Chain Of Infection and Infection Control

Date: 04/11/2025

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Outline

- The chain of infection: All six links
- Transmission modes:
  - contact transmission
  - droplet transmission
  - airborne transmission
  - vector transmission
  - common vehicle transmission
- Strategies for breaking infection chain

Introduction: Definitions & Key Concepts

What is Infection Control?

Infection control is **the discipline** concerned with preventing nosocomial or healthcare-associated infections through evidence-based practices and procedures.

Key Terminology:

- **Healthcare-Associated Infections (HAIs):** Infections acquired by patients during the process of receiving healthcare

Introduction: Definitions & Key Concepts

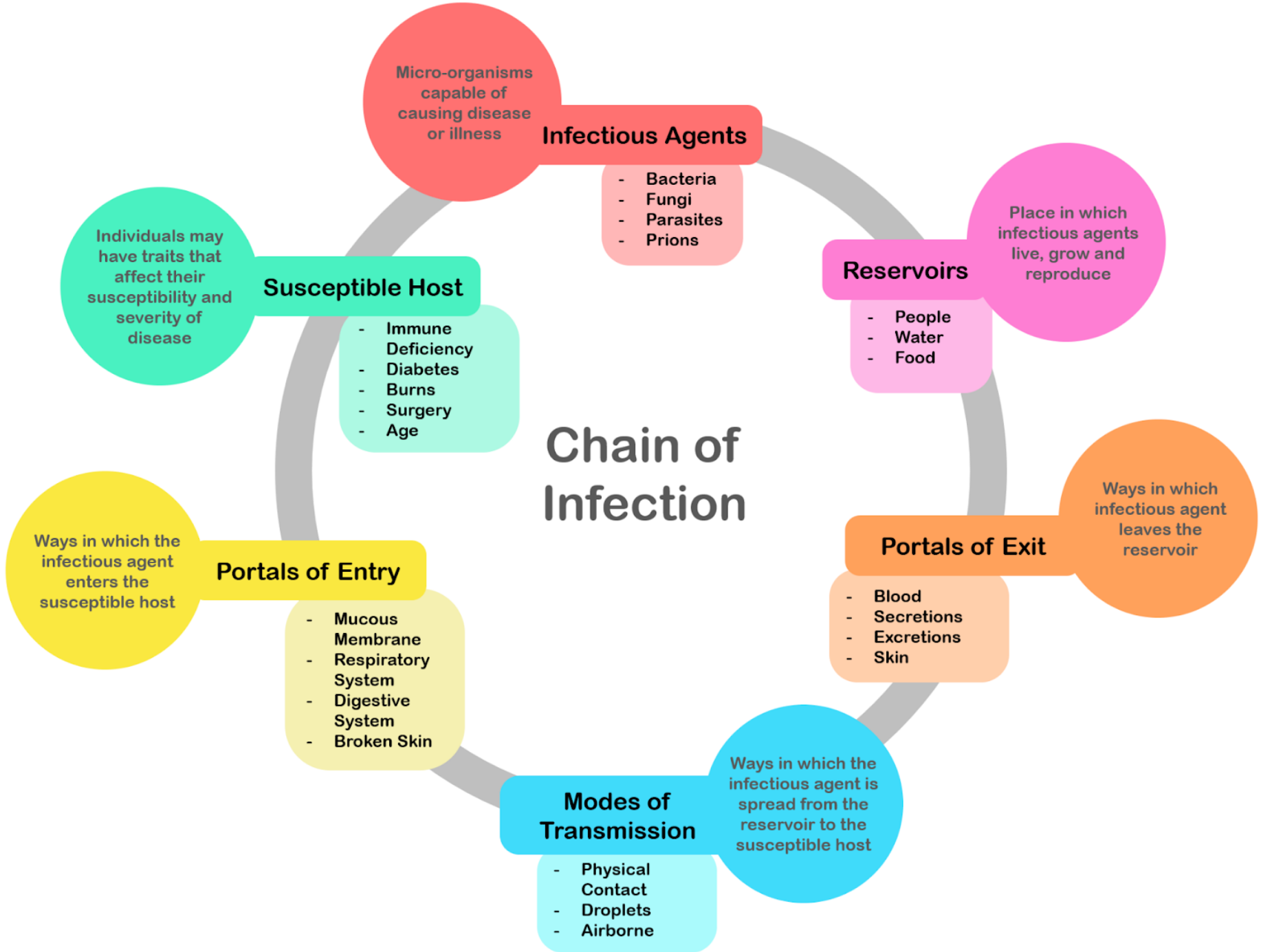
- **Colonization vs. Infection**
  - **Colonization:** Microorganisms present but NOT causing disease or immune response
  - **Infection:** Microorganisms causing tissue damage and clinical symptoms
- **Communicable/Contagious Disease:** Disease that can be transmitted from person to person or from animal to person
- **Source/Reservoir:** The place where infectious agents live, grow, and multiply (humans, animals, environment)

The Chain of Infection - Overview

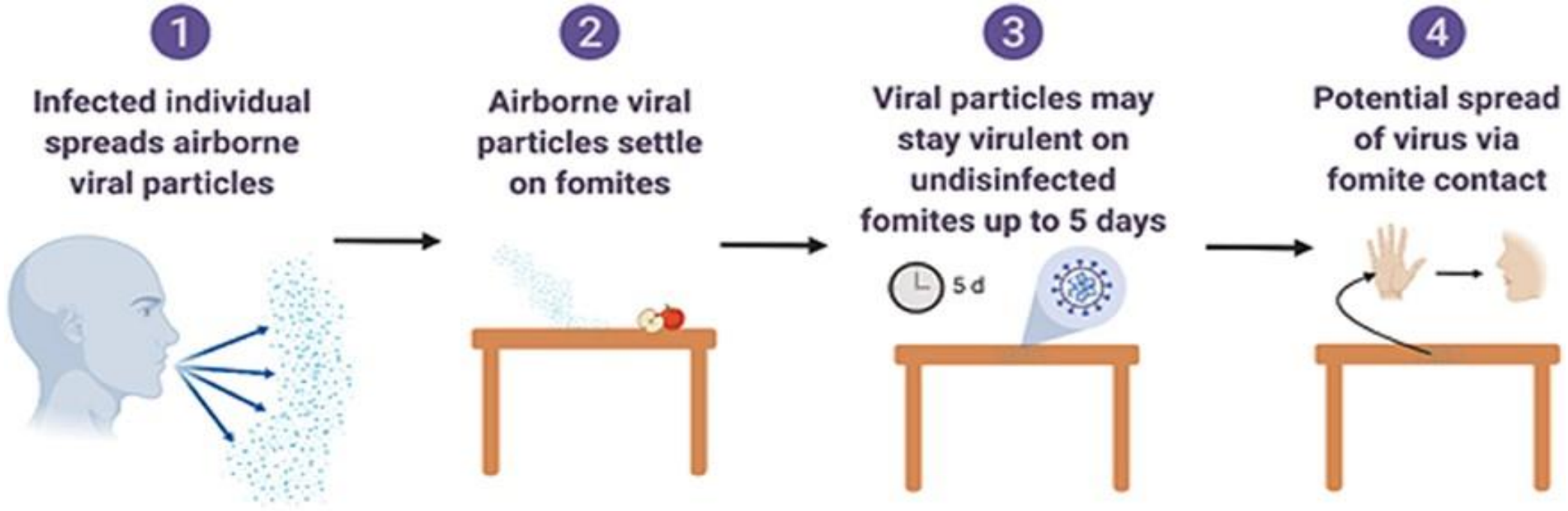
Fundamental principle:

- For an infection to occur and spread, All Six links in the chain must be present and connected.
- Breaking any single link will stop the transmission of infection.

This is the foundation of all infection control strategies!


Chain of Infection
Infectious Agents
Micro-organisms capable of causing disease or illness
- Bacteria
- Fungi
- Parasites
- Prions
Reservoirs
Place in which infectious agents live, grow and reproduce
- People
- Water
- Food
Portals of Exit
Ways in which infectious agent leaves the reservoir
- Blood
- Secretions
- Excretions
- Skin
Modes of Transmission
Ways in which the infectious agent is spread from the reservoir to the susceptible host
- Physical Contact
- Droplets
- Airborne
Portals of Entry
Ways in which the infectious agent enters the susceptible host
- Mucous Membrane
- Respiratory System
- Digestive System
- Broken Skin
Susceptible Host
Individuals may have traits that affect their susceptibility and severity of disease
- Immune Deficiency
- Diabetes
- Burns
- Surgery
- Age

The Chain of Infection – Example

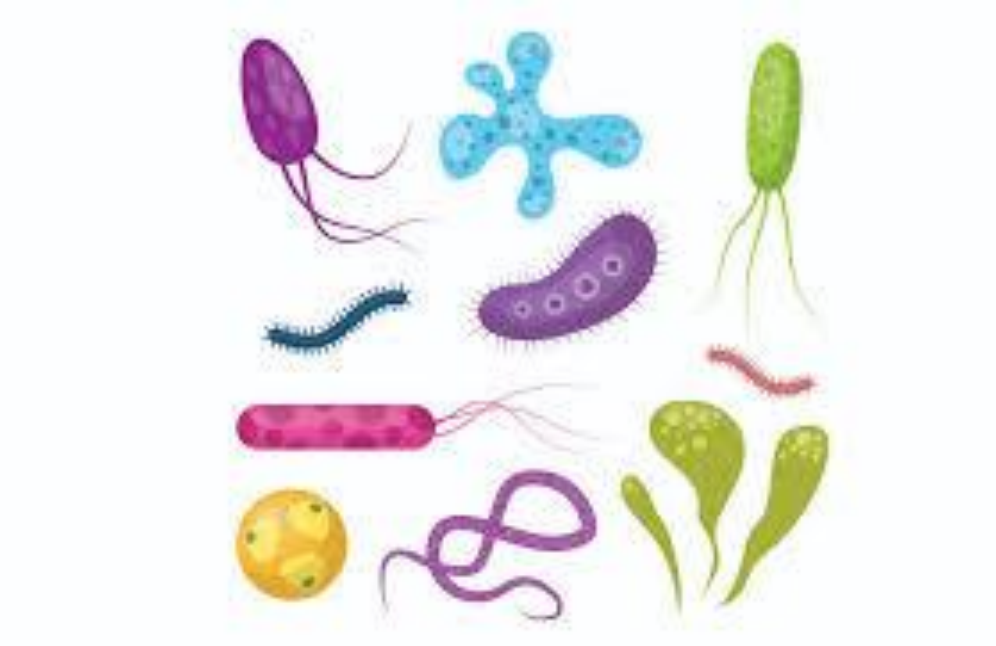


The Chain of Infection - Infectious Agent

Definition: The microorganism capable of causing disease (pathogen)

Types of infectious agents:

1. Bacteria
2. Viruses
3. Fungi
4. Parasites
5. Protozoa



The Chain of Infection - Reservoir

The place where infectious agents live, grow, and multiply. The natural habitat of the microorganism.

Types of reservoirs:

1. **Human reservoirs** (Most common in healthcare): patients, healthcare workers, visitors

2. Environmental reservoirs: equipment & medical devices, water, air

- **Other:** linen and laundry, food, waste materials

3. Animal reservoirs: pets visiting patients, service animals, pests: rats, cockroaches, flies

The Chain of Infection - Portal of Exit

The path by which an infectious agent leaves the reservoir (host body or environment)

Key Principle: The portal of exit is usually related to the site where the organism is located in the body.

Major portals of exit:

1. **Respiratory tract :** Mechanisms: Coughing, Sneezing, Talking, Singing

- **Organisms expelled through** droplets (large particles), aerosols (small particles), respiratory secretions

The Chain of Infection - Portal of Exit

2. Gastrointestinal tract: exits through faeces, vomitus, saliva (in some infections)

3. Genitourinary tract: exits through urine, vaginal secretions, semen

4. Blood and body fluids: exits through blood (cuts, needle sticks, iv sites), wound drainage, any body fluid

5. Skin and mucous membranes: exits through open wounds, skin lesions (pustules, vesicles), exudates

6. Transplacental (Mother to fetus): crosses the placenta during pregnancy

The Chain of Infection - Mode of Transmission

The method by which the infectious agent travels from the reservoir/portal of exit to the susceptible host.

- The five major modes of transmission:
  1. Contact transmission
  2. Droplet transmission
  3. Airborne transmission
  4. Vector borne transmission
  5. Common vehicle transmission

The Chain of Infection: Mode of Transmission- Contact transmission

A. Direct contact: Physical skin-to-skin contact between infected person and susceptible host

- Examples:
    - Healthcare worker touching infected wound, then touching another patient.
    - Shaking hands with infected person

The Chain of Infection: Mode of Transmission- Contact transmission

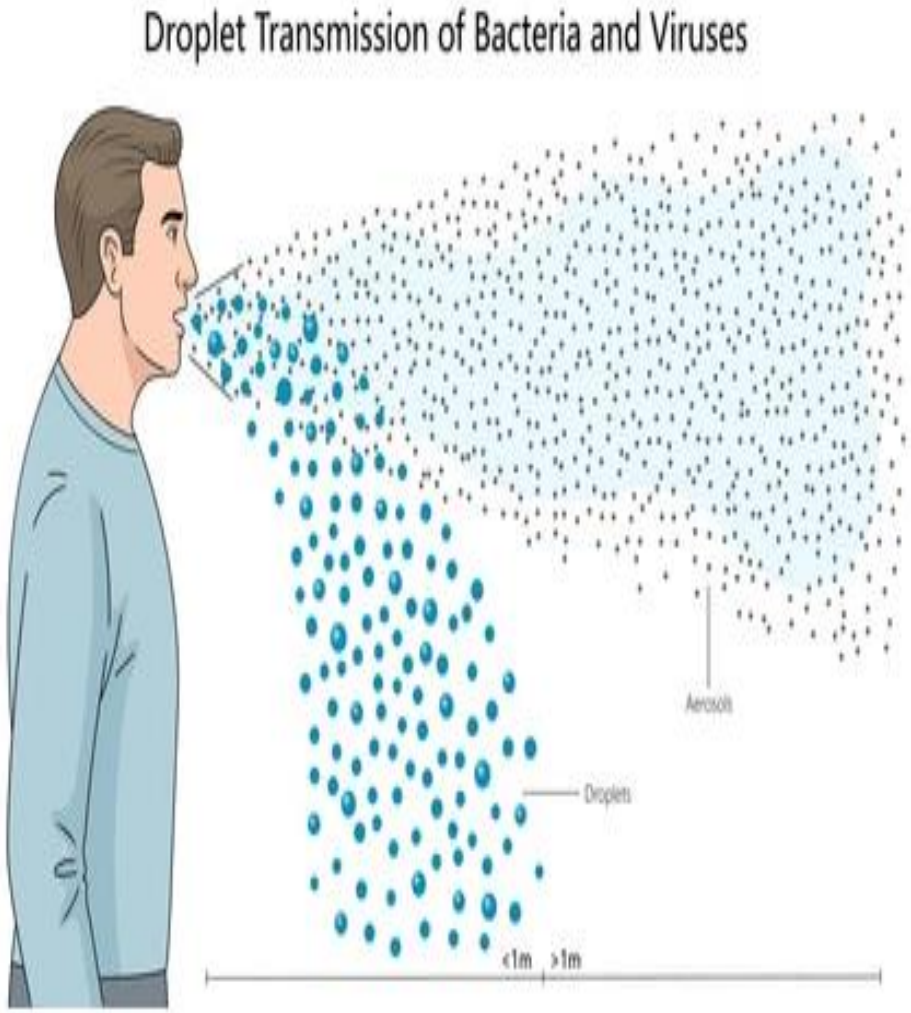
B. Indirect contact: Transfer via contaminated intermediate object (fomite)

- No direct person-to-person contact
- Fomites (contaminated objects):
  - Medical equipment: stethoscopes, BP cuffs, thermometers
  - Personal items: phones, tablets, pens
  - Environmental surfaces: bed rails, door handles
  - Contaminated hands of healthcare workers

The Chain of Infection: Mode of Transmission- Droplet transmission

Characteristics:

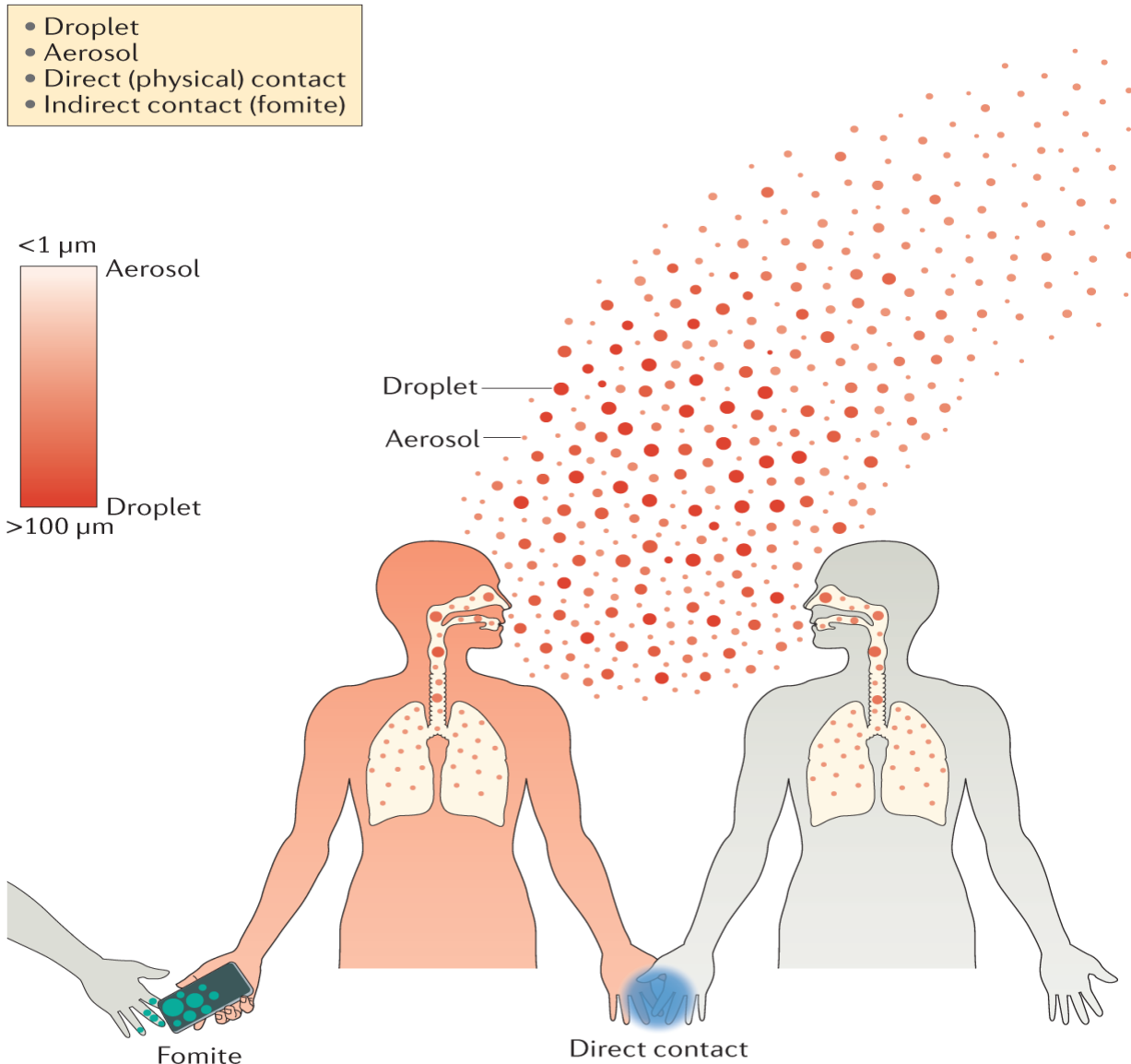
- Large respiratory droplets (>5 microns in diameter)
- Generated during coughing, sneezing, talking, suctioning
- **Travel up to 1-2 meters** from source
- Drop to ground due to gravity - do NOT remain suspended in air



The Chain of Infection: Mode of Transmission- Droplet transmission

How transmission occurs:

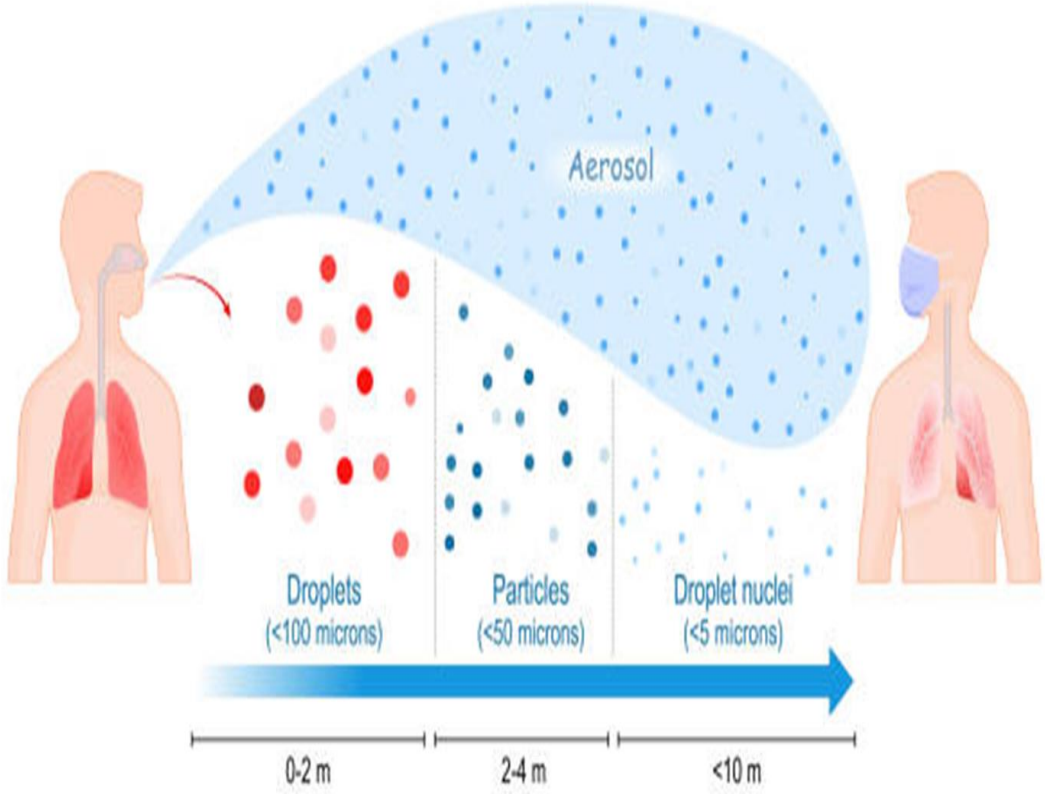
- Droplets expelled from infected person
- Land on mucous membranes of nearby person (eyes, nose, mouth)
- Or land on nearby surfaces, then transferred by touch



The Chain of Infection: Mode of Transmission- Airborne transmission

Characteristics:

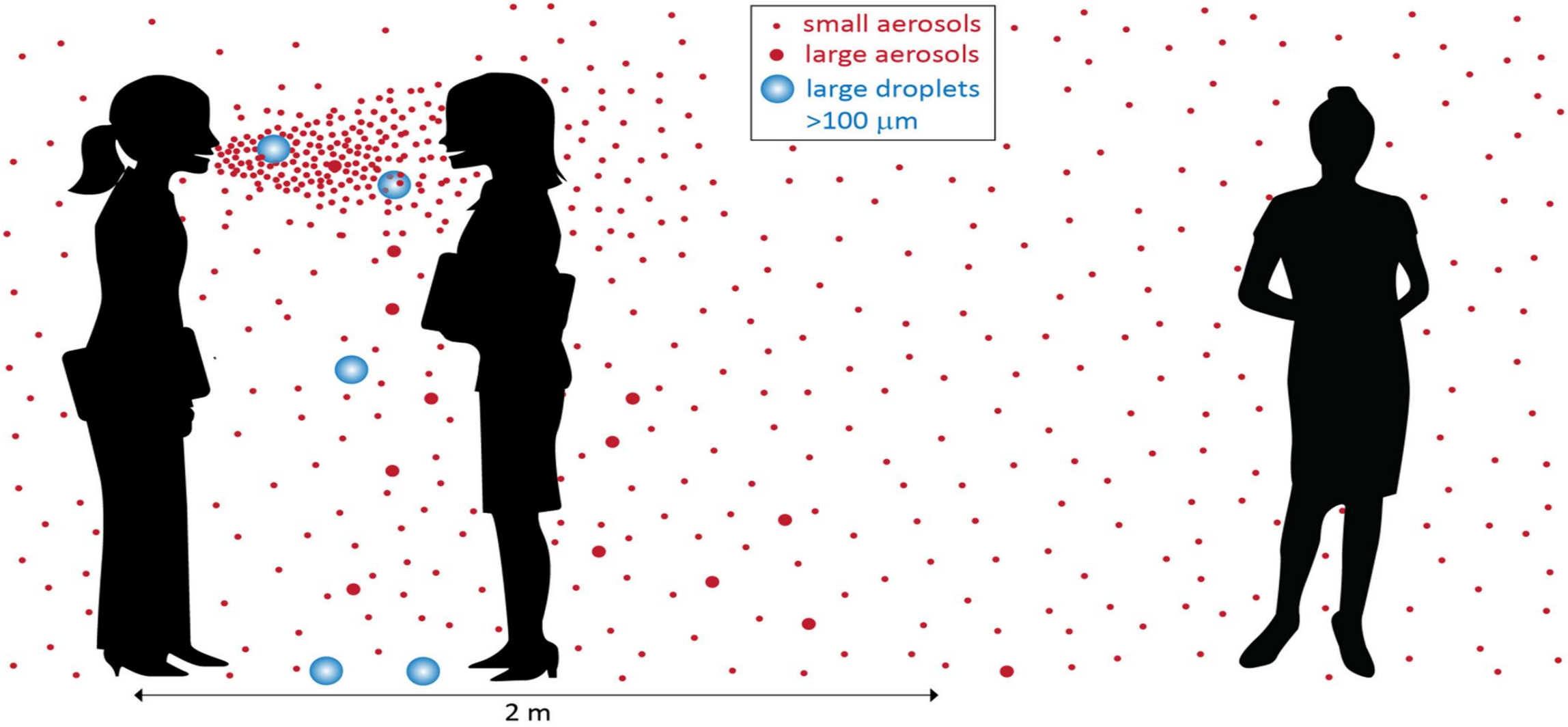
- Very small particles called "droplet nuclei" (<5 microns)
- Remain suspended in air for LONG periods (hours)
- Can travel Long distances (>2 meters, throughout room/building)
- Can be carried by air currents, Spread by air circulation and ventilation systems
- Can be inhaled by persons far from the source



Comparison: Droplet vs. Airborne

Feature	Droplet	Airborne
Particle size	>5 microns	<5 microns
Distance travelled	Up to 2 meters	Throughout room/building
Remains in air	NO - falls quickly	YES - hours
Protection needed	Surgical mask	N95 respirator
Room requirement	Regular room OK	Negative pressure (AIIR)

The Chain of Infection: Mode of Transmission- Droplet vs. Airborne



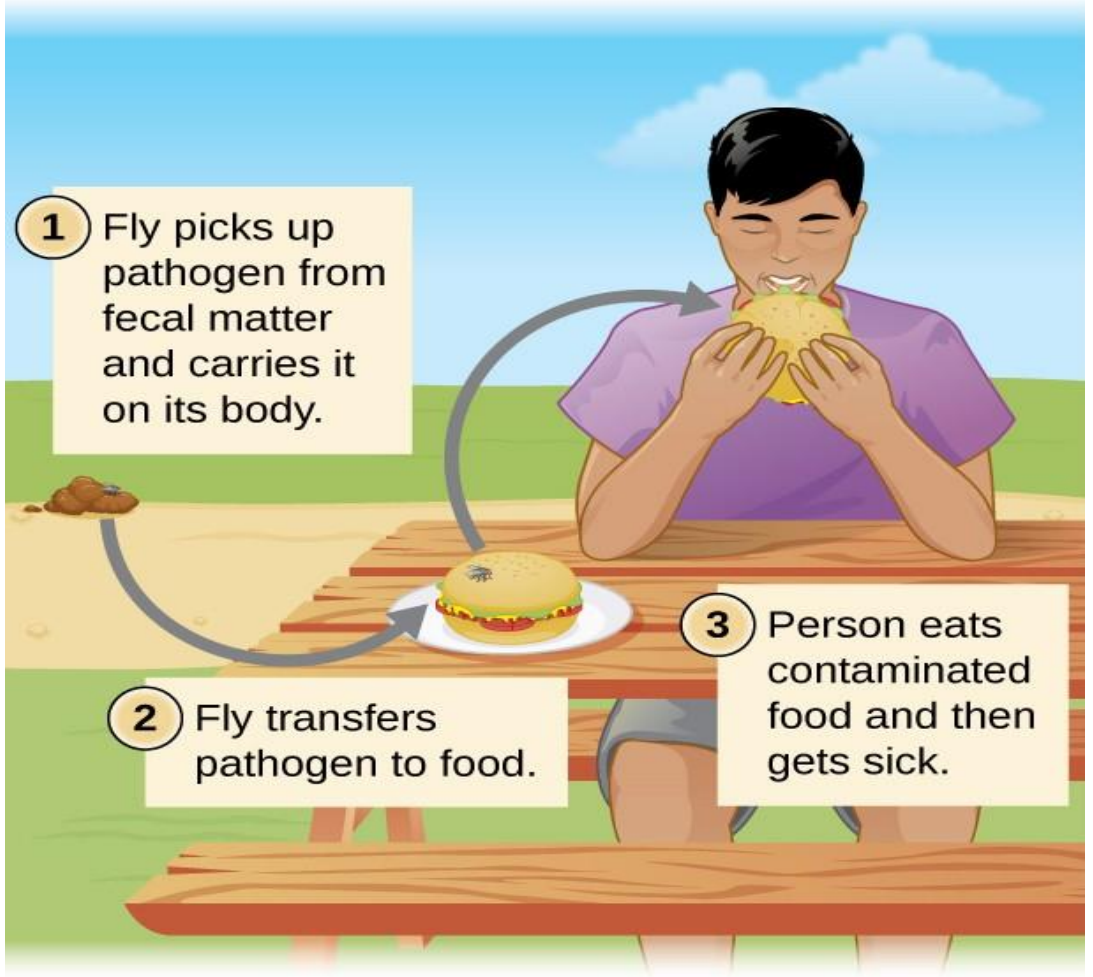
The Chain of Infection: Mode of Transmission- Vector borne transmission

Transfer through insects or arthropods (vectors)

Types:

A. Mechanical transmission:

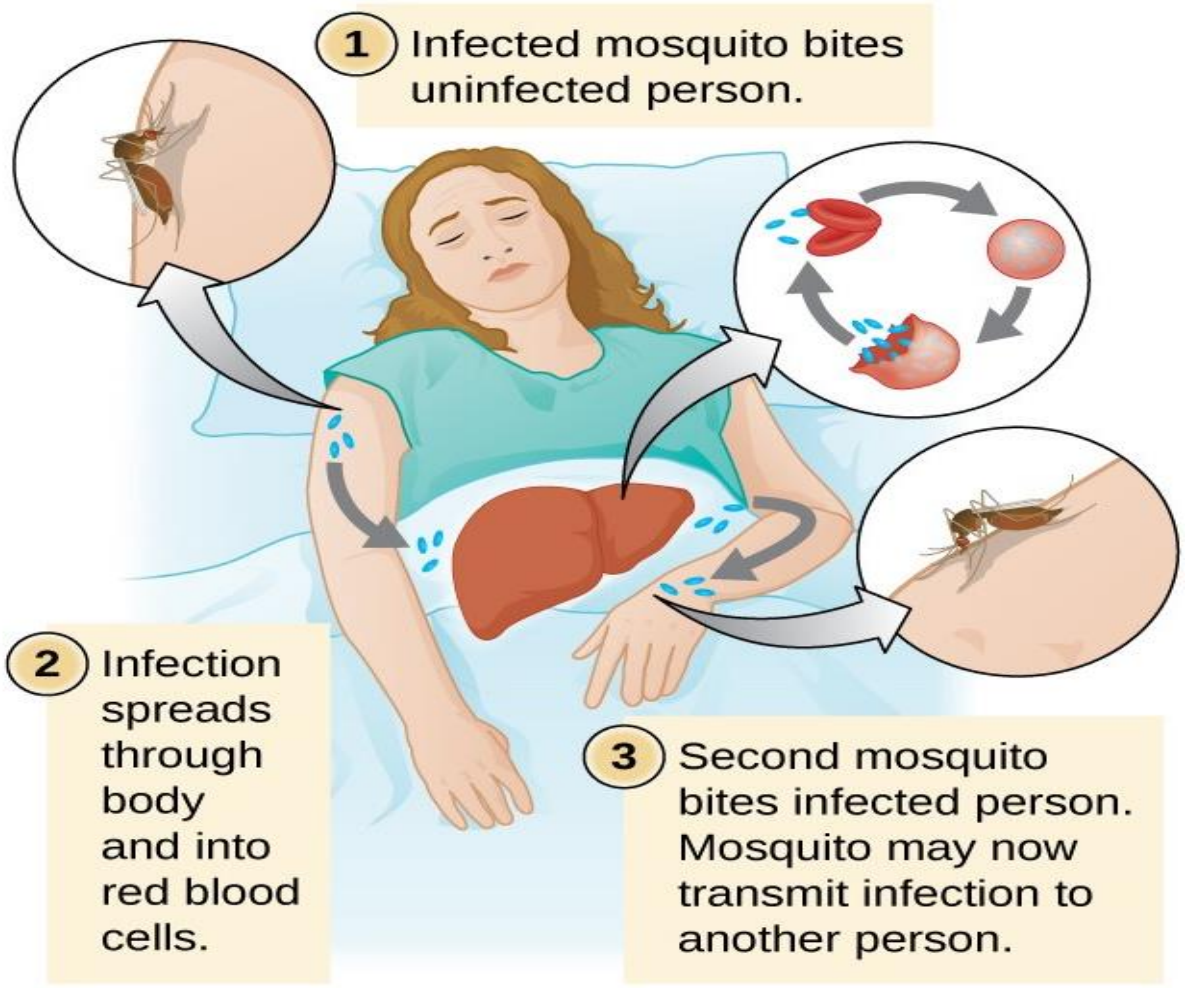
- Organism carried on body of vector
- Example: Flies carrying faeces on their legs



The Chain of Infection: Mode of Transmission- Vector borne transmission

B. Biological transmission:

- Organism multiplies or develops in vector
- Examples: Mosquitoes → Malaria



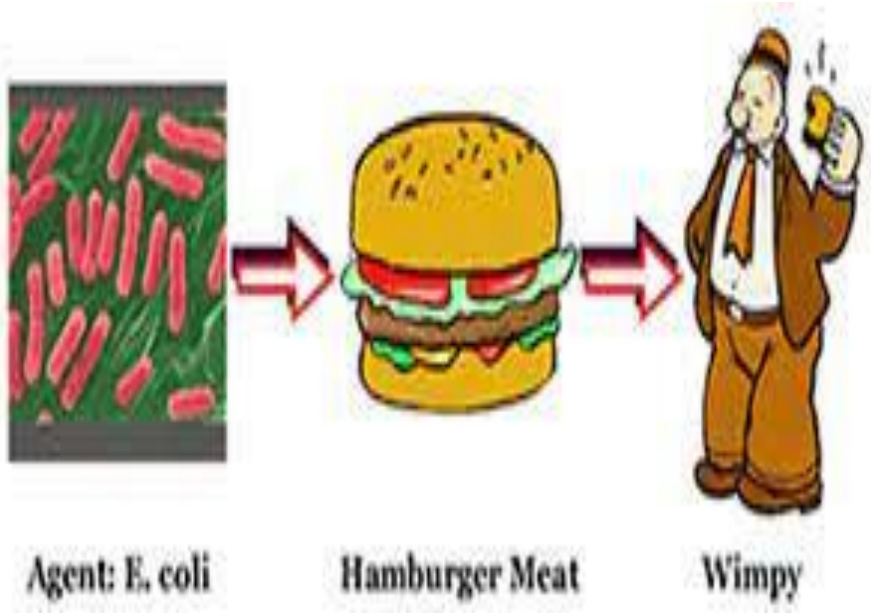
The Chain of Infection: Mode of Transmission- Common vehicle transmission

Single contaminated source transmits to multiple people

Types:

A. Waterborne: Contaminated water systems, as in Cholera

B. Foodborne: Contaminated food, as in Hepatitis A



The Chain of Infection: Mode of Transmission- Common vehicle transmission

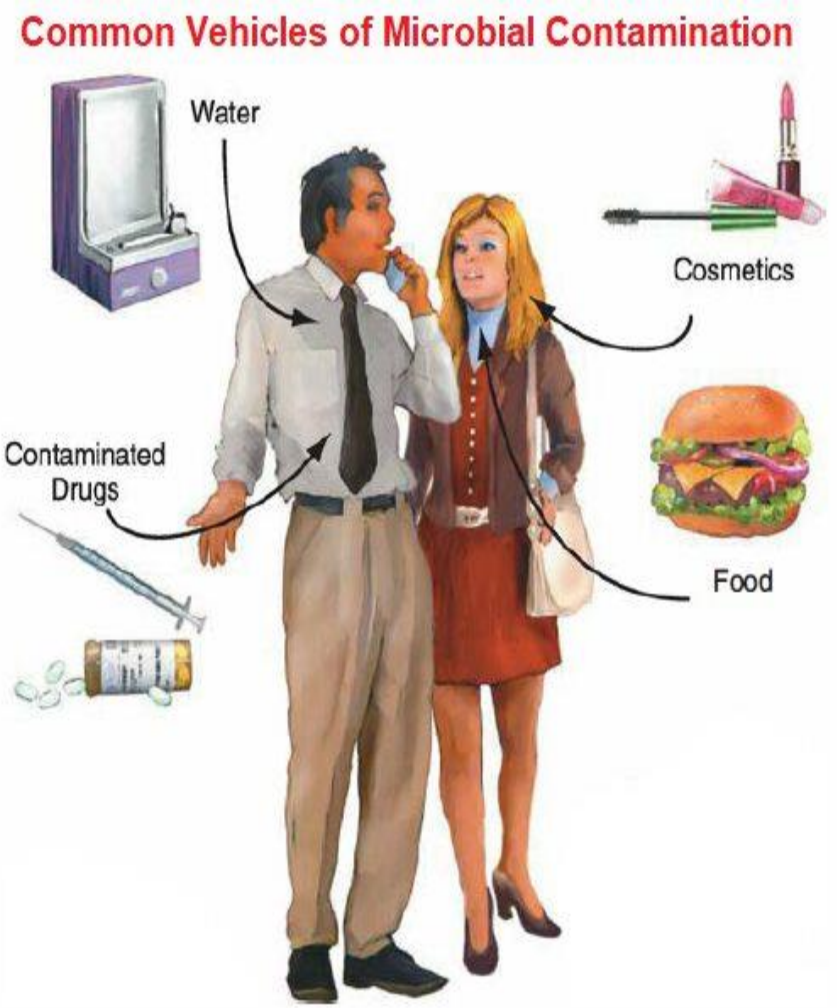
C. Bloodborne: Contaminated blood products (rare now due to screening), Contaminated IV solutions, medications

- Examples: HIV, Hepatitis B and C

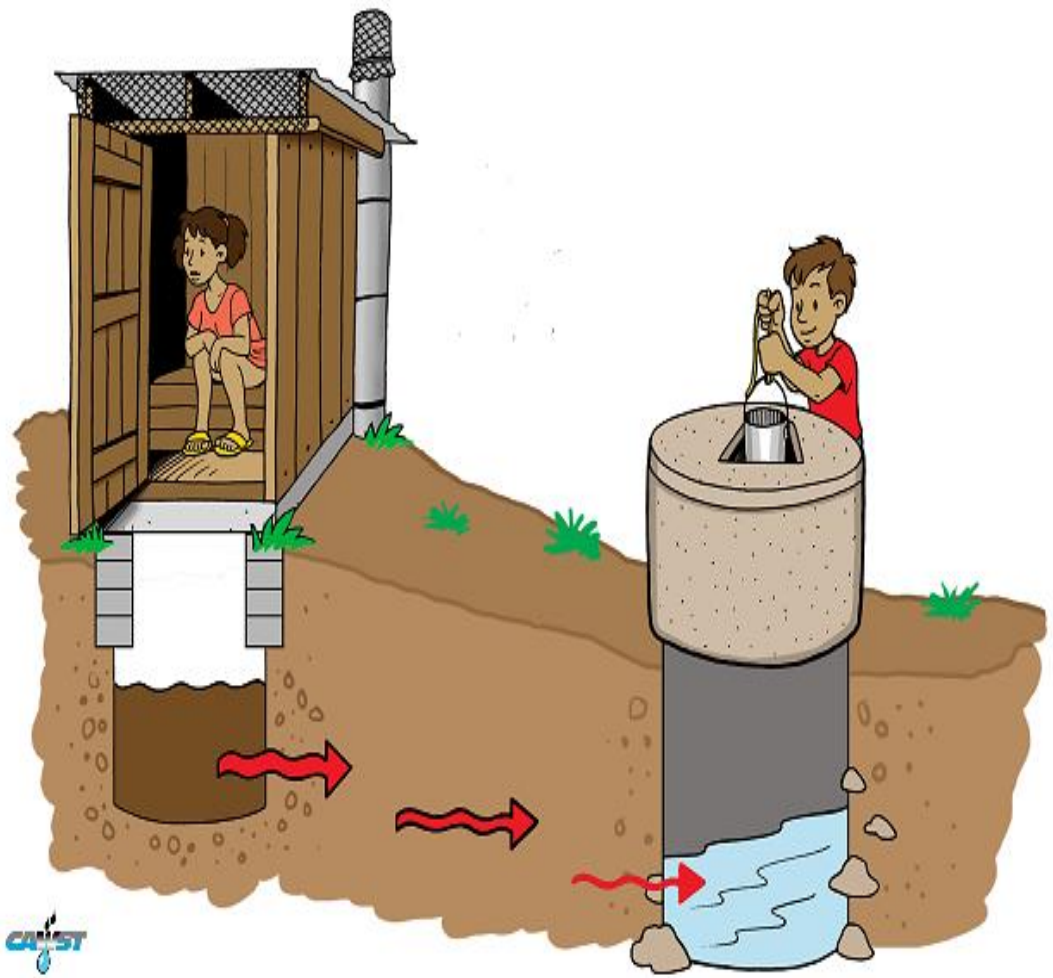
D. Fomites: Contaminated equipment or supplies

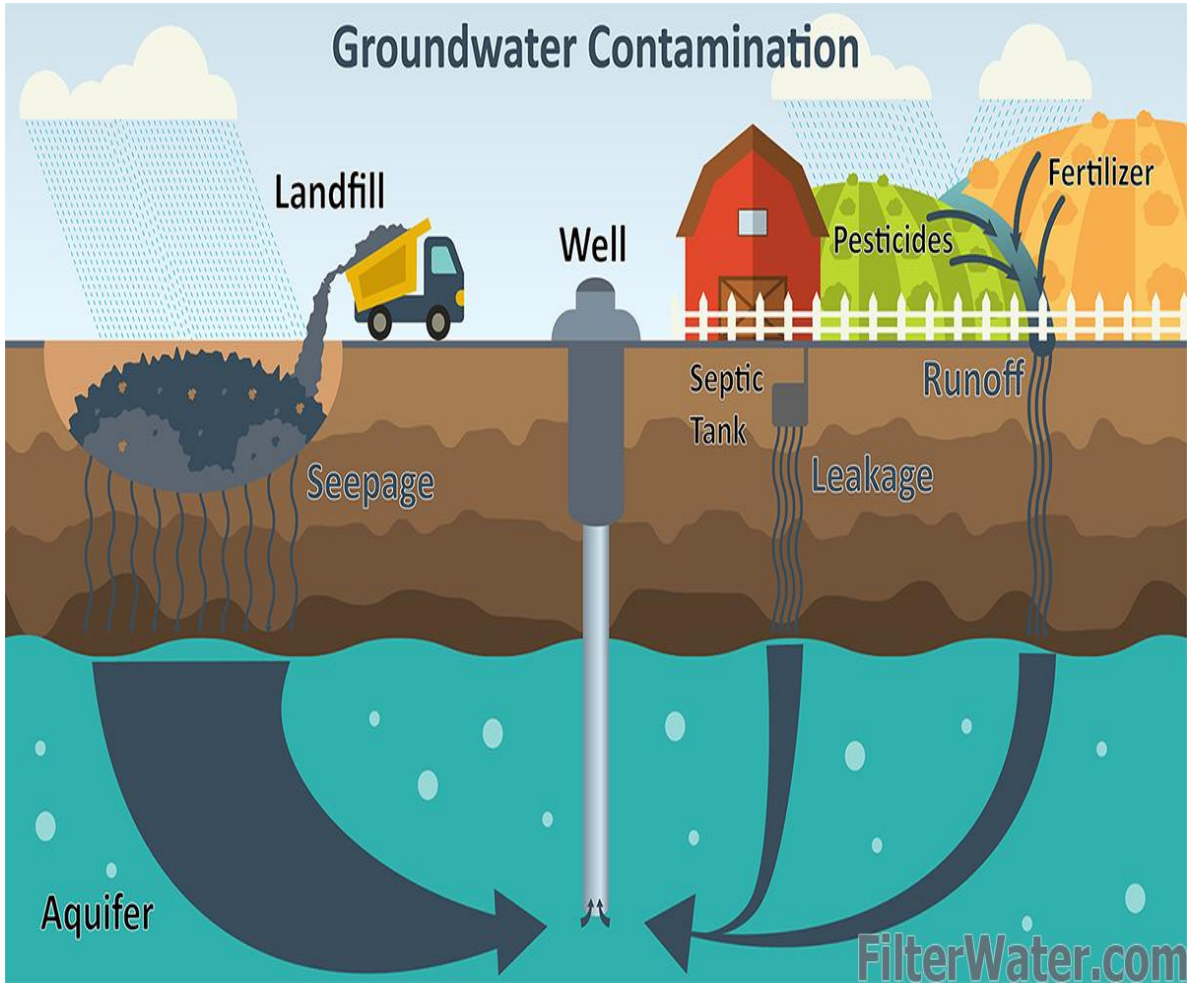
- Examples: Surgical instruments, endoscopes

Results in outbreaks - multiple cases from single source

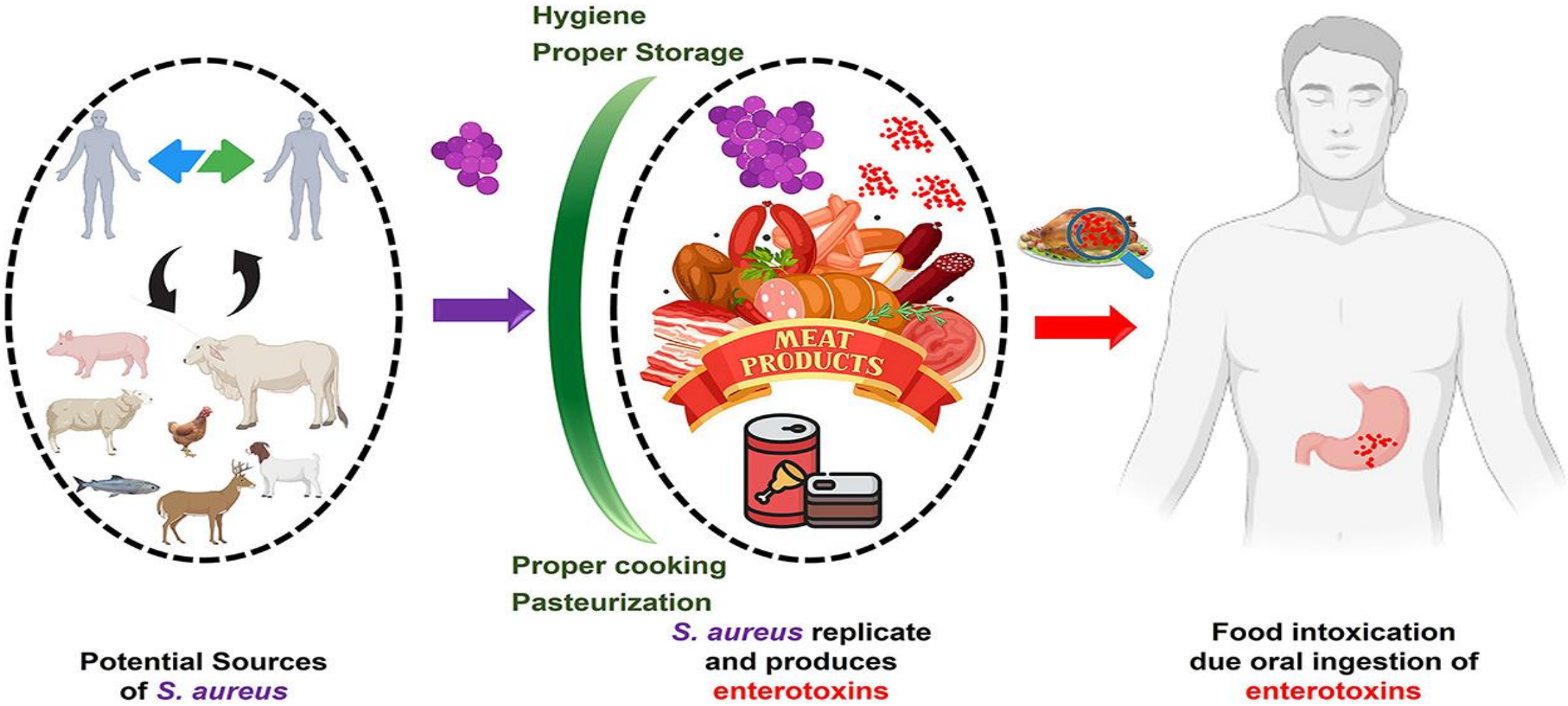


The Chain of Infection: Mode of Transmission- Common vehicle transmission- Example 1





The Chain of Infection: Mode of Transmission- Common vehicle transmission- Example 3



The Chain of Infection: Portal of Entry

Definition: The route by which an infectious agent enters a susceptible host's body.

- **Key Principle:** Portal of entry is often the SAME as the portal of exit (but not always!)

Major portals of entry:

- Respiratory, gastrointestinal, genitourinary tract, mucous membranes, skin - intact or broken, transplacental
- Parenteral route (Injection/penetration directly into tissues or bloodstream)
  - Mechanisms: Needlestick injuries, Injections, Blood transfusions

The Chain of Infection: Susceptible Host

Definition: A person who lacks resistance to an infectious agent and is therefore vulnerable to infection.

- **Key Principle:** Not everyone exposed to a pathogen will develop infection. susceptibility varies based on host factors.

Factors that increase susceptibility:

1. Age: very young (infants and children), elderly (>65 years)
2. Immunocompromised status or Chronic diseases
3. Nutritional status: malnutrition
4. Medications (beyond immunosuppressants)
    - Antibiotics: Disrupt normal flora
    - Proton Pump Inhibitors (PPIs): Reduce stomach acid

Breaking the Chain of Infection

The goal of infection control is to control and prevent the spread of infections within the healthcare setting:

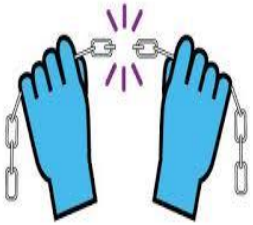
✓ Patient-to-patient transmission

✓ Patient-to-staff transmission

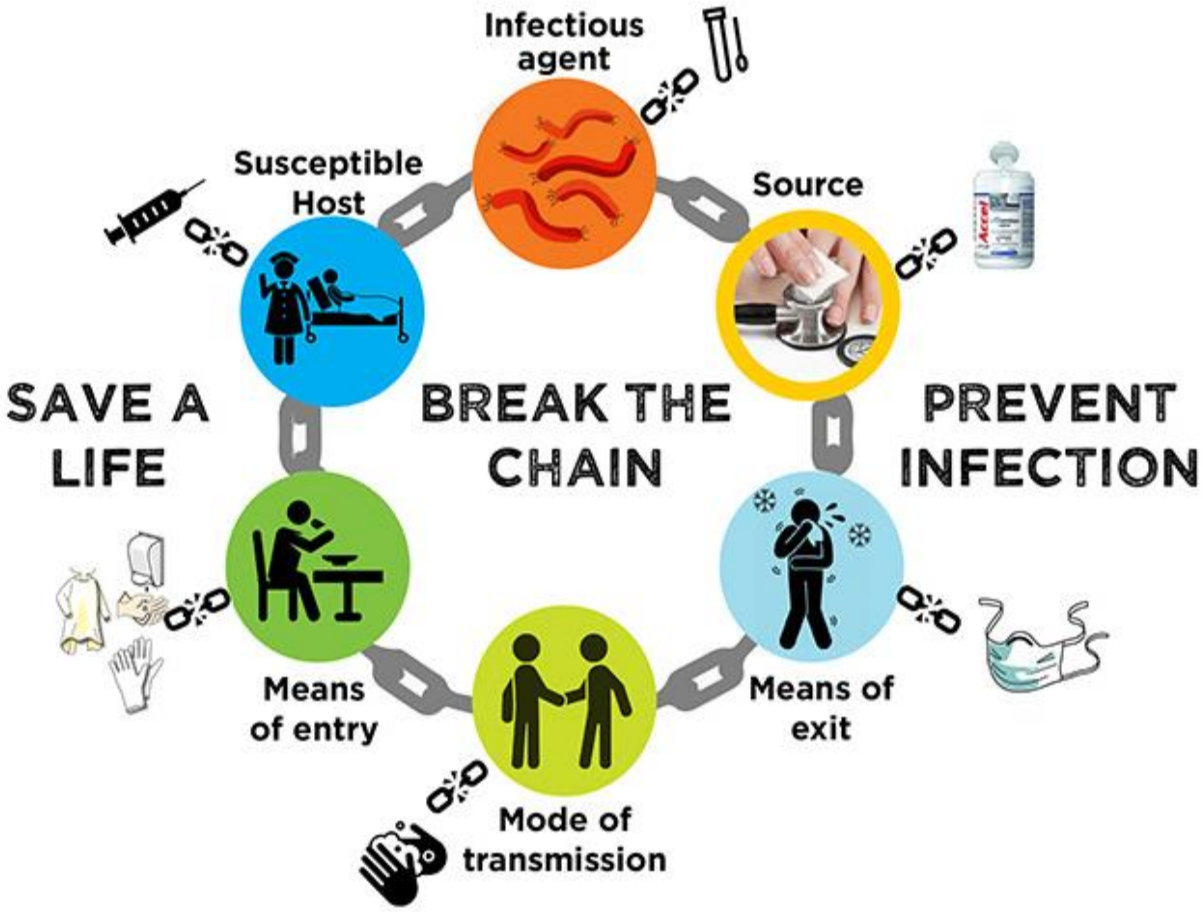
✓ Staff-to-patient transmission

✓ Staff-to-staff transmission

Breaking the Chain of Infection



- **REMEMBER:** Breaking ANY single link stops the transmission of infection!
- All infection control measures target one or more links in this chain.



Breaking the Chain of Infection: Strategies to break each link

- **How to Break It:**

✓ **Sterilization** and **Disinfection:** Autoclave sterilization of surgical instruments, alcohol-based disinfection of surfaces

✓ **Antimicrobial therapy** - Treating active infections

✓ Proper waste disposal - Segregate and dispose of infectious waste

Breaking the Chain of Infection: Strategies to break each link

For CONTACT transmission:

✓ **Hand hygiene** - Single most important measure!

✓ **Gloves and gowns** - Barrier protection

Breaking the Chain of Infection: Strategies to break each link

Breaking the Chain of Infection: Strategies to break each link

For DROPLET transmission:

✓ Surgical masks - For healthcare workers within 6 feet

✓ Physical distancing - Maintain >2 meters when possible

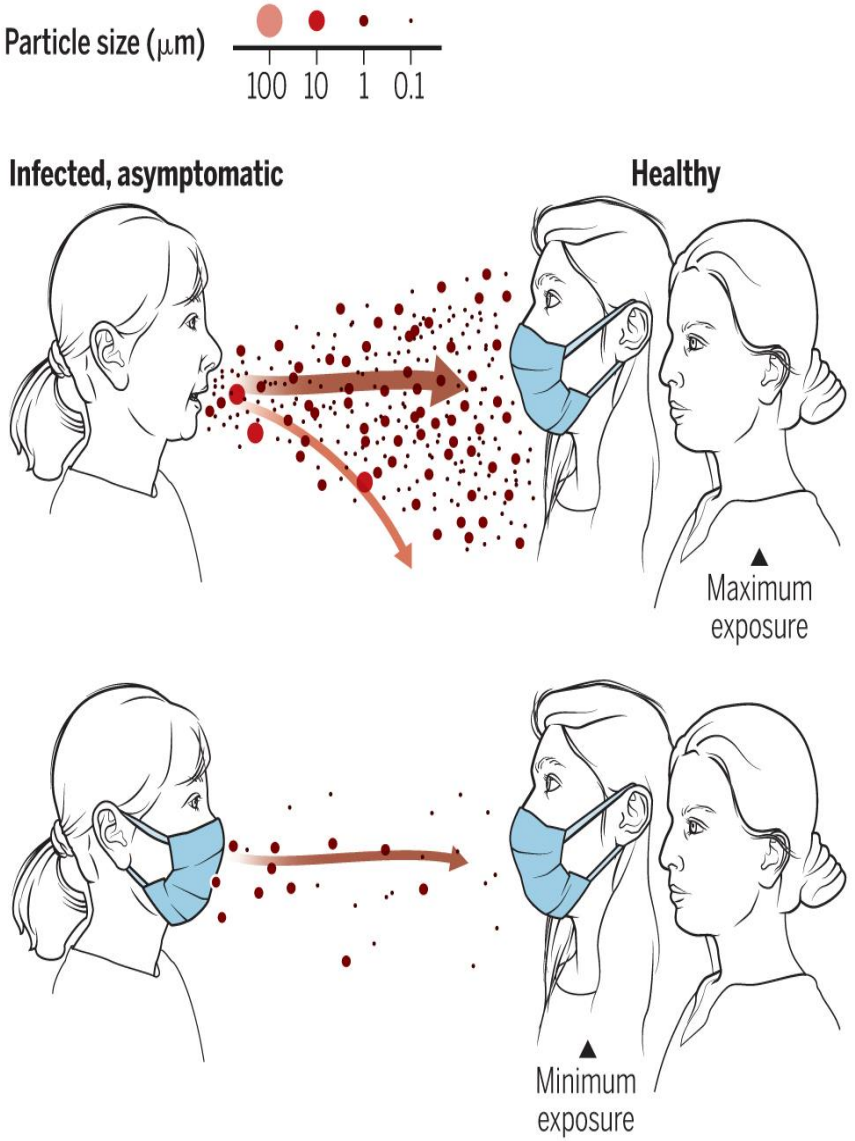
✓ Patient masks during transport, Limit visitors, Private room preferred

For AIRBORNE transmission:

✓ N95 respirators

✓ Negative pressure room - Air exhausted outside, Keep door closed, Limit room entry

✓ Patient wears mask during transport



Breaking the Chain of Infection: Strategies to break each link

- **How to Break It:**

✓ Food safety - proper storage and preparation, water treatment - clean water supply

✓ **Proper wound dressing** - Contain drainage from wounds

✓ **Safe handling of body fluids** - Use PPE, proper containers

✓ **Toilet hygiene** - Proper sewage disposal

✓ **Safe injection practices** - One needle, one syringe, one time

✓ **Blood product screening** - Test all donations

✓ **Vaccination**

Thank you