

Principles of Communicable Diseases Epidemiology

Lecture- 2

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Portal of exit

Portal of exit is the path by which an agent leaves the source host.

The portal of exit usually corresponds to the site at which the agent is localized.

Pathogens often leave hosts in materials the body secretes or excretes.

Modes of transmission

An infectious agent may be transmitted from its natural reservoir to a susceptible host in different ways.

There are different classifications for modes of transmission.

Mode of transmission

Direct transmission

Direct contact

Droplet infection

Contact with soil

Inoculation into skin or mucosa

Trans-placental (vertical)

Indirect transmission

Vehicle-borne

- Vector-borne
- Mechanical
- biological

Fomite-borne

Unclean hands and fingers

Three groups of transmission

✓ Contact transmission

- **Direct**
- **indirect**
- **Droplet**

✓ Vehicle transmission

- **Airborne**
- **waterborne**
- **Foodborne**
- **Blood borne**

✓ Vector transmission

- **Biological**
- **mechanical**

Factors Influencing Disease Transmission

Agent

- Infectivity
- Pathogenicity
- Virulence
- Immunogenicity
- Antigenic stability
- Survival

Environment

- Weather
- Housing
- Geography
- Occupational setting
- Air quality
- Food

Host

- Age
- Sex
- Genotype
- Behaviour
- Nutritional status
- Health status

Single & multiple modes of transmission:

some infectious diseases spread by one means only :

- **Meningococcal meningitis – droplet infection**
- **Cholera, enteric a – ingestion infection**
- **Malaria – arthropod borne infection**
- **Tetanus, rabies – contact infection**

□ **Some infectious diseases spread by more than one means which maybe either is equally important, or one mean gets the upper hand, while the others are also important or rare.**

- **Poliomyelitis: respiratory & ingestion infection**
- **Brucellosis: ingestion infection (mainly), inhalation & contact (occasionally)**

Direct Transmission

- **In direct transmission, an infectious agent is transferred from a reservoir to a susceptible host by direct contact or droplet spread.**
- **Direct contact occurs through skin-to-skin contact, kissing, and sexual intercourse.**

- **AIDS and gonorrhoea are spread from person to person by direct contact.**
- **Direct contact also refers to contact with soil or vegetation harboring infectious organisms.**
- **Hookworm is spread by direct contact with contaminated soil.**

Droplet spread refers to spray with relatively large, short-range aerosols produced by sneezing, coughing, or even talking.

□ Droplet spread is classified as direct because transmission is by direct spray over a few feet, before the droplets fall to the ground.

□ Droplets are relatively large ($>5 \mu\text{m}$) and projected up to about one meter.



□ Pertussis and meningococcal infection are examples of diseases transmitted from an infectious patient to a susceptible host by droplet spread.

Vertical infections: human reservoir diseases are transmitted through either person to person or mother to infant infection.

The first is considered (transverse infection), while the second is the (vertical infection).

Vertical infection is transmitted from mother to infant in three ways:

a- Inutero infection

b- Perinatal infection: the fetus acquires infection from infected birth canal during child birth .Herpes simplex virus of genital herpes of mother involves:

The nervous system and may cause neurological damage, with high case fatality rate.

c-Infection through nursing (lactation): breast milk is free of infection and have anti- infection value as well. Some viral infection of mother may pass in milk: CMV, HIV, and HBV& HCV.

Indirect transmission

Indirect transmission holds a variety of mechanisms including the traditional 5Fs “flies, fingers, fomites , food , and fluid.

Essential requirement

❖ The infectious agents must be capable of surviving outside the human host in the external environment and retain its basic properties of pathogenesis and virulence till it finds new host.

Factors determining external survivability of disease agent:

- ✓ **Characteristics of the agent**
- ✓ **Non-living object**
- ✓ **Influence of environmental factors like temp and humidity**
- ✓ **Drug resistance**

Vehicle- borne transmission indicates transmission of the infectious agent through the help of water, food, ice, blood, or other biological products as tissues and organs.

- **Of these water and food are the most frequent vehicles of transmission.**

- **The infectious agent may have multiplied or developed in the vehicle before being transmitted; or only passively transmitted in the vehicle.**

Examples :

- ❑ **Diseases transmitted by water and food
acute Diarrhea , typhoid fever, cholera,
hepatitis A , food Poisoning& intestinal
parasites .**

- ❑ **Disease transmitted by blood : hepatitis B, C**

Airborne transmission occurs when infectious agents are carried by dust or droplet nuclei suspended in air.

- ❑ **Airborne dust includes material that has settled on surfaces and become resuspended by air currents as well as infectious particles blown from the soil by the wind.**
- ❑ **Airborne Transmission via aerosols (airborne particles $<5\mu\text{m}$) that contain organisms in droplet nuclei or in dusts.**

In contrast to droplets that fall to the ground within a few feet, droplet nuclei may remain suspended in the air for long periods of time and may be blown over great distances.

Measles, for example, has occurred in children who came into a physician's office after a child with measles had left, because the measles virus remained suspended in the air.

Vectors such as mosquitoes, fleas, and ticks may carry an infectious agent through purely mechanical means or may support growth or changes in the agent.

Examples of mechanical transmission are flies carrying *Shigella* on their limbs and fleas carrying *Yersinia pestis*, the causative agent of plague, in their gut.

In contrast, in biologic transmission, the causative agent of malaria disease undergoes maturation in an intermediate host before it can be transmitted to humans.

Portal of entry

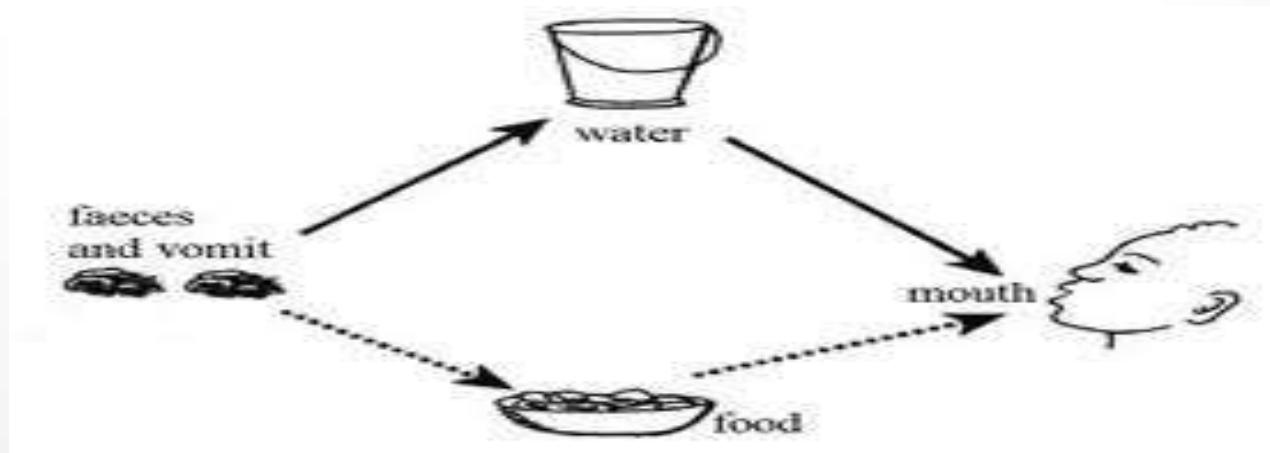
The portal of entry refers to the manner in which a pathogen enters a susceptible host.

The portal of entry must provide access to tissues in which the pathogen can multiply or a toxin can act.

Often, infectious agents use the same portal to enter a new host that they used to exit the source host.

For example, influenza virus exits the respiratory tract of the source host and enters the respiratory tract of the new host.

In contrast, many pathogens that cause gastroenteritis follow a so-called “fecal-oral” route because they exit the source host in feces, are carried on inadequately washed hands to a vehicle such as food, water, or utensil, and enter a new host through the mouth.



Other portals of entry include the **skin (hookworm), **mucous membranes** (syphilis), and **blood** (hepatitis B&C, human immunodeficiency virus).**