



M10 - Infection Control

3 more properties

Learning Objectives

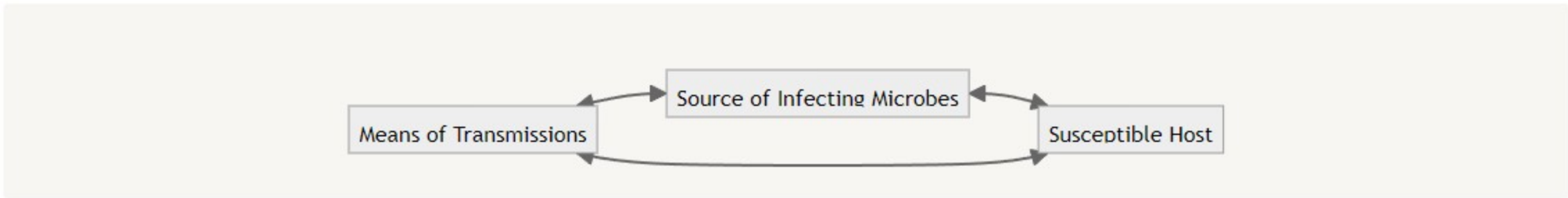
- Define infection, colonization, and contamination.
- Describe the main routes of transmission of pathogens in the healthcare setting and name examples of micro-organisms for each route.
- Define standard precautions and transmission-based precautions.
- List the important components of standard and transmission-based precautions.
- Discuss the importance of hand hygiene in the healthcare setting and describe the methods of performing hand hygiene.
- Define disinfection, antiseptis, and sterilization; list the hierarchy of resistance exhibited by different groups of micro-organisms.
- List the important methods for disinfection and sterilization, and the main clinical applications of the common disinfectants.
- Describe the **Spaulding's classification** for medical devices and its practical implication.

Infection Control

Aim: Prevent hospital-acquired (nosocomial) infections

	Definition
Infection	Deposition and multiplication of microbes → associated tissue reaction. - in tissues, or - on surfaces of the body
Colonization	Presence of micro-organisms with little or no host responses.
Contamination	The soiling of inanimate objects (Prions/Virus) or living material with harmful → Potentially infectious, or unwanted matter.

More About Transmission Nosocomial Infection



Transmission Type	Description	Examples
Contact transmission	<ul style="list-style-type: none">★ Direct Contact: P2P, vertical transmission★ Indirect Contact: Contaminated intermediate object.	<ul style="list-style-type: none">GI, Respiratory, skin and soft tissue pathogens:★ Staphylococcus aureus★ Streptococcus pyogenes★ Clostridium difficile★ Escherichia coli O157:H7★ Shigella★ Hepatitis A virus★ Norovirus - 诺如病毒★ Rotavirus - 轮状病毒★ Sarcoptes scabiei (causing scabies)
Vectorborne transmission	Transmitting Arthropod-borne Inf.	Uncommon
Common vehicles	Foodborne infections Contaminated Medications Contaminated IV fluids Contaminated Medical devices	Uncommon → But can lead to outbreaks

Remarks

- Vertical Transmission: **Pregnant → Fetus**

Transmission Type	Sources of droplets	Particle Size	Examples
Respiratory Droplet transmission	<ul style="list-style-type: none">★ Coughing, sneezing, talking★ Suctioning, Bronchoscopy	>5 µm	<ul style="list-style-type: none">★ Hemophilus influenzae★ Neisseria meningitidis★ Corynebacterium diphtheriae★ Bordetella pertussis★ Influenza & Parainfluenza★ Mumps★ Rubella viruses - 德国麻疹病毒
Airborne transmission	★ Airborne droplet nuclei	≤5 µm	<ul style="list-style-type: none">★ Measles virus - 麻疹★ Varicella-Zoster virus★ Mycobacterium tuberculosis

Principles of Healthcare infection control

- 2 types of precautions → × Spread of Infections
 - Standard precautions [First line of Defense] → Care of All Patients [Regardless of diagnosis]
 - Combine the concepts of universal precautions [↓ Blood-Borne & ↓ Body Substances]
 - Transmission-based precautions

▼ Procedure - Standard Precautions
1. Hand hygiene.
2. Proper use of personal protective equipment (PPE).
3. Sharps handling and disposal. No recapping of needles!
4. Environment control, e.g. environmental cleaning and management of spills.
5. Reprocessing of reusable instruments and equipment.
6. Aseptic technique.
7. Management of waste and linen (床单).

More about Healthcare Infection Control - Hand Hygiene

	Description
Hand cleansing	Physically or mechanically removing dirt
Handwashing	Plain or antimicrobial soap and water
Hygienic hand disinfection/antiseptis	↓ Microorganisms: antiseptic hand rub → Kill the transient (暂时) organisms & some resident flora.
Surgical hand disinfection/antiseptis	Antiseptics: Eliminate resident skin flora

More about Healthcare Infection Control - Transmission Based Precautions

Precaution Type	PPE	Description
Contact precautions	Gloves and gowns	Against contact transmission of pathogens
Droplet precautions	Surgical masks	Against large particle droplets
Airborne precautions	N95 respirators	Against droplet nuclei

Remarks:

- Use appropriate PPE based on the type of precautions needed.
- Provide equipment exclusively for patients.
- Determine patient placement, such as **single rooms** or **cohort isolation with negative-pressure ventilation**.
- Take precautions during patient transfers.

Aldehydes

- 2% Glutaraldehyde activated alkaline Sol. / Cidex
 - Bactericidal, fungicidal, virucidal
 - Tuberculocidal, Sporicidal.
- Formaldehyde:

Sterilization	Disinfection
37% Formalin	3-8%

Phenolics

- Bactericidal, fungicidal, virucidal.
- Slowly active against acid-fast bacilli and spores.
 - E.g.: Mycobacteria

Alcohol

- **Only when not visibly contaminated.**
- **60-70% Ethanol, Isopropanol, N-Propanol**
- Poor penetrative powers.
- ✓ Bactericidal, Fungicidal, Tuberculocidal, Virucidal.
× Sporicidal.

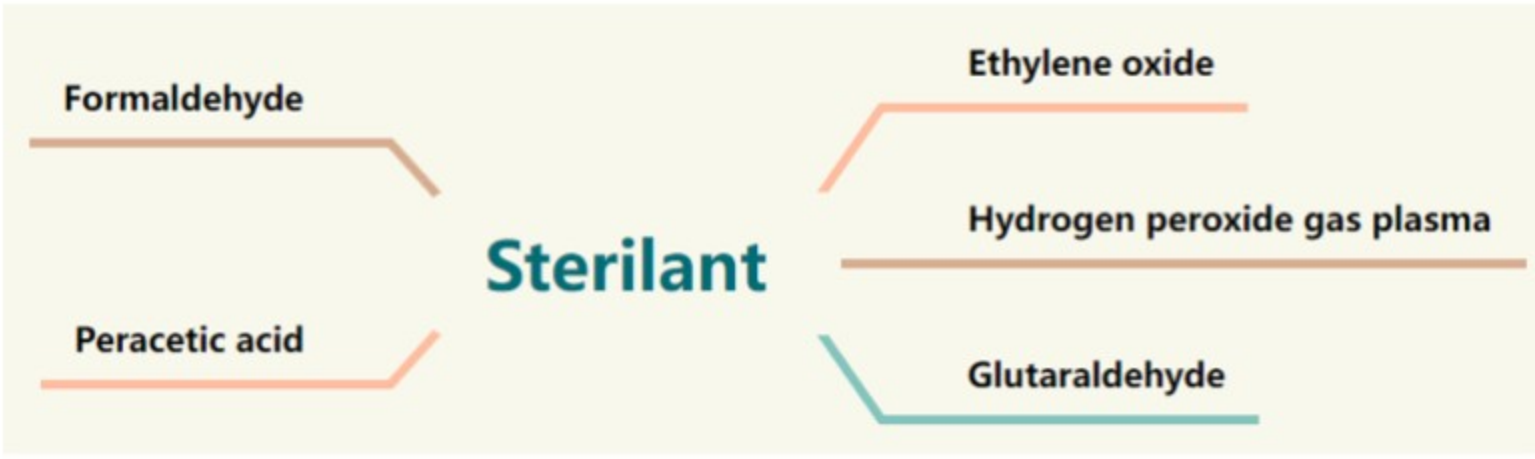
Sterilization & Disinfection

	Description
Sterilization	Use of a physical or chemical procedure to destroy all microbes.
Disinfection	Physical or chemical procedure on inanimate objects that destroys most pathogenic microbes.
High-level disinfection	Destroys all micro-organisms except high numbers of bacterial spores.
Low-level disinfection	Destroys vegetative bacteria, some fungi, and viruses but not mycobacteria or spores.
Antiseptis	Use of a germicide on skin or living tissue to inhibit or destroy microbes.

Physical - Sterilization & Disinfection

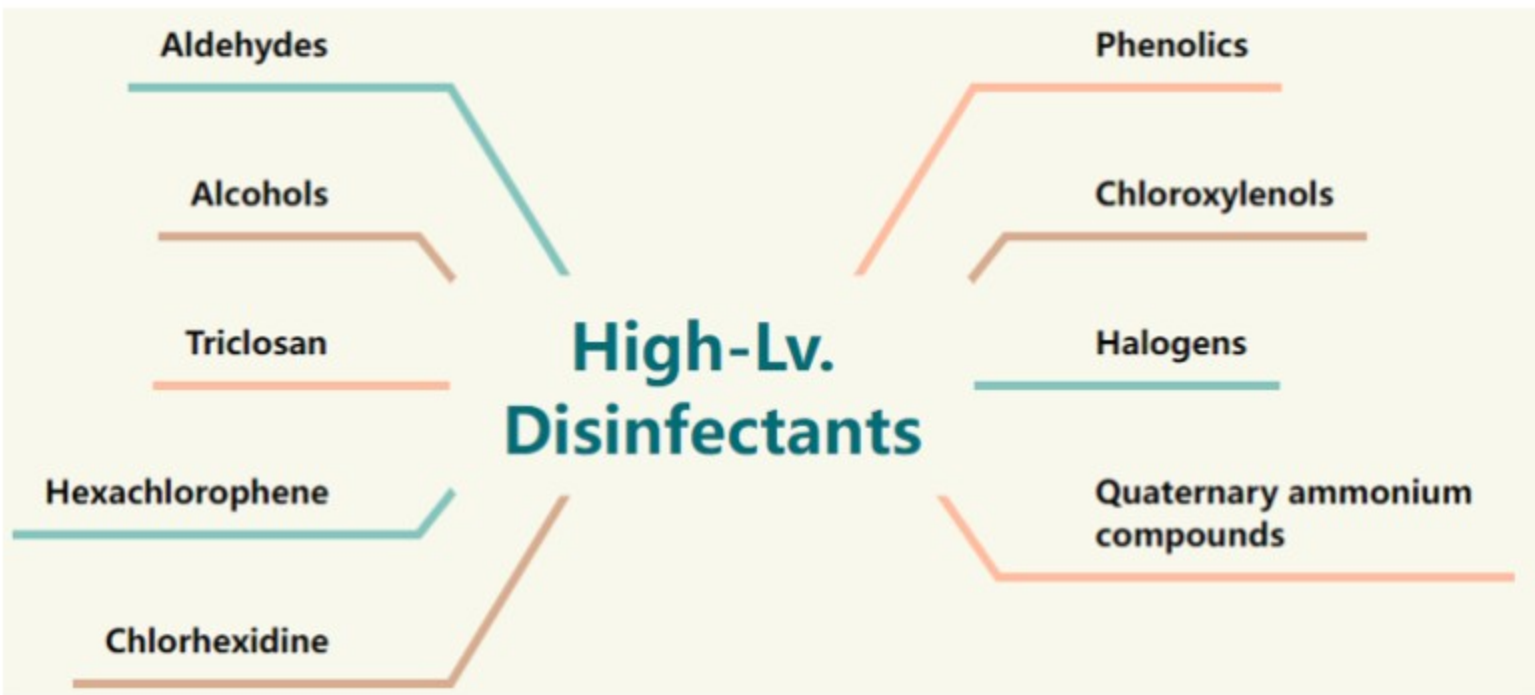
	Description
Dry heat	Flaming, hot air oven
Moist heat (sterilization)	Autoclaving at 121°C for 15 minutes or 134°C for 3 minutes
Moist heat (disinfection)	Boilers, thermal washer disinfectors
Ionizing radiation	Commercially used for sterilization of food and other products using β or γ radiations
Ultraviolet radiation	Wavelength of 254–260 nm, with poor penetrating power
Membrane filtration	Using filters of various pore sizes (e.g., 0.45 µm, 0.22 µm); not considered 'sterilization' as viruses cannot be removed by filtration

Chemical - Sterilization & Disinfection



Text Version

- Chemical - Sterilant @ Proper Conc.
 - Ethylene oxide
 - Hydrogen peroxide gas plasma
 - Glutaraldehyde
 - Peracetic acid
 - Formaldehyde



Text Version

- High-Lv. Disinfectants
 - Phenolics
 - Chloroxylenols
 - Halogens
 - Quaternary ammonium compounds
 - Chlorhexidine
 - Hexachlorophene
 - Triclosan
 - Alcohols
 - Aldehydes

Chemical Disinfectants resistance in decreasing order

Prions → Bacterial spores → Mycobacteria → Parasitic cysts →
Non-enveloped viruses → Non-sporulating Gram-negative bacteria →
Fungi → Non-sporulating Gram-positive bacteria → Enveloped viruses

For Prions: **The use of disposable equipment is recommended.**
[Non-disposable items]:
1. Autoclave at 134°C for 18 minutes.
2. 1 N NaOH or NaOCl for 1hr (+) Autoclave at 121°C for 1hr

Application of sterilization and disinfection - Spaulding's classification

Device Type	Description	Examples
Critical devices	Contact with the blood stream or sterile body areas.	Intravascular catheters Implants Needles Surgical instruments
Semi-critical devices	Contact with mucons membranes . Sterilization / high-level disinfection.	Endoscopes Respiratory therapy equipment
Devices that come into contact with intact skin	Require only low-level disinfection or simple cleaning	Stethoscopes Sphygmomanometer cuffs

Cetrimide

- Non-toxic with detergent properties
- **Can be contamination by bacteria**
 - **Pseudomonas Aeruginosa**
 - Non-Tuberculous Mycobacteria

Pathogens	Effectiveness
Gram-positive bacteria	High
Gram-negative bacteria	Low
Mycobacterium tuberculosis & HBV	Ineffective
HIV	Variable

Halogens

- Cl Compound: For spillage of blood & body fluids
 - **1-5% NaOCl / Powder** (e.g. Clorox)
 - Sodium dichloroisocyanurate, Presept
- I Compound: Disinfection of Skin (antiseptis)
 - Iodine tincture
 - Irritant
 - Iodophors - [Povidone-iodine]
 - Complexes of iodine and Solubilizers
 - Non-Irritant