

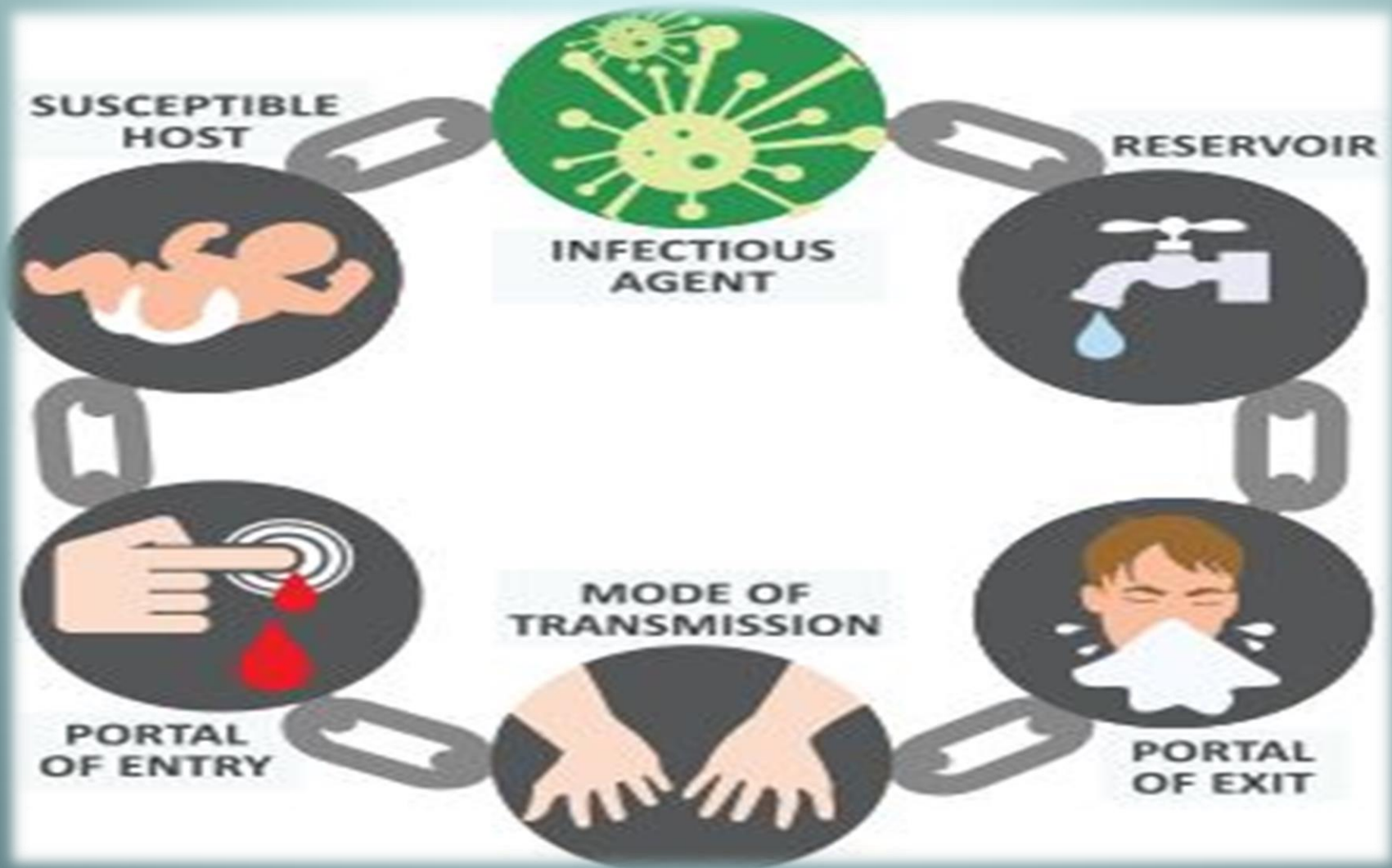
Pathogen transmission

The chain of infection

Objectives

- As healthcare professionals, it is important to understand two things about infection
 1. The various ways infection can be transmitted
 2. The ways the infection chain can be broken

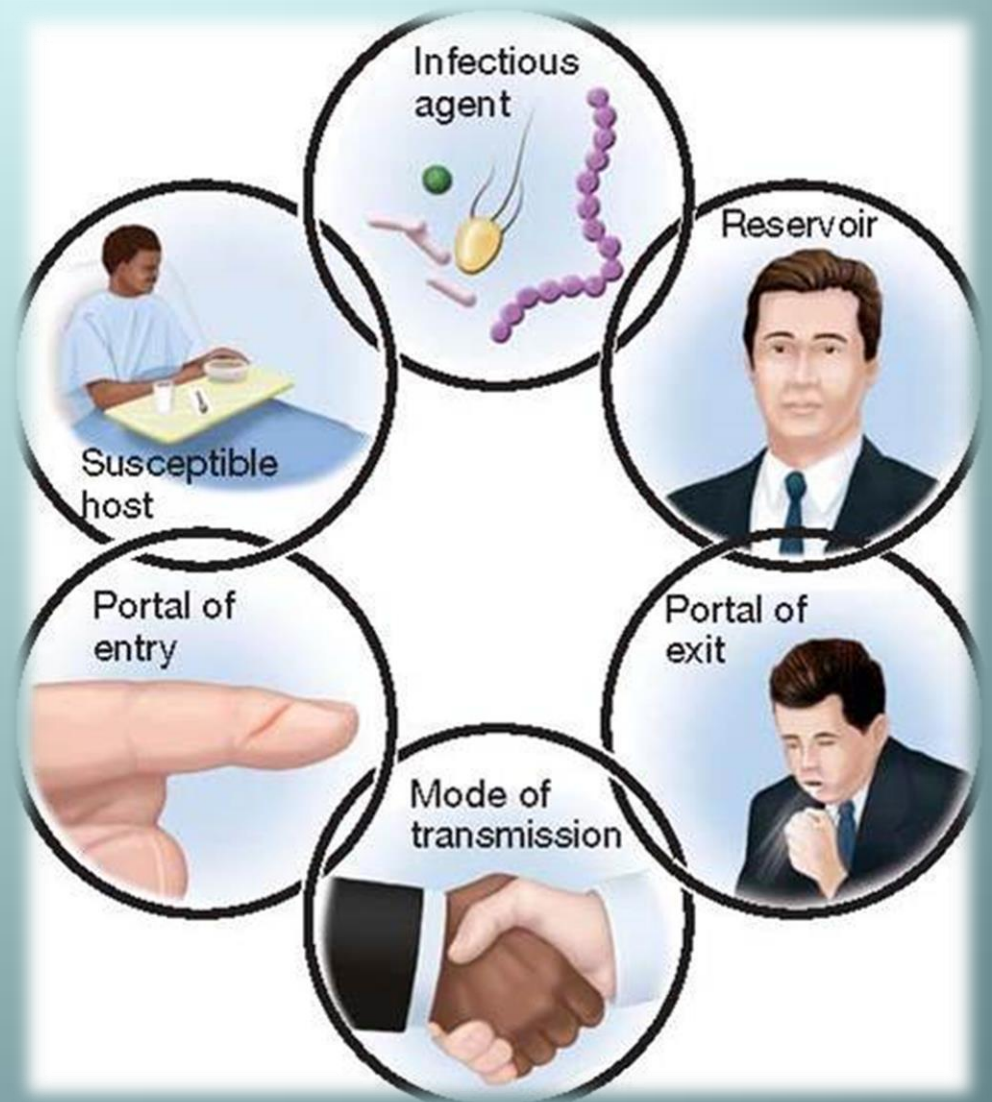
The chain of infection




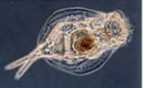
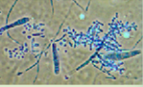


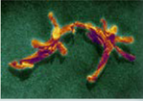
The chain of infection

Example: Cold virus

1. Pathogen
2. Reservoir
3. Portal of exit
4. Mode of transmission
5. Portal of Entry
6. Susceptible host



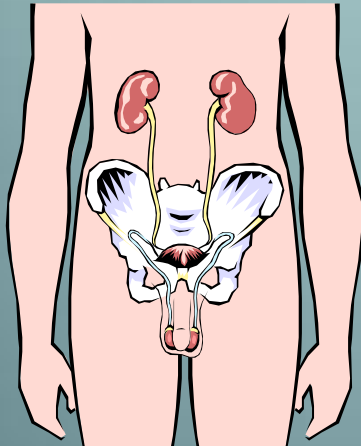
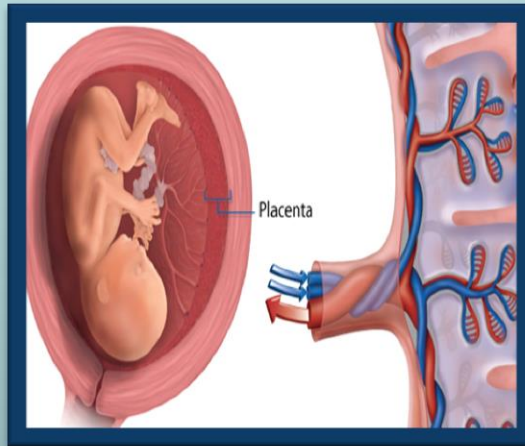
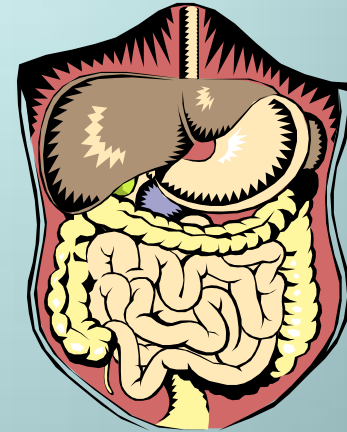
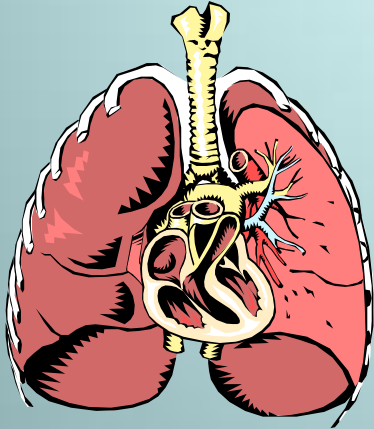
1- Pathogen

Agent	Organism Description	Disease	
Metazoa	<ul style="list-style-type: none"> Multicellular Many are parasites 	<ul style="list-style-type: none"> Trichinellosis: raw meat Hookworm: fecal contamination of water and soil 	
Protozoa	<ul style="list-style-type: none"> Single-celled with a well-defined nucleus Some are parasites 	<ul style="list-style-type: none"> Malaria: mosquito-born Giardiasis: upper small intestine 	
Fungi	<ul style="list-style-type: none"> Non-motile, filamentous 	<ul style="list-style-type: none"> Histoplasmosis: lung infection-dust contaminated with bird droppings Candidiasis: mucous membranes lesions 	
Bacteria	<ul style="list-style-type: none"> Single-celled with no nucleus Bacterial spores – survive extreme conditions (disinfection, dry surfaces) 	<ul style="list-style-type: none"> TB Tetanus Staphylococcal and Pneumococcal diseases Bacillus and clostridium spores 	
Viruses	<ul style="list-style-type: none"> Small particles with a nucleic acid core coated by protein 	<ul style="list-style-type: none"> Influenza HIV Polio 	
Prions	<ul style="list-style-type: none"> Misfolded proteins with no genetic material capable of replication Capable of damaging the brain 	<ul style="list-style-type: none"> BSE – bovine spongiform encephalopathy/mad cow disease CJD – Creutzfeld-Jacob disease 	

2- Reservoirs of infection

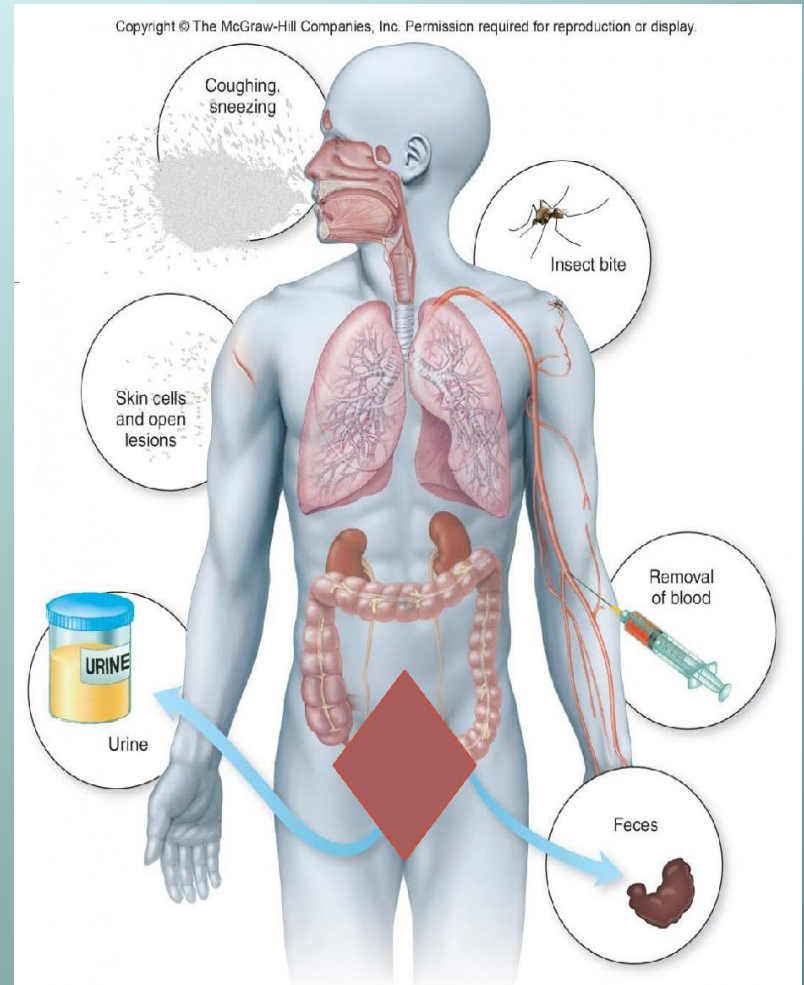
Reservoir	Types	Phases	Characteristics
Human	<ul style="list-style-type: none"> • Symptomatic • Infected and become ill 		<ul style="list-style-type: none"> • Incapacitated • Diagnosed • Isolated
	<ul style="list-style-type: none"> • Asymptomatic • Infected with no signs of illness 	<ul style="list-style-type: none"> • Incubatory: transmit infection before showing symptoms – measles, HIV • Inapparent infections (subclinical cases): capable of transmission but never develop illness – polio, HepA in children, meningococcal meningitis • Convalescent carriers: infectious during and after recovery from illness - salmonellosis • Chronic carriers: transmit disease long after recovery (>1 yr) – HepB in newborns 	<ul style="list-style-type: none"> • Undiagnosed • Higher risk of transmission
Animal	<ul style="list-style-type: none"> • Symptomatic • Infected and become ill 		<ul style="list-style-type: none"> • Incapacitated • Diagnosed • Isolated
	<ul style="list-style-type: none"> • Asymptomatic • Infected with no signs of illness 		<ul style="list-style-type: none"> • Undiagnosed • Higher risk of transmission
Environmental	<ul style="list-style-type: none"> • Plants, soil, water, food, fomites 		<ul style="list-style-type: none"> • Fungi: Histoplasmosis – soil • Bacteria: Tetanus, anthrax, botulism – soil

3, 4, and 5



3- Portal of exit

A portal of exit is the site from where micro-organisms leave the host to enter another host and cause disease/infection



3- Portal of exit

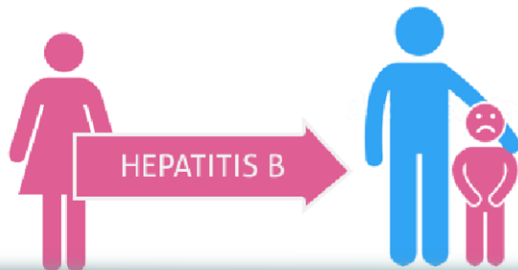
Portals of Exit	Description	Types of diseases
Respiratory	<ul style="list-style-type: none"> • Most important portal and the most difficult to control • Common route of diseases that cause respiratory illnesses 	<ul style="list-style-type: none"> • Common cold, influenza, TB • Measles, mumps, rubella and pertussis, Haemophilus influenza type b (Hib), pneumococcal disease – all vaccine preventable
Genitourinary	<ul style="list-style-type: none"> • Route of sexually transmitted diseases • Parasitic and bacterial diseases spread by urine 	<ul style="list-style-type: none"> • HIV, syphilis
Alimentary – Gastrointestinal tract (GIT)	<ul style="list-style-type: none"> • Bites • Feces – controlled by good hygiene, proper food preparation, access to clean water and sewage 	<ul style="list-style-type: none"> • Rabies • HepA, salmonella, cholera, typhoid
Skin	<ul style="list-style-type: none"> • Superficial lesions that produce infectious discharges • Percutaneous penetration through mosquito bites or infected needles 	<ul style="list-style-type: none"> • Smallpox, chickenpox (varicella), syphilis • Malaria, HepB, HepC, HIV
Transplacental	<ul style="list-style-type: none"> • Mother to fetus • Not common 	<ul style="list-style-type: none"> • Measles, HIV, syphilis • Cytomegalovirus – most common infectious cause of developmental disabilities

4- Modes of transmission

Transmission of pathogens

■ Horizontal transmission

- All other transmissions among individuals of the same species
- STDs, insect vectors, bodily fluids/blood
- Bacterial meningitis, cold sores



■ Vertical transmission

- Direct transmission of pathogens from mother to baby
 - Just before/after birth
 - Via placenta or breast milk
 - HIV, Hepatitis B,C, Cytomegalovirus (CMV)

six common ways for spreading the infectious agents

One-to-one contact	Direct	<p>Direct physical contact (body surface to body surface) between infected or colonized individual and susceptible host.</p> <p>Examples of transmission: Shaking hands; kissing</p> <p>Examples of infections: Common cold; sexually transmitted diseases</p>
	Indirect	<p>Infectious agent deposited onto an object or surface (fomite) and survives long enough to transfer to another person who subsequently touches the object.</p> <p>Examples of transmission: contaminated instruments</p> <p>Examples of infections: rhinovirus; influenza</p>
	Droplet	<p>Contact, but transmission is through the air. Droplets are relatively large (>5 μm) and projected up to about one metre.</p> <p>Examples of transmission: Sneezing; coughing, or (in health care) during suctioning</p> <p>Examples of infections: Meningococcus; pertussis; influenza (maybe: there is some debate); respiratory viruses</p>
Non-contact	Airborne	<p>Transmission via aerosols (airborne particles <5μm) that contain organisms in droplet nuclei or in dusts. Can be spread via ventilation systems.</p> <p>Examples of transmission: Via ventilation system in a hospital;</p> <p>Examples of infections: TB; varicella; measles; chickenpox; smallpox (and maybe influenza: controversial, as more likely via droplets)</p>
	Vehicle	<p>A single contaminated source spreads the infection (or poison) to multiple hosts. This can be a common source or a point source.</p> <p>Examples of transmission - Point source: Food-borne outbreak from infected batch of food; cases typically cluster around the site (such as a restaurant); IV fluid; medical equipment</p>
	Vector borne	<p>Transmission by insect or animal vectors.</p> <p>Example of infections: Mosquitoes and malaria</p>

5- Portal of entry

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6- Susceptible host

- The support of pathogen life & its reproduction depend on the degree of the host's resistance.
- **Immunocompetent host**
- **Immunocompromised host**

6- Susceptible host

- **Factors**

- Immune status
- Age
- Malnutrition
- Chronic diseases
- Medications
- Invasive devices

People at high risk of contracting diseases

- Children and their families
- Elderly
- Chronically ill people
- Smokers and those with respiratory problems
- People who live or work with someone sick
- Residents or workers in poorly ventilated buildings



How to interrupt the chain of infection