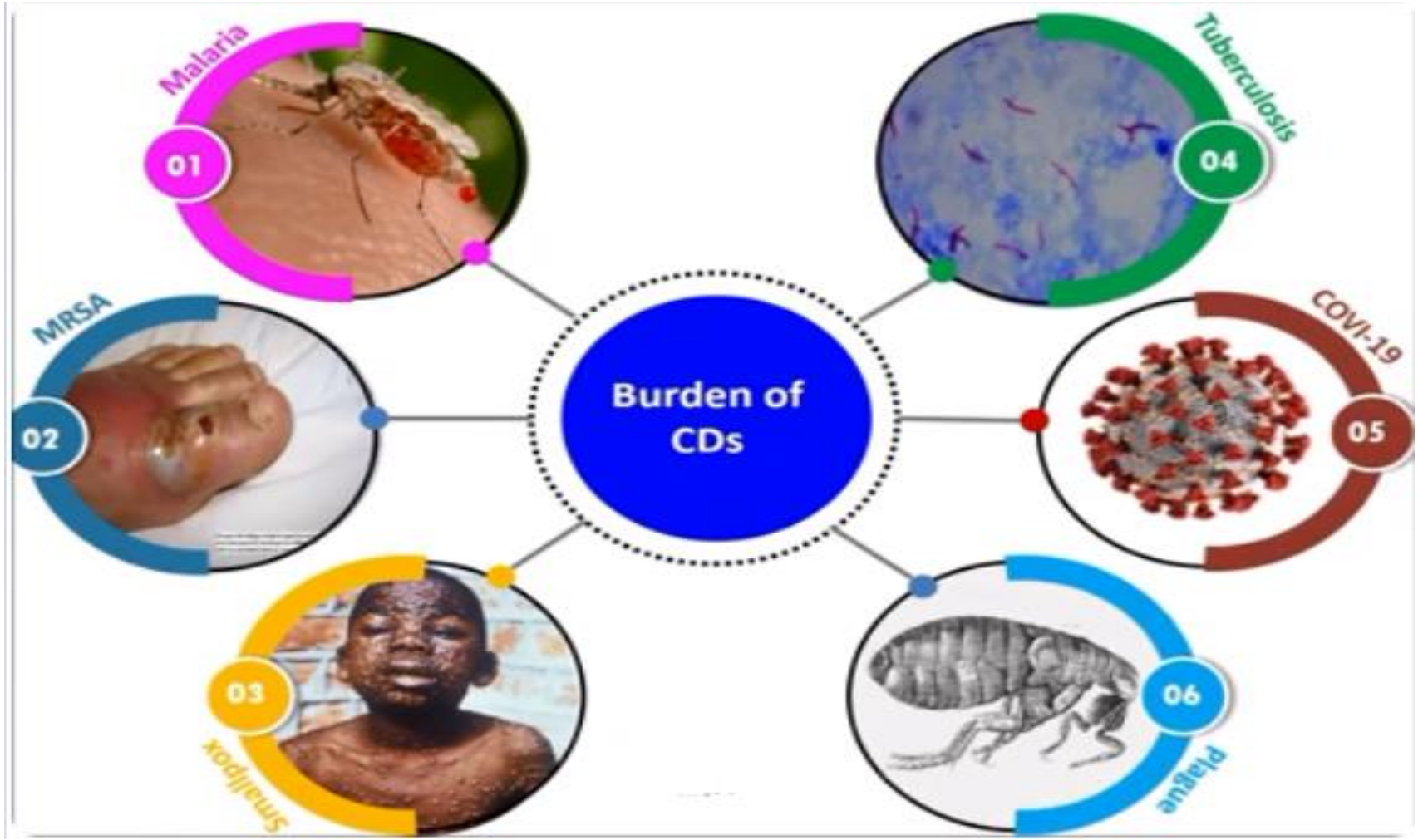
Chapter 8

Infectious (communicable) Diseases


Burden of CDs
01
Malaria
02
MRSA
03
Smallpox
04
Tuberculosis
05
COVI-19
06
Plague

Infectious (communicable) Diseases

Definitions:

Infectious diseases: diseases caused by microscopic organisms that invade the body and can spread from one person to another.

Incubation period*:* the time between infection and the onset of symptoms. Each organism has a characteristic incubation period depending on the status of the host like age and susceptibility.

Host response: the clinical response in an exposed population depends on factors such as host immune status.

Reservoir of infection: the habitat of the infectious agent, which may be in humans (e.g. measles), animals (e.g. rabies) or the environment (e.g. malaria).

Infectious (communicable) Diseases

Definitions:

Outbreak: two or more cases of infection with a suggested relation e.g. transmission between cases/exposure to a common source of infection.

Epidemic: an increase in incidence above that which may continuously present in a population.

Pandemic – epidemic that spans the world(several countries)

Endemic disease: a disease that have a relatively steady frequency over a long period of time in a particular location.

Sporadic : occasional cases reported at irregular intervals

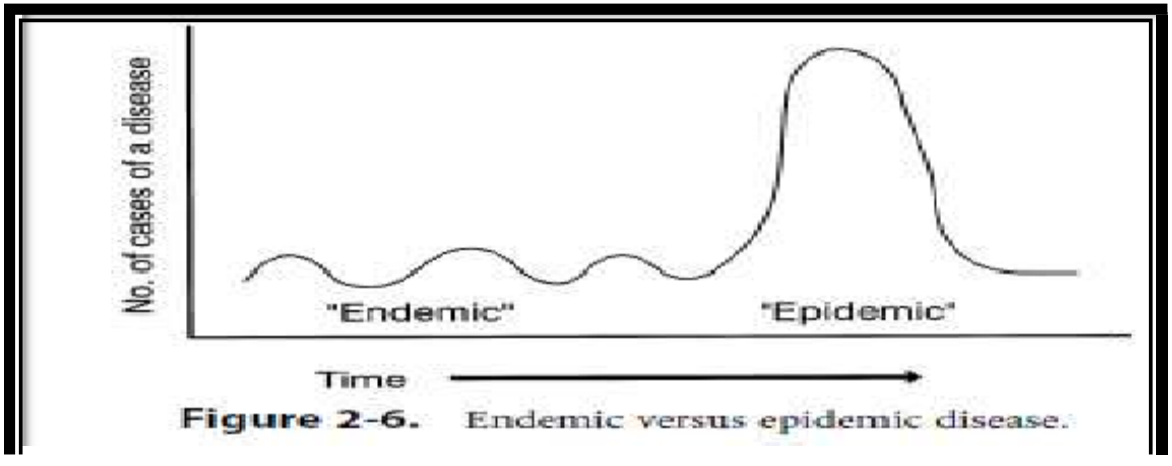
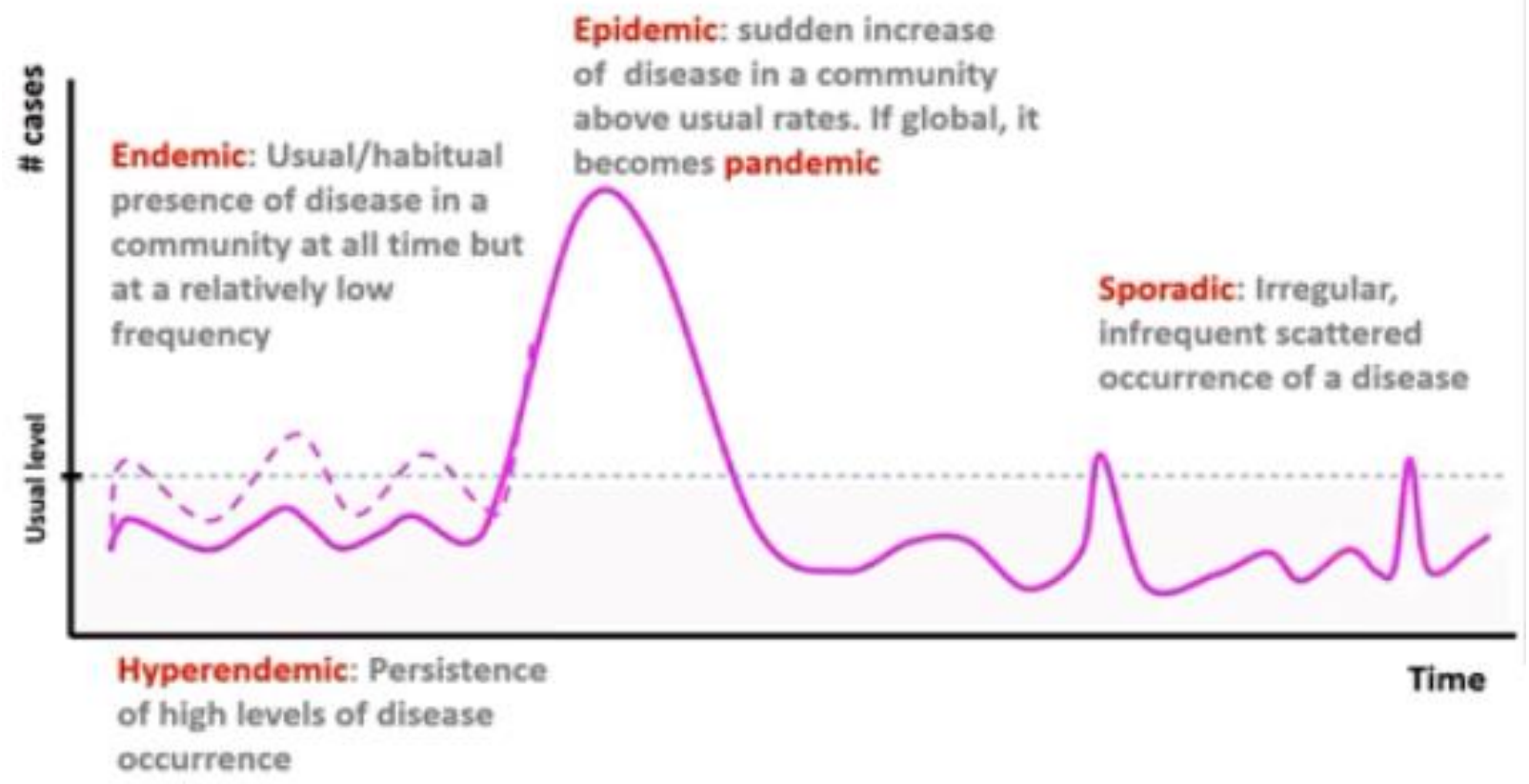
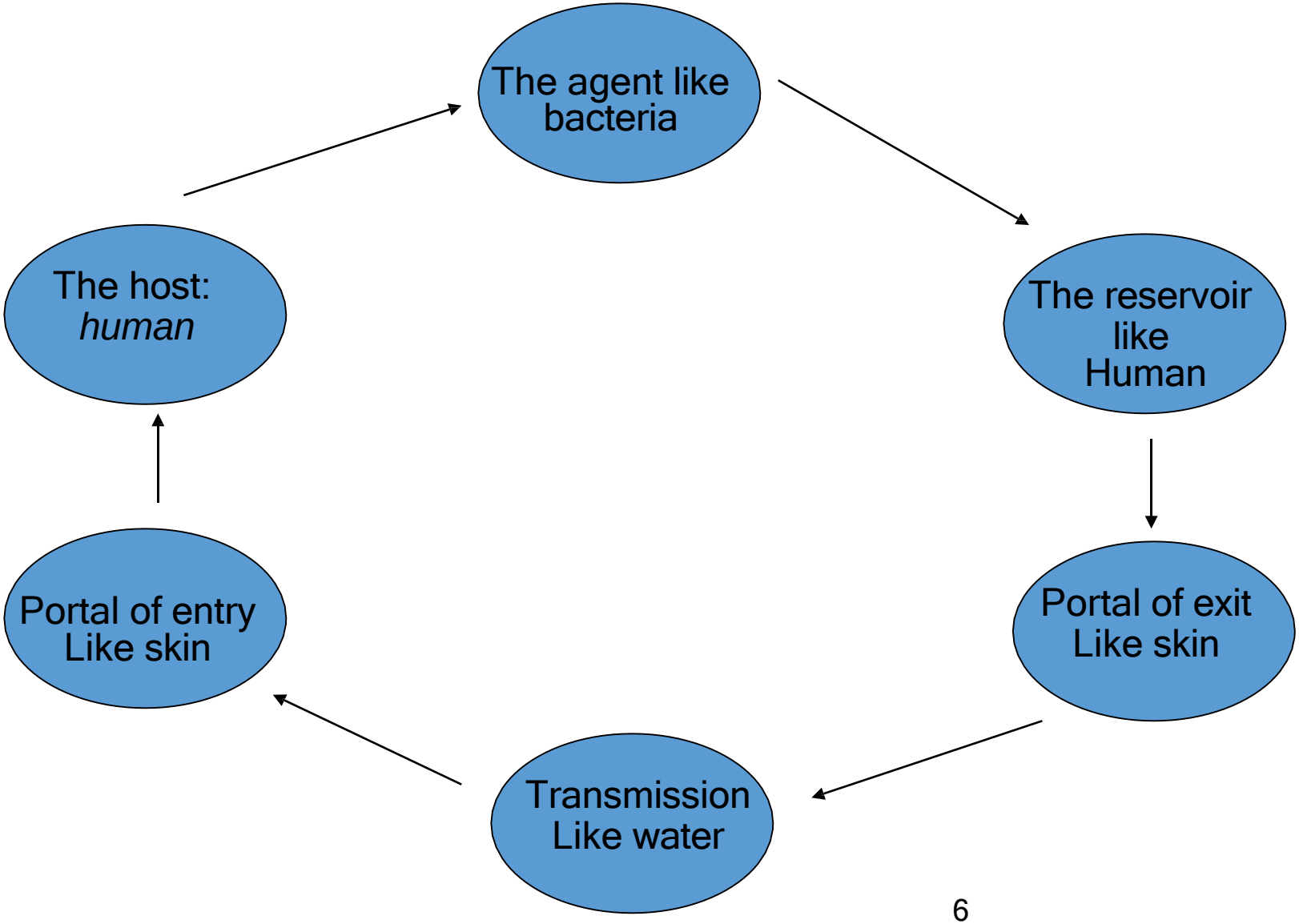


Figure 2-6. Endemic versus epidemic disease.

Endemic, Epidemic, Pandemic



Infectious disease process (Cycle):



Infectious disease process (Cycle):

A. The etiological agents:

1. **Bacteria** Most bacteria species are harmless, many are beneficial. some are pathogens, including cholera, diphtheria, leprosy, plague, pneumonia, tetanus, tuberculosis, & typhoid fever.

2. Viruses: Viruses are able to survive and reproduce only in the living cells of a host. Once a virus invades a living cell, it directs the cell to make new virus particles. These new viruses are released into the surrounding tissues, and seek out new cells to infect. The diseases caused by viruses includes mumps, measles, influenza, rabies, hepatitis, poliomyelitis, smallpox, AIDS, and certain types of cancer.

3. Fungi: Some fungi are external parasites of humans, causing skin conditions such as ringworm. Other fungi invade internal tissues; examples include yeast that infect the genital tract and several fungi species that cause a type of pneumonia.

Infectious disease process (Cycle):

4. Parasites:

Protozoans: are single-celled, that live in moist environments. The most infamous pathogenic protozoans are *Plasmodium,* which cause malaria. These agents include also Members of the genus *Trypanosoma* produce trypanosomiasis, (African sleeping sickness), leishmaniasis, and amoebae .

Parasitic worms: flatworms include tapeworms, which live in the intestines of a host organism. Hooks and suckers on the head attach a tapeworm to the intestinal wall, and a tough outer coating protects against the host's digestive juices.

5. Prions: are extremely tiny protein particles found in the brain, nerve, and muscle cells. Prions cause disease by changing normal proteins into an abnormal shape. These mutated proteins can cause mad cow disease.

B. The reservoir:

Reservoir of infection: the habitat of the infectious agent, which may be in humans (e.g. measles), animals (e.g. rabies) or the environment (e.g. malaria).

There are many types of reservoirs:

Clinical reservoirs: patients with clear symptoms. They are the less serious because we can control the transmission of disease.

Asymptomic reservoirs: they are considered as **the most dangerous types of reservoirs** because they may transmit the disease without knowing that they are infected e.g. hepatitis B and AIDS patients.

Chronic reservoirs: patients who suffer from a disease, symptoms can be treated but they may still have the agent e.g. Brucellosis & Amoeba.

C. ***Portal of exit:*** is the route by which the agent will exit from the reservoir. There are many routes of exit:

1. Respiratory tract: agents will exit by the secretions of the respiratory tract in the form of droplets when the person coughs, sneezes, talks or sings e.g. Influenza, common cold, tuberculosis, COVID 19.

2. Alimentary (digestive) tract: the agent will exit with the secretions of the digestive tract like salivary secretions (rabies) or feces (Amoebae).

3. Blood products: agents may exit with blood or blood products like AIDS, hepatitis B.

4. Skin: some of the etiological agents may exit through the wounds or cuts in the skin like sexual transmitted diseases (syphilis).

5. Genito-urinary tract: some of the agents may exit with the secretions of the genital tract or urinary tract of both male and female e.g. AIDS, hepatitis B.

6. In-utero: agents may exit from the mother to her fetus through placenta during pregnancy like tetanus, hepatitis B and AIDS. This is one way direction.

D. Transmission of diseases:

1. Direct contact:

The easiest way to catch most infectious diseases is by coming in contact with someone who has a disease. This "someone" can be a person, an animal or, unborn baby from mother. Three ways infectious disease can be spread through direct contact are:

A. Person to person. The most common way for infectious disease to spread is through the direct transfer of germs from one person to another. The germs can also spread through the exchange of body fluids from sexual contact or a blood transfusion.

B. Animal to person: pets can carry many germs. Being bitten or scratched by an infected animal like dogs and cats can transmit a disease, or even cause death.

C. Mother to unborn child. A pregnant woman may pass germs to her unborn baby. Germs can pass through the placenta, as is the case of the AIDS rubella and tetanus, or during labor and delivery, like a mother infected with streptococcus.

D. Droplet transmission

When a person cough or sneeze, droplets expel into the air. A patient sick with flu expel droplets contain the germ that caused illness. Droplets travel only about three feet because they're too large to stay suspended in the air.

2. **Indirect contact:**

A. Through the air

1. Particle transmission

Some germs travel through the air in particles considerably smaller than droplets. These tiny particles remain suspended in the air for extended periods of time and can travel in air currents like Tuberculosis and SARS.

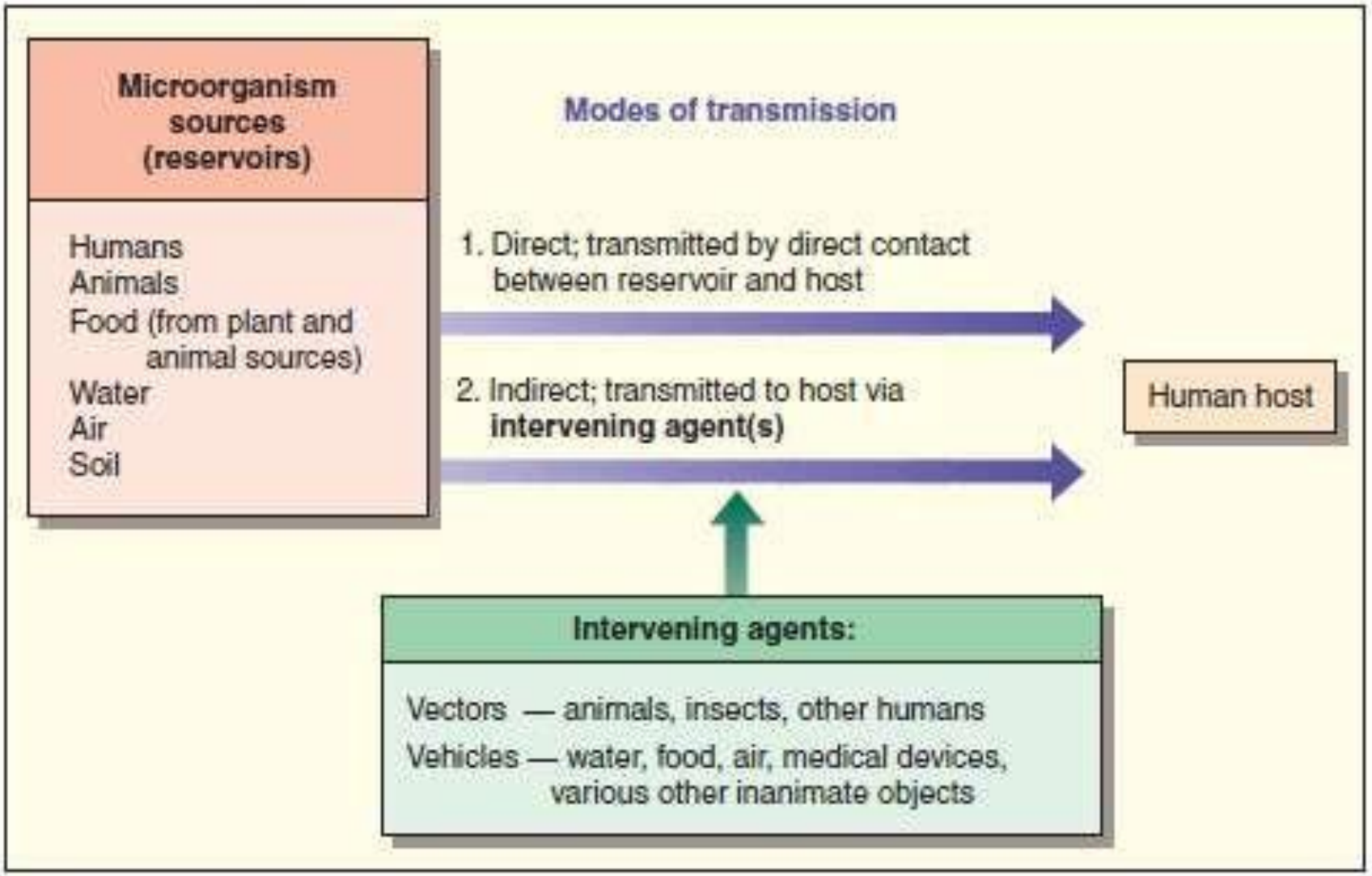
B. Vectors carriers:

Germs rely on insects like as mosquitoes, fleas, to move from host to host. These carriers are known as vectors. E.g. mosquitoes carry malaria.

C. Vehicle spread (Food contamination):

disease-causing germs can infect people through food and water. Food is the vehicle that spreads the germs and causes the illness.

For instance, contamination with Escherichia coli (E. coli) is common.


Microorganism sources (reservoirs)
Humans
Animals
Food (from plant and animal sources)
Water
Air
Soil
Modes of transmission
1. Direct; transmitted by direct contact between reservoir and host
2. Indirect; transmitted to host via intervening agent(s)
Human host
Intervening agents:
Vectors — animals, insects, other humans
Vehicles — water, food, air, medical devices, various other inanimate objects

direct & indirect mode of transmission

Table 7.2. Modes of transmission of an infectious agent

Direct transmission	Indirect transmission
Touching Kissing	Vehicle-borne (contaminated food, water, towels, farm tools, etc.)
Sexual intercourse	Vector-borne (insects, animals)
Other contact (e.g. childbirth, medical procedures, injection of drugs, breastfeeding)	Airborne, long-distance (dust, droplets) Parenteral (injections with contaminated syringes)
Airborne, short-distance (via droplets, coughing, sneezing)	
Transfusion (blood)	
Transplacental	

Examples of mode transmission

- Airborne: (tuberculosis)
- Waterborne: Amoeba
- Foodborne: Salmonellosis
- Insect-borne: leishmania
- Direct contact: sexual diseases as syphilis
- Contaminated blood hepatitis B,C viruses
- Through skin schistosomiasis

CDs: Modes/methods of Transmission

Insects

- Malaria
- WNF
- Leishmania
- Lyme disease

Transplacental-Congenital

- HIV
- Rubella
- Toxoplasma
- Hepatitis B-E

Drug abuse

- HIV
- Hepatitis B, C

Blood transfusion

Burden of CDs: Mode of Transmission

Airborne

- TB
- Flu, cold, COVID-19
- Measles
- Smallpox
- Chickenpox

Foodborne

- *Campylobacter*
- Salmonella
- As in waterborne

Waterborne

- Hepatitis A
- Cholera
- *Salmonella*
- Giardiasis
- Cryptosporidiosis
- *E. coli*-O157

Breast feeding

- HIV
- CMV
- HTLV-1

TB, tuberculosis; HIV, human immunodeficiency virus; CMV, cytomegalovirus; HTLV-1, human T-lymphocyte virus-1

E. Portal of entry:

The etiological agents may enter the body of the suspected host by the same routes they exit except for uterus transmission it is one way direction since the mother can transmit the agent but not vise versa.

F. Host:

In order for the infection to occurred, we need a host.

Not every one can get the infection, only those who are at risk of infection

with high risk factors like:

- Age, gender
- Host immune system & Immunization
- Occupation
- Nutritional status
- Hygienic practices

Examples of infectious diseases:

Influenza (flu): contagious viral infection of the respiratory tract.

- Influenza is caused by a virus transmitted from one person to another in droplets coughed or sneezed into the air.
- It is characterized by cold like symptoms.
- Some people are vulnerable to complications such as bronchitis and pneumonia.
- This group includes:
  - children with asthma,
  - people with heart or lung disease, and
  - the elderly.

Recommended treatment consists of:

- Bed rest
- Increased intake of fluids.
- Certain drugs to treat flu symptoms,

2. Tuberculosis (TB): chronic or acute bacterial infection that primarily attacks the lungs.

- Symptoms include coughing, chest pain, shortness of breath.
- Children and people with weakened immune systems are the most susceptible to TB.
- TB is transmitted from person to person, usually by air droplets.

Types of TB:

1. Primary TB: person infected has no noticeable symptoms. Primary TB is not contagious in this early stage.
2. Secondary TB: the bacteria multiply & destroy tissue in the lungs and may spread to the rest of the body via the bloodstream.

- Coughing of blood or phlegm may occur.
- At this secondary stage, carriers of TB can infect others

3. **Mumps:** acute infectious disease caused by a virus characterized by swelling of the salivary glands.

   - Its incidence is highest between the ages of 5 and 9.

   - Transmitted by droplets from the respiratory tract of infected persons,

   - it is highly contagious.

   - In adult males, inflammation of the testes occurs in up to 20% of the cases, may cause sterility.

   - In children, infection of the auditory nerve can cause deafness.

4. **Measles:** highly contagious disease caused by a virus.

- Measles is characterized by:

- small red dots appearing on the surface of the skin.
- irritation of the eyes (especially on exposure to light).

Treatment:

- Patients are kept isolated from other susceptible individuals, usually resting in bed.
- skin lotions to lessen itching.

5. **German Measles**: (rubella) contagious disease caused by virus infection.

The disease is characterized by:

- a rose-colored rash: the rash, first appears on the face and spreads rapidly to the chest, limbs, and abdomen.
- It is most common among teenagers & young adults;

- It can have severe consequences for women in the first three months of pregnancy.
- The newborn child may has various congenital abnormalities:

  heart defects, mental retardation, deafness & cataracts.

- The incidence of these malformations is high so physicians recommend therapeutic abortion, if miscarriage has not already resulted from the disease.

6. **Hepatitis:** inflammation of the liver caused by viruses, bacterial infections, or continuous exposure to alcohol, drugs, or toxic chemicals.

- Hepatitis can also result from an autoimmune disorder, in which the body mistakenly sends disease-fighting cells to attack its own healthy tissue, in this case the liver.

- The liver's functions, including:
  1. filtering harmful infectious agents from the blood.
  2. storing blood sugar (energy forms), vitamins & minerals.
  3. producing many proteins necessary for life like enzymes.

- Symptoms include:
- The main symptom is jaundice, a yellowing of the skin and eyes that occurs when the liver fails to break down excess yellow-colored bile pigments in the blood.

Types of Hepatitis:

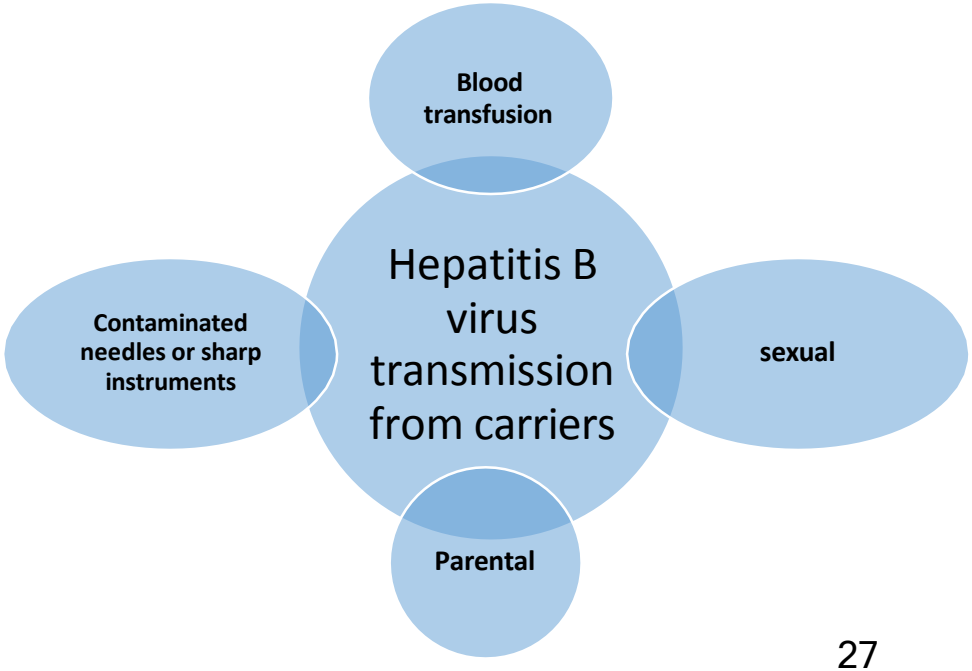
1. Hepatitis A virus (HAV): lives in feces in the intestinal tract. It is spread:

- when infected individuals do not wash their hands after using the toilet and then handle food.
- when a person changes an infected infant's diapers and then handles food before washing his or her hands.
- People who eat contaminated food.
- Drinking water contaminated with raw sewage.

2. **Hepatitis B virus (HBV)**: lives in blood & other body fluids.

HBV is transmitted through:

- Unprotected sexual intercourse with an infected person.
- Sharing of infected needles or other sharp instruments that break the skin.
- Through blood donation & organ transplantation.
- From the mother to fetus during pregnancy or during childbirth.
- In 10 % of infections, patients develop chronic hepatitis B.



- **Prevention of hepatitis:**

1. Safe and effective vaccines are available to prevent hepatitis A and B infection. Vaccination is recommended for all newborn babies, infants, adolescents, and people in at risk for hepatitis, such as health workers.

2. To avoid exposure to body fluids of infected individuals.
3. Always washing hands after using the toilet or changing an infant's diapers.
4. Safe disposal of needles and sharp instruments and
5. Avoid using others personal things like tooth brush & razors.

7. **Tetanus (**lockjaw)**:** serious infectious disease of the nervous system, in which a bacterial toxin causes severe muscle spasm.

- The infection occurs when wounds are contaminated with *Clostridium tetani,* which is found in dirt.

  This occurs both in deep, penetrating wounds and in crushing wounds with extensive tissue destruction.

- The symptoms are:
- Difficulty in swallowing and in opening the jaws.
- Muscle spasms.

Treatment of tetanus:

- cleaning the wound,
- eliminating the bacteria with antibiotics,
- neutralizing the exotoxin with antitoxin,
- reducing muscle spasm, and supporting or aiding respiration.

Prevention: the best way is by using immunization for:

- Children.
- Pregnant women.
- Injured people.

8. Food-borne Illness or Food Poisoning: any illness associated with eating food contaminated by:

- disease-causing bacteria, viruses, or parasites;
- Natural toxins like mushrooms ; or
- harmful chemical agents like insecticides & heavy metals.

The symptoms usually include:

- Abdominal pain
- stomach cramps.
- Vomiting & diarrhea.
- dehydration (excessive fluid loss from the body) may cause fainting.

Examples of food borne Illness:

1. *E. coli*, bacteria normally present in human intestines & can produce toxins.

- It can cause kidney damage, as well as
- Septicemia (blood poisoning).
- In some cases the infection can lead to death, even with medical intervention.
- *E. coli* may develop from:

1. consuming undercooked beef,
2. unpasteurized milk, or
3. from handling food without washing hands after changing diapers.

2. Salmonellosis: caused by bacteria.

- It spread through:
- Eating undercooked poultry,
- using cooking utensils and cutting boards used for the preparation of raw poultry without properly cleaning them,
- eating eggs or egg products that were not properly refrigerated.

3. **Brucellosis**:(Undulant Fever):, infectious disease caused by bacteria. The disease has been known as Malta fever, Mediterranean fever and goat fever.

Transmission:

1. **Ingestion** of raw or unpasteurized diary products.
2. **Inhalation**: with high risk to lab technicians and slaughter workers
3. **Direct contact** with placenta or secretion from the infected animals to **cuts in the** skin and mucus membrane which affect:
   - slaughterhouse workers, meat-packing employees & veterinarian (vets).

Symptoms:

- high night fevers
- central nervous system disorders,
- miscarriage.
- **Prevention**: good heat treatment for milk & avoid raw milk products.

Sexual transmitted diseases

1. **Acquired immune deficiency syndrome(AIDS)** caused by HIV (Human Immune deficiency virus). The virus can be transmitted by
   - Sexual contact
   - Contaminated Blood& blood products
   - Among drug abuser who shared blades and needles
   - From infected mother to babies during delivery

2. **Syphilis** caused by the bacterium Treponema pallidum bacteria

Environmental transmission

1. microbes residing in soil;

-Example: tetanus caused by *Clostridium tetani* which reside in the soil transmitted through cuts in the skin with contaminated objects.

2.**Zoonoses**: microbes residing in animal.

-Those microbes can be transmitted by variety of modes

examples of zoonoses

- **Bacterial zoonoses**: Salmonellosis from poultry
- **Parasitic zoonoses**: Taeniasis,
  leshmaniasis & toxoplasmosis
- **Viral zoonoses**: Rabies transmitted by bites of infected dogs
- **Fungal zoonoses**: Dermatophytoses are superficial mycoses
- **Leishmaniasis** a parasitic infection that can be transmitted to human by intermediate host female sandflies which will transmit the parasite from dogs, rodents

Hospital acquired infections(Nosocomial)

- **Health care associated infections:** infections the patients acquired during receiving treatment for other condition at health care facilities as nursing homes, hospitals, one day care, outpatient clinics.
- **Nosocomial** is a Latin word means hospital.
- Patients will be infected with microbes from hospital.
- Many microbes become drug resistant and hard to treat.

Nosocomial infection result from interaction of three factors

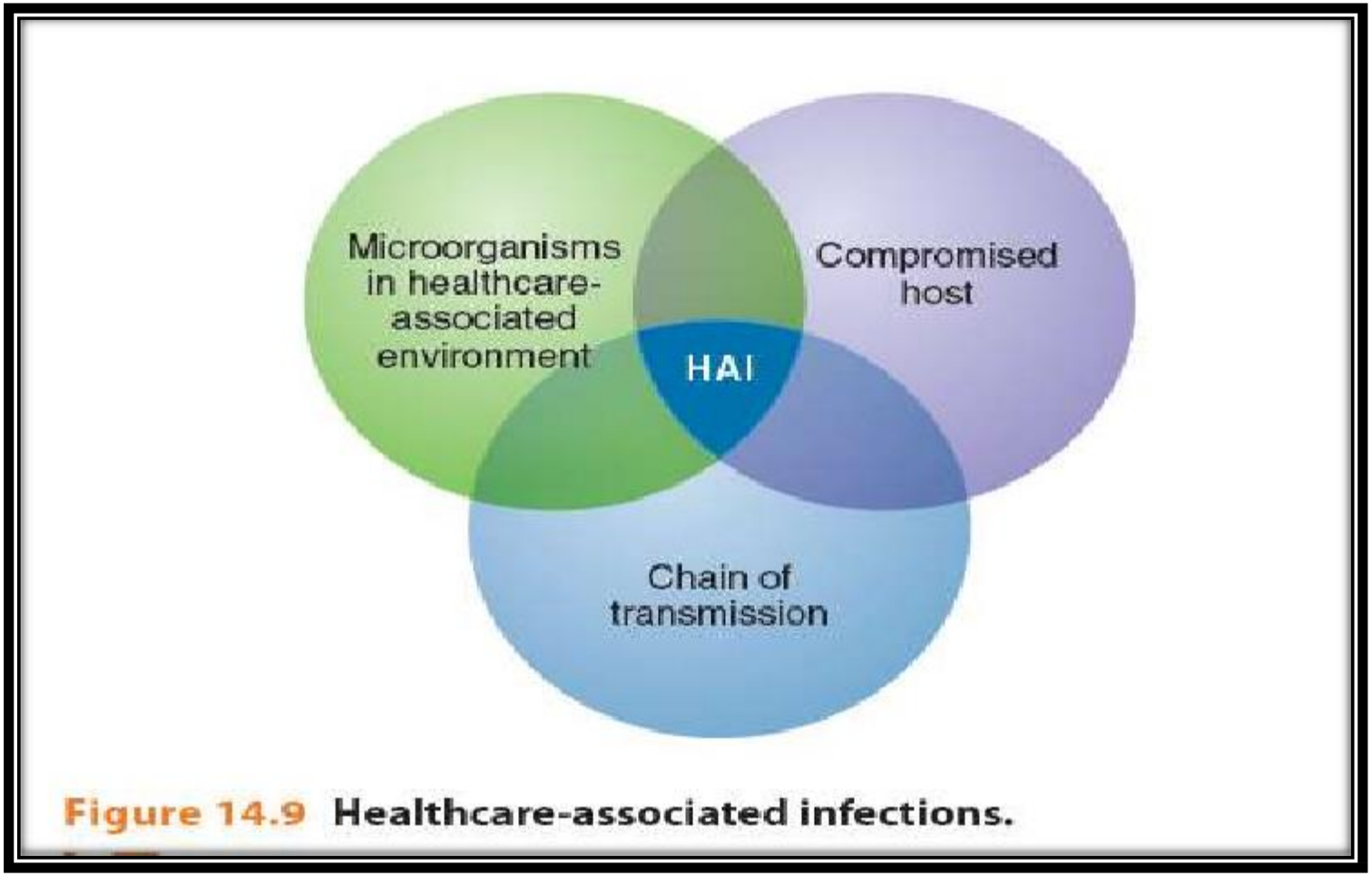


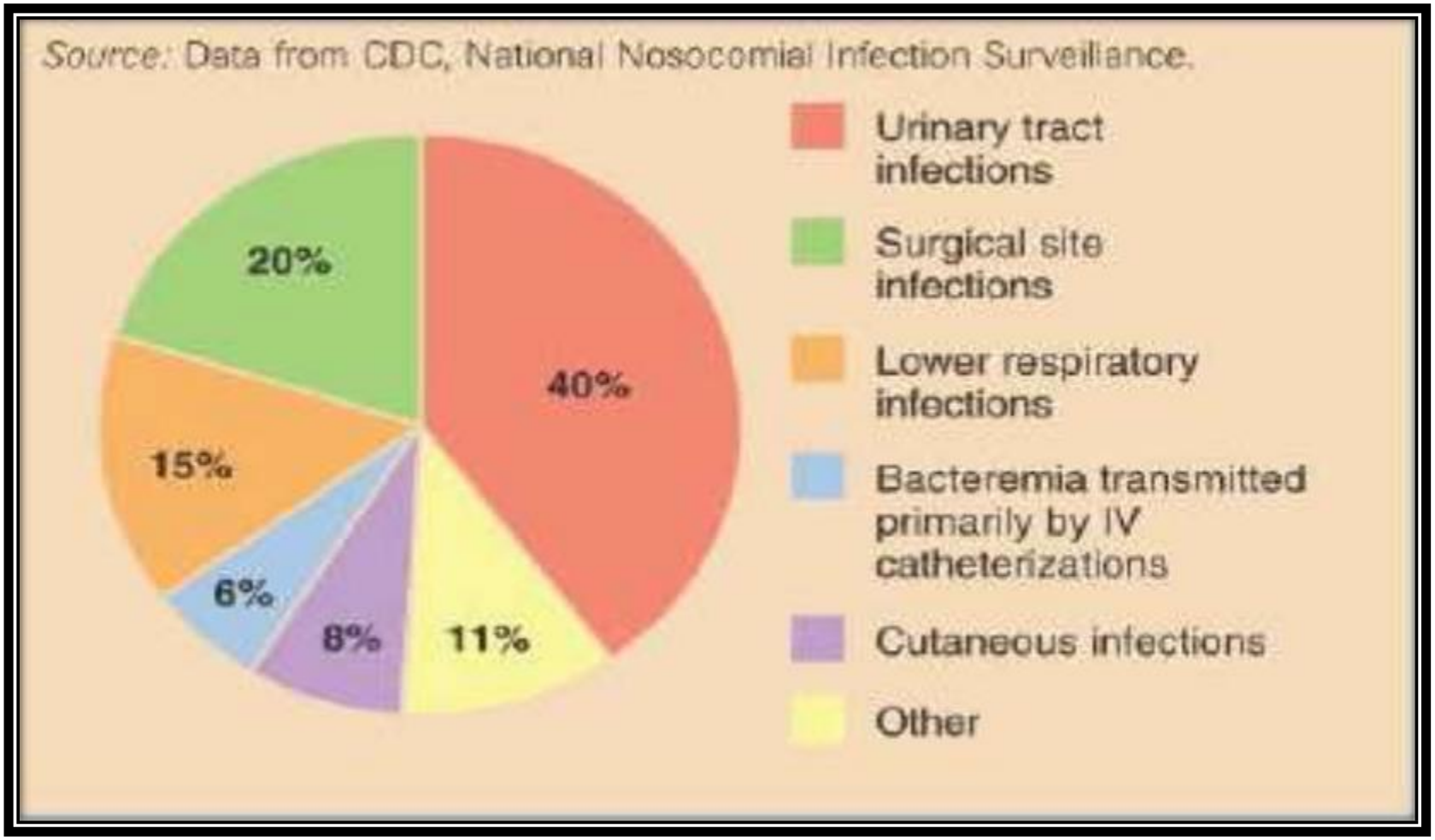
Figure 14.9 Healthcare-associated infections.

1. Compromised host (vulnerable patients): is an individual whose resistance to infection is impaired by:

- ❑ Disease: Patients with HIV
- ❑ Drugs: as patients with organ transplantation/ chemotherapy receiving patients
- ❑ Cuts in the skin and mucus membrane (burns, surgical wounds/ injury / medical invasive procedures.

- Those compromised host are susceptible to low grade bacterial or fungal infections.

Principle Sites for Nosocomial infections in compromised host



2. Microbes in the hospital

- Most of microbes in hospital that cause Nosocomial infections are (**opportunistic microbes)**that don't cause infection in healthy individuals but infect only immune weakened patients.

- Presence of **antimicrobial resistant microbes** in the hospital due to over use of drugs.

- **Example of microbes causing noscomial infection**
  - *Staphylococcus aureus* : bacteria commonly found on the skin, hair . the noses & throats of people and animals.
  - **Intensive care unit (ICU)***: Enterococcus* are part of the normal intestinal flora of humans and animals
  - ***In neonates units****: streptococcus group B causes septicemia and meningitis*

3. Chain of transmission

Direct contact transmission from:

- medical staff to patients,
- patients to patients: ICU, oncology unit & hemodialysis
- visitors to patients

Indirect transmission through fomites (like urine catheter, intravenous catheters) and ventilation systems.

Infectious disease in developing countries

- Infectious diseases have a great significance in developing countries.
- In these countries, infectious diseases will have effects on **social and economic** status of the population as well as travelers will **transmit the disease** to new areas.

- Diarrheal diseases accounts for majority of these infections. Other infections include measles and respiratory infection in children, malaria in Africa, HIV infection and AIDS
- Lack of adequate sanitation and clean water participate in spread of schistosomiasis
- Malnutrition lead to diarrhea