Introduction Of Communicable Disease

- **Objectives :**

1- Define communicable disease, control, elimination and eradication.

2- Draw the cycle of infection.

3-Give examples of different types of infectious agents associated with diseases in humans.

4-List types of reservoir of infection.

5-Classify carriers and explain their public health importance in disease transmission.

6-Illustrate with examples the different modes of transmission of communicable diseases.

7-Define incubation period.

8-Classify and differentiate types of immunity.

9-Outline the measures for prevention and control of communicable diseases.

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- **Resources :**
  Slides.
  Doctor's notes.

[Colors index : Important | Notes | Note | Slides | Extra] [Editing file | Share note]

Communicable Diseases

An illness caused by an **infectious agent** or its toxic product which can be **transmitted** directly or indirectly or through **vector** from the reservoir to a susceptible **host**.

Definition of Terms:

- **Control:** Refers to the activities conducted to bring a disease or a health problem at a very low level till it becomes no longer a public health problem.

- **Elimination:** Termination of all modes of transmission to a reduction of the incidence of the disease to the zero in a confined or specific geographic locality as a result of deliberate efforts yet, continued intervention methods are required.

- **Eradication:** Termination of all modes of transmission of infection by extermination of the infectious agent. The concept of eradication is a global one. Smallpox is the only disease that has been eradicated to date is smallpox. (complete removal)

Chain of infection:

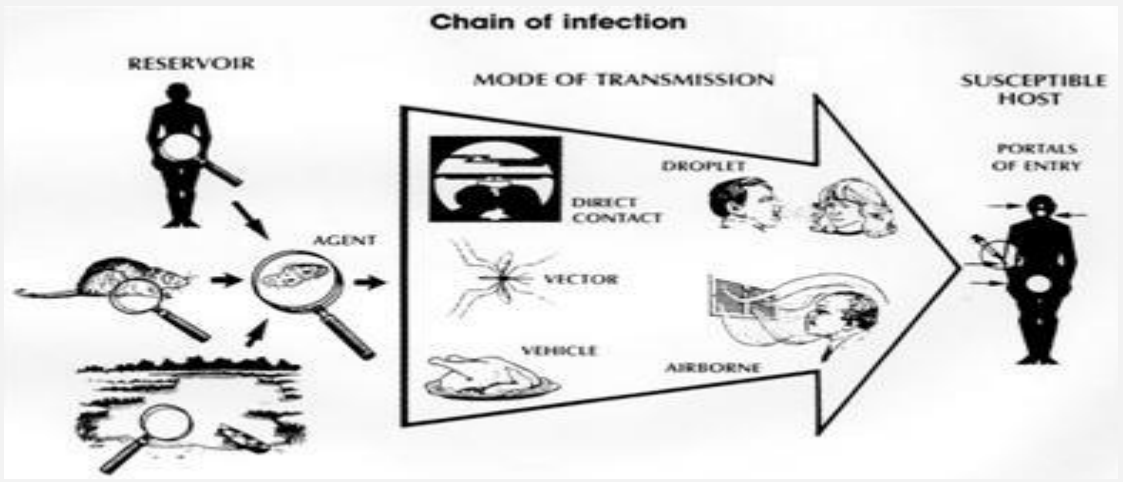
- The **reservoir** of an infectious agent is the habitat in which the agent normally lives, grows, and multiplies. Reservoirs include humans, animals, and the environment.

- **Portal of exit** is the path by which a pathogen leaves its host. For example, influenza viruses and Mycobacterium tuberculosis exit the respiratory tract, schistosomes through urine, cholera vibrios in feces.

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

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

- The final link in the chain of infection is a susceptible host. Susceptibility of a **host** depends on genetic or constitutional factors, specific immunity, and nonspecific factors that affect an individual's ability to resist infection or to limit pathogenicity.



Communicable Diseases

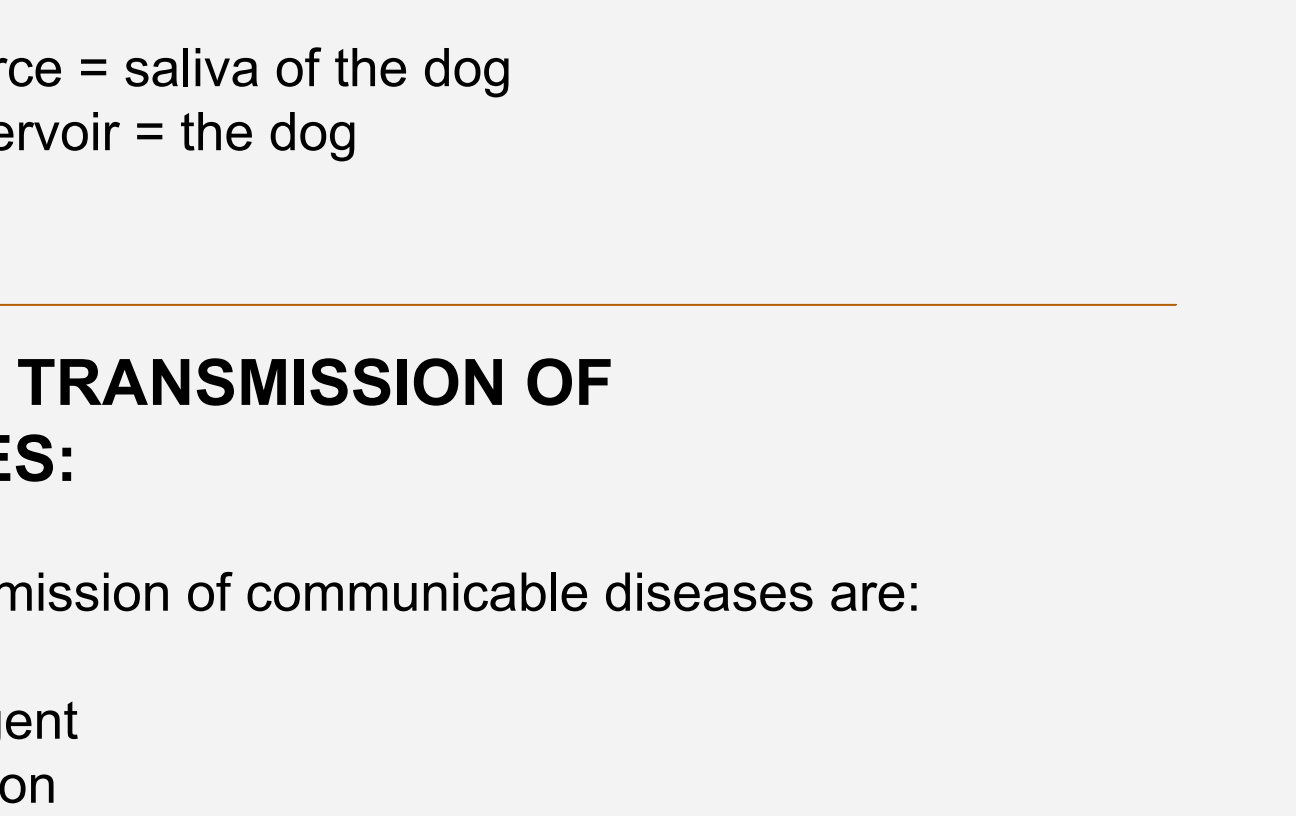
Examples of infectious agents associated with diseases in humans:

- **Neisseria gonorrhoeae:** Source = humans
  Reservoir = humans.
- **Salmonella typhi:** Source = food/water
  Reservoir = humans
- **Hepatitis C:** Source = transfusion, blood products
  Reservoir = humans
- **Rabies virus:** Source = saliva of the dog
  Reservoir = the dog

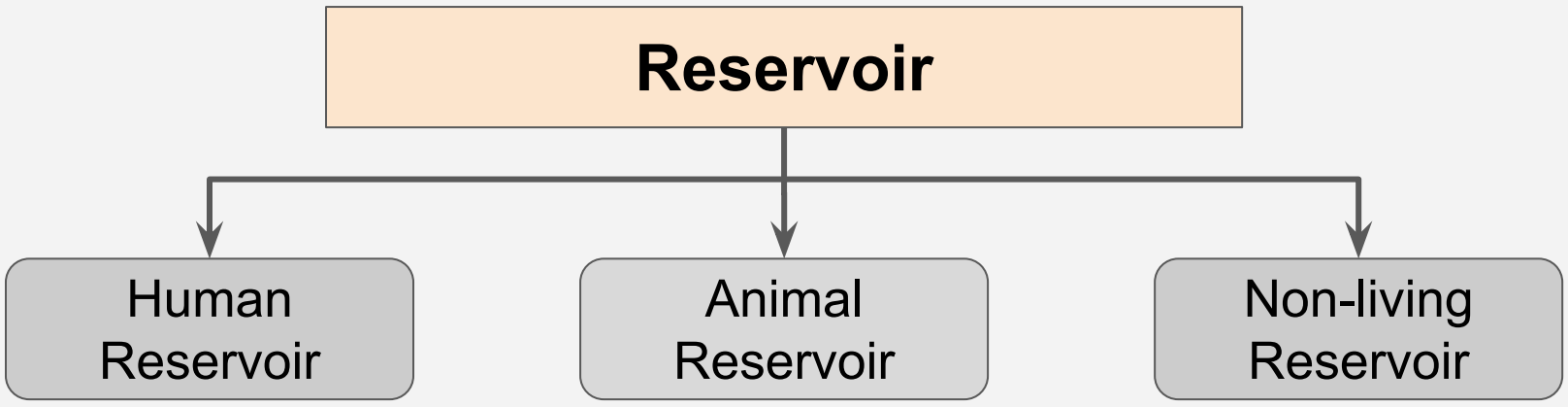
PREREQUISITES FOR THE TRANSMISSION OF COMMUNICABLE DISEASES:

The six pre-requisites for the transmission of communicable diseases are:

1. Presence of microbiological agent
2. Presence of reservoir of infection
3. Portal of exit through which the microbiological agent leaves the reservoir
4. Mode of transmission
5. Portal of entry (inlet) through which the microbiological enters the host
6. Presence of susceptible host



Reservoir of Infection



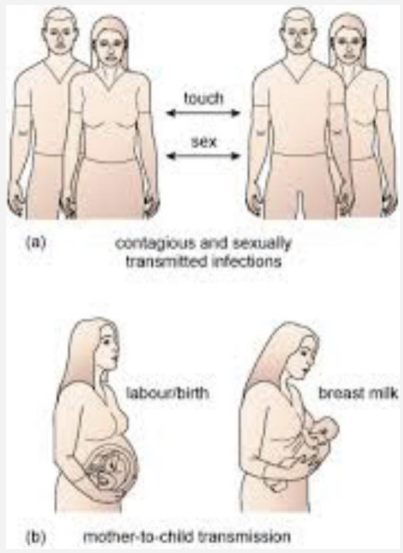
1. Human to Human

- Most viral and bact. RTIs
- Most staph and strept.
- STD
- Human reservoir could be cases or carriers

Human

↕

Human



Carriers and their public health importance in disease transmission:

- Hosts without obvious illness
- Continue to spread the pathogen even though they have recovered from illness.
- Unless the family and other close contacts of the sick person or even the whole population can be treated, carriers will remain a threat to the health of those surrounding them.

Table 2.2. Examples of infections with asymptomatic carriers

Infection	*Asymptomatic infections*
Bacillary dysentery	common [3]
Cholera (El Tor)	only 1 in 30-50 infections develops illness [16]
Giardiasis	1 in 2-4 infections develops illness [44]
Polio	very common
Typhoid fever	very common [73]
Schistosomiasis	very common [16]
Hookworm	very common
Yellow fever	common [3]
Japanese Encephalitis	only 1 in 1,000 infections develops illness [44]
Filariasis	very common
Malaria	common [3]
River blindness	common [2]
Plague	common during epidemics [73]

Reservoir of Infection

Importance of Carriers:

- **Number:** carriers may outnumber cases.
- **Difficulty:** carriers don't know that they are infected.
- **Mobility:** carriers are mobile, cases are restricted.
- **Chronicity:** carriers re-introduce infection and contribute to endemicity.

Effect of carriers on disease transmission:

- Iceberg effect in temperate zone.
  These are the fact that carriers constitute a hidden reservoir of infection and that they may outnumber actual cases.

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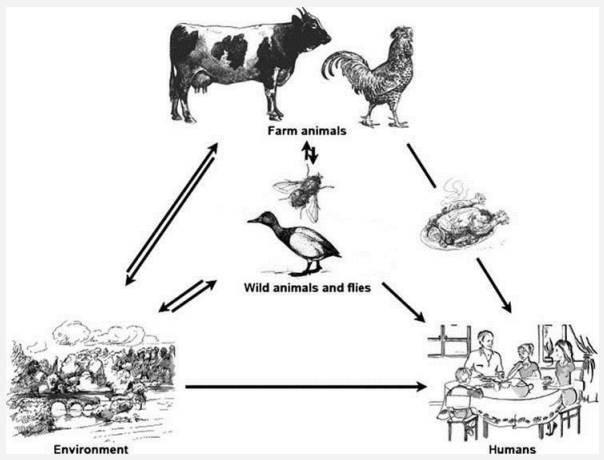
2. Animal to Human:

Zoonosis

Animal ⟷ Animal ⟶ Human



3. Non-living reservoir:

Soil, water…

- Tetanus
- Botulism
- Fungi (ringworm and hookworm)

Reservoir of Infection

AGENT FACTORS RELATED TO DEVELOPMENT OF A DISEASE:

- **Pathogenicity:** Ability of the organism to produce disease or damage to the host/ specific clinical picture

- **Virulence:** Ability to produce severe pathological reaction. Measured by the ratio of clinical to subclinical disease and case fatality rate

- **Dose of infection (inoculum):** high probability of severe disease with higher dose of infection

- **Viability of the organism (resistance):** Ability of the organism to live outside the body

- **Spore formation:** Maintain viability for a long period in unfavorable environmental conditions

- **Antigenic power of the organism:** Ability to stimulate the immune system to produce antibodies or antitoxin with subsequent immunity. Measured by the second attack frequency

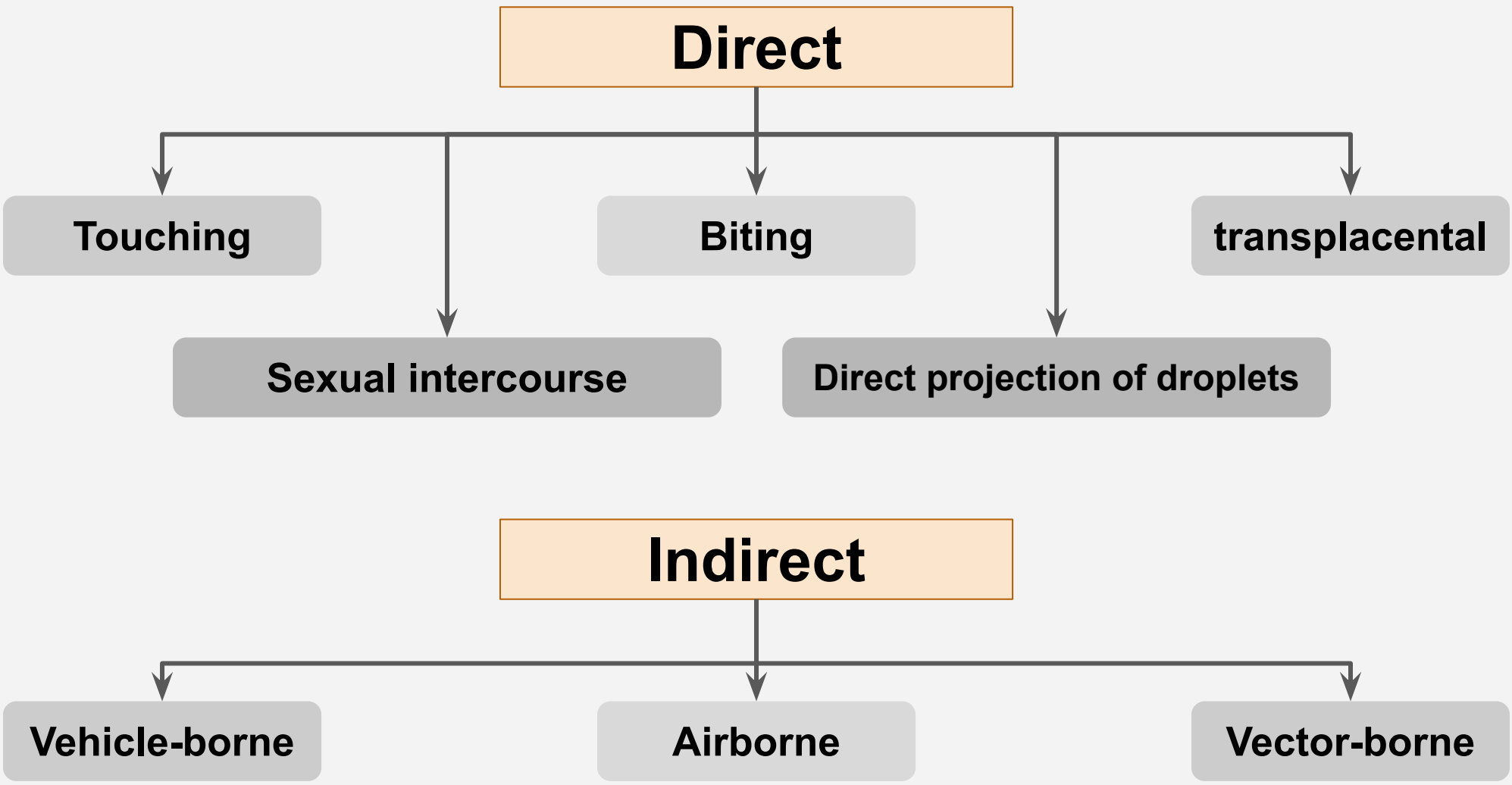
- **Ease of communicability** is measured by the secondary attack rate, which is the number of secondary cases, occurring within the range of incubation period following exposure to a primary case expressed as a percentage of susceptible.

INCUBATION PERIOD:

- It is the period between the entry of the organism and the appearance of the first symptom of the disease

- **Important for:**
  - Surveillance and quarantine in some diseases
  - Application of preventive measures to abort or modify the attack.
  - Identification of the source of infection

Modes of transmission



Direct Transmission

Refers to the transfer of an infectious agent from an infected host to a new host, without the need for intermediates such as air, food, water or other animals. Direct modes of transmission can occur in two main ways:

- **Person to person:** through touching, biting, kissing, sexual intercourse or direct projection of respiratory droplets into another person's nose or mouth during coughing, sneezing or talking. A familiar example is the transmission of HIV from an infected person to others through sexual intercourse.
- **Transplacental transmission:** This refers to the transmission of an infectious agent from a pregnant woman to her fetus through the placenta. An example is MTCT of HIV.

Modes of transmission

Indirect transmission

Indirect transmission is when infectious agents are transmitted to new hosts through intermediates such as air, food, water, objects or substances in the environment, or other animals.

1- Airborne transmission:

The infectious agent may be transmitted in dried secretions from the respiratory tract, which can remain suspended in the air for some time. For example, the infectious agent causing tuberculosis can enter a new host through airborne transmission.

❖ **Air-borne**

- Droplet infection (direct spread): Whooping cough
- Droplet nuclei (indirect air-borne): TB, histoplasmosis
- Dust particles (indirect air-borne): Fungal spores

2- Vehicle-borne transmission:

A vehicle is any non-living substance or object that can be contaminated by an infectious agent, which then transmits it to a new host. **Contamination** refers to the presence of an infectious agent in or on the vehicle.

❖ **Food and drink borne**

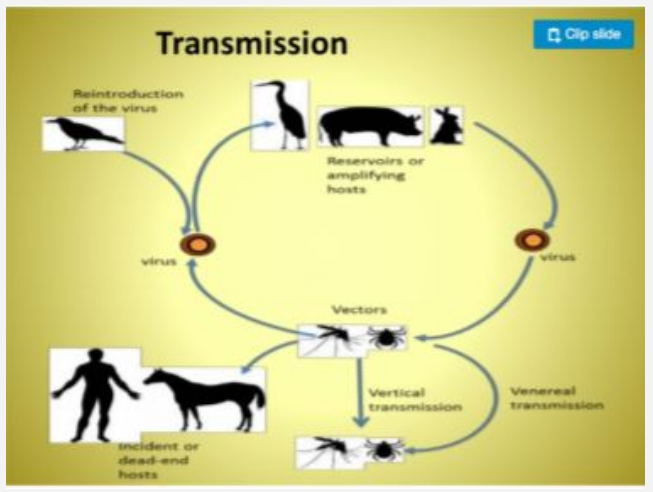
- Food and drink borne illnesses are caused by the consumption of drinks that are contaminated with organism causing disease.
- The most commonly recognized are: campylobacter, Salmonella and Escherichia coli bacteria
- Human hands or/and flies

Modes of transmission

Indirect transmission

3- Vector-borne transmission:

A vector is an organism, usually an arthropod, which transmits an infectious agent to a new host. Arthropods which act as vectors include houseflies, mosquitoes, lice and ticks.



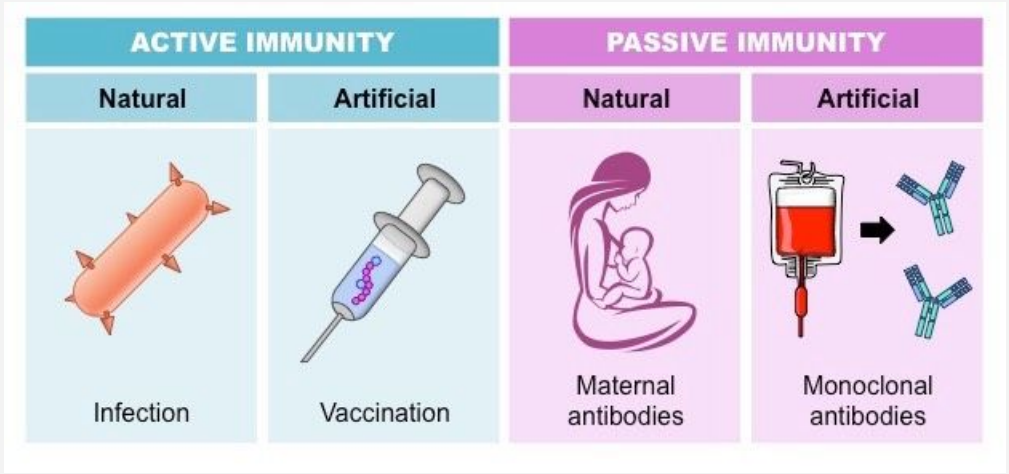
- **Arthropod-borne**

Group of infectious agents that are transmitted by bloodsucking arthropods from one vertebrate host to another.

Examples:

Virus	Reservoir	Vector	Disease
Chikungunya	Monkeys	Mosquito	Chikungunya fever
Dengue	Monkeys, Human	Mosquito	Dengue hemorrhagic fever
Japanese B Encephalitis	Wild birds, Pigs	Mosquito	Encephalitis
Kyasanur Forest Disease	Forest birds, animals	Tick	Hemorrhagic fever
Sindbis	Birds	Mosquito	Sindbis fever

Types of immunity



1-Susceptible host and immunity

- A person or other living animal, that afford subsistence or lodgment to an infectious agent under natural condition.
- Susceptibility to infection is universal but susceptibility to disease depends immunity and resistance.

2-Immunity: Natural resistance of the body offered by skin, gastric acidity etc.

- **Acquired immunity:**
  - **Passive**: acquired through transferred antibodies from mother to infant (**natural**) or by administration of immunoglobulin or antisera (**artificial**)
  - **Active**: post infection immunity (**natural**) or following vaccination (**artificial**)

- **Herd immunity:** (getting protected because others are vaccinated) (**pic** / **video**)
  - Also known as community immunity, **refers to** the protection offered to everyone in a community by high vaccination rates. With enough people immunized against a given disease, it's difficult for the disease to gain a foothold in the community. This offers some protection to those who are unable to receive vaccinations

- **People who depend on herd immunity:**
  Some people in the community rely on herd immunity to protect them. These groups are particularly vulnerable to disease, but often cannot safely receive vaccines:
  • People without a fully-working immune system, including those without a working spleen and those with HIV.
  • People on chemotherapy treatment whose immune system is weakened
  • Newborn babies who are too young to be vaccinated
  • Elderly people
  • Many of those who are very ill in hospital

Prevention and control of communicable diseases

- **Measures applied to disease agents:** Sterilization and disinfection

- **Measures applied to reservoir of infection:**

  •**Cases:** Case finding, reporting to the local health authority in order to apply the appropriate control measures for contact and the environment, isolation (strict isolation or discharge/body fluid isolation) for the whole period of communicability and treatment.

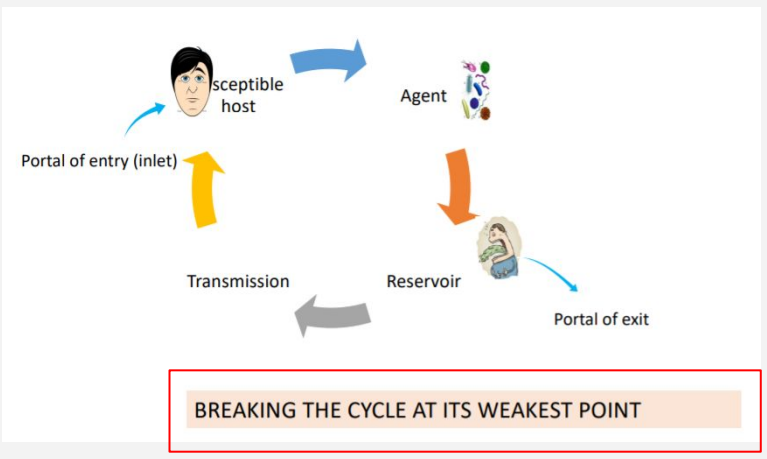
  •**Carriers:** Identification of carriers in the community, treatment and exclusion from work till the organism is eliminated especially if food handlers or working with children.
  Its cost effectiveness depends on the proportion of carrier in the community as well as the sensitivity of their occupation.

  •**Animal reservoir:** Adequate animal husbandry(تزاوج), immunization (if vaccine is available), treatment of infected animals and killing if treatment is not feasible.

- **Measures applied to contact:** Enlistment, surveillance for the longest incubation period of the disease, isolation (if indicated) as well as increase resistance by immunization or chemoprophylaxis.

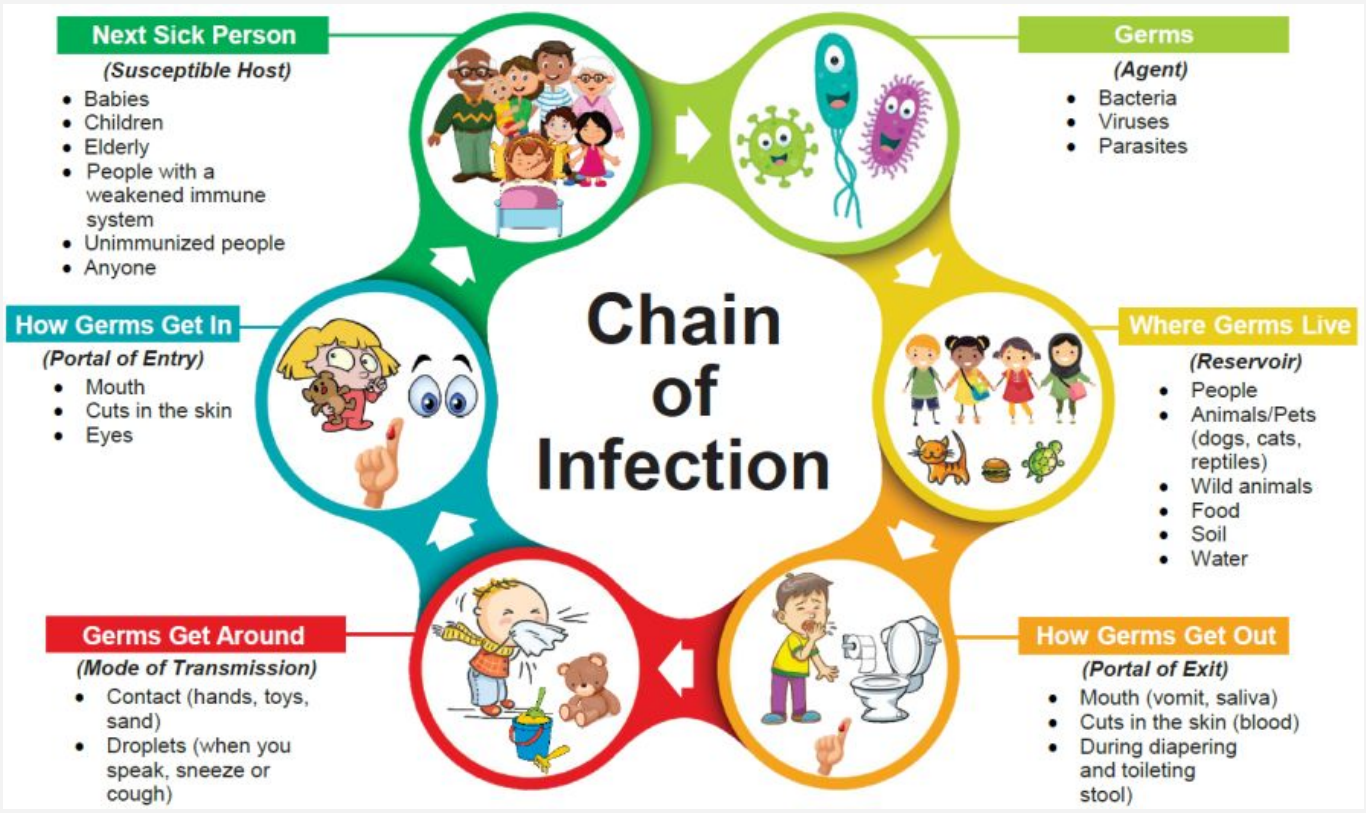
- **Measures applied to the environment:** sanitation (water/food/sewage)

- **Measures applied to the host:** Health education, adequate personal hygiene, sound nutrition, immunization and chemoprophylaxis



Summary

Remeber you need these things for transmission of the disease (Pre-requisites)



Reservoir: The habitat in which the the infectious agent lives in, grows and multiplies. It could be humans, animals and the environment.

Portal of Exit: The path by which a pathogen leaves its host.

Portal of Entry: How the pathogen enters the susceptible host.

An **infectious agent** can enter **the susceptible host** by different mechanisms. This host is susceptible due to **defect** in the ability of resisting the infection or to limit the pathogenicity.

Are you able to know the difference?

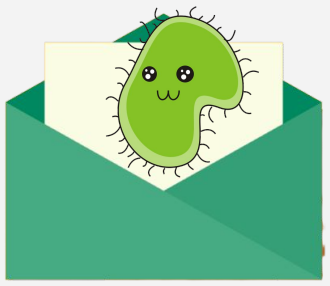
Control: Bringing a disease at **very low level** till it becomes **no longer a public health problem.**

Elimination: Incidence of the disease is **ZERO** in **specific area** and this requires the termination of all modes of transmission and continuing the efforts.

Eradication: **Extermination** of the infectious agent, and this is a **global** one. **Smallpox** is the only agent that has been eradicated.

Carriers

Hosts without obvious illness and they can spread the disease even if they recovered from it.
Their importance of identifying these hosts lies in:
1-They may outnumber the cases (Iceberg effect)
2-They do not they are infected
3-They are mobile and free to move
4-Re-introduce the infection and contribute to endemicity



Modes of Transmission

Direct
No need for intermediates and they are two ways:
-Person to person
-Transplacental transmission

Indirect
There is an intermediate:
-Airborne
-Vehicle-borne
-Vector-borne

Agent factors (Development of disease)

1-Pathogenicity (ability to produce the disease, give specific clinical picture)
2-Virulence (ability to produce severe pathological reaction. It can be MEASURED.)
3-Dose of infection (Inoculum)
4-Viability of the organism (resistance, can live outside the host)
5-Spore formation (unfavorable environment)
6-Antigenic power of the organism
7-Ease of communicability (Secondary attack rate)

Incubation Period
It is the period between the entry of the organism and the appearance of the first symptom
It is important to know it for the purpose of prevention, identification and surveillance

Herd Immunity
Protection to everyone in the community by high vaccination rates. This offers immunity for those who can not the vaccinations (Immunosuppressants, Newborn babies, elderly and hospitalized patients (very ill ones)

PREVENTION and CONTROL of the disease (Breaking the cycle at its weakest point) and that's done by different methods!

MCQs

1-You have been assigned with infection control team to one of the countries that has an epidemic of a certain disease. If you are aiming to eliminate it then what is your target?

A) A level at which animal can only be affected
B) Not endemic anymore
C) Zero level
D) Less hospitalization

2-Which of the following agents' reservoir is dogs?

A) Neisseria Gonorrhoeae
B) Salmonella Typhi
C) Hepatitis C
D) Rabies Virus

3-For a transmission to happen, what is required?

A) A weakened agent
B) Weakened immunity
C) Closed wound
D) Clean water

4-A carrier is the host that shows no symptoms, which disease can fit this definition ?

A) Polio
B) Neisseria Gonorrhoeae
C) Salmonella
D) Influenza

5-Tetanus can be found in

A) Air
B) Soil
C) Birds
D) Humans

6-Which measure is applied to the reservoir to control it?

A) Vaccination of animals
B) Encouraging people to raise pets in their homes
C) Surveillance
D) Education

1-C
2-D
3-B
4-A
5-B
6-A