.H. nurse, both as tool in conducting the investigation to evaluate & explain phenomena observed in the course of work & as a basis for interpreting & evaluating the epidemiological literature.

- Epidemiological methods such as measures of health , serve as tools for assessing community needs & evaluating the impact of C.H. programmes of disease prevention & health promotion.
- The body of knowledge derived from epidemiological studies , including the natural history & patterns of disease occurrence & factors associated with high risk for developing disease, serves as an information base for C.H. practice .
- It provides a frame work for planning,& evaluating community intervention programmes.

- Serves as a basis for assessing individual & family health needs & for planning nursing interventions.
- Provides tools for evaluating success of interventions.
- Nurses may be the one who initiate a study & more frequently assist in data collection.
- In actual practice, C.H. nurse is considered as the foot soldier in the army of epidemiology.
- Epidemiologist depend on C.H. nurse for follow- up on various conditions.