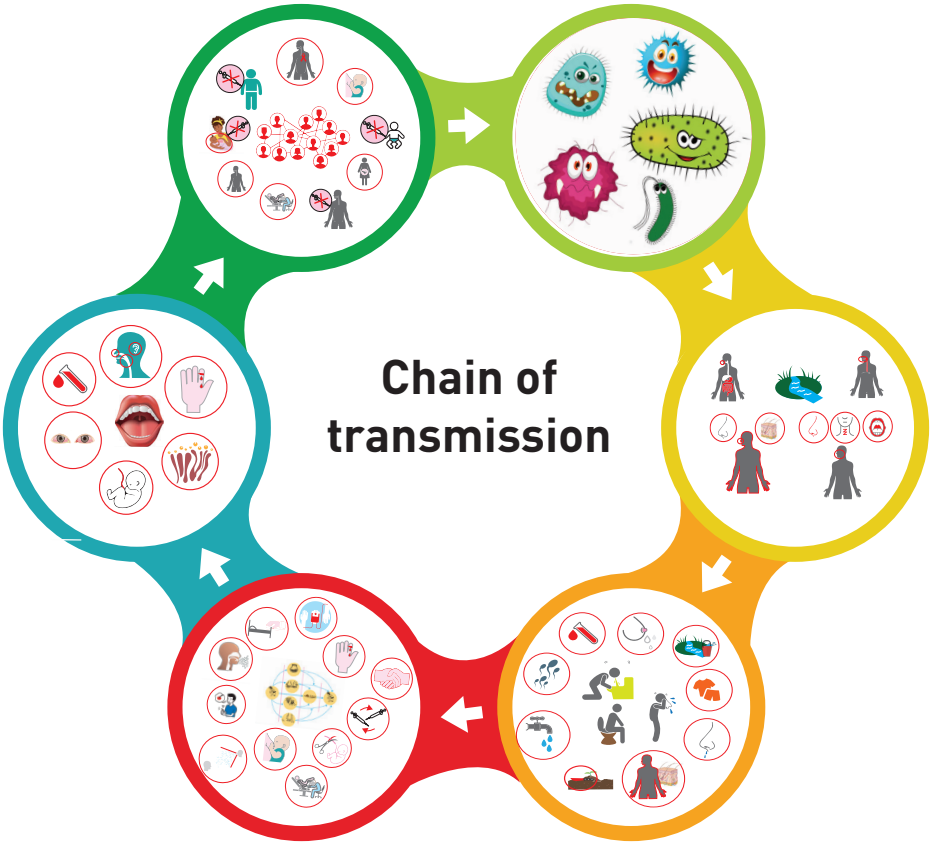
INTRODUCTION TO INFECTION PREVENTION & CONTROL



INFECTION PREVENTION & CONTROL

MSF ACADEMY FOR HEALTHCARE

MSF Academy for Healthcare – 2020 - Graphic Design : A. Filot

CONTENT

ABBREVIATIONS

AMR.....Antimicrobial resistance
HAI or HCAI .....HealthCare-Associated Infection
IPC..... Infection prevention & control
HCW ..... Health Care Worker
MRSA.....Multi Resistant Staphylococcum Aureus
WHO .....World Health Organisation

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This manual is a collective effort by health and education professionals acting as a reference in their area of expertise and having all field experience.

Despite all efforts, it's possible that certain errors may have been overlooked in this manual. Please inform the authors of any errors detected at the following email address: msfacademy.nursing@msf.org

The authors would be grateful for any comments or criticism to ensure that this manual continues to evolve and remains adapted to the field reality

INFECTION PREVENTION AND CONTROL (IPC) IN HEALTH FACILITY ARE A SET OF INTERNATIONALLY RECOGNIZED MEASURES THAT ARE PUT IN PLACE **TO AVOID THE RISK OF INFECTION.**

It demands **collective participation** in order to fulfill a fundamental objective in the health care world: PROVIDING THE PATIENT WITH SAFE CARE *(so that the patient will not suffer any damage related to an act of care from which he or she has benefited).*

Everyone knows that health care activities are not risk-free for the patient or the health care worker.

The hospital environment, by the presence of a large cohort of patients of all ages coming for different problems and pathologies, is rich in microorganisms that will be present in the air and the environment *(floors, walls, furniture, equipment, ...)* but also on patients, caregivers and even healthcare workers *(who move from one patient to another during their care activities).*

Some of these microorganisms are said to be PATHOGENIC because they are likely to cause infections and diseases that could be avoided if this set of preventive practices were respected by any individual *(medical staff, families, visitors, ...)*

A. WHAT IS A HEALTH CARE ASSOCIATED INFECTION (HAI) ?

Health care-associated infection (HAI) is an **infection occurring in a patient during the process of care which was not present neither incubating* at the beginning of the care**. A delay of at least 48 hours after the beginning of the care is needed to consider the infection as a health care-associated infection. **(silent time from the moment of exposure to an infectious agent until signs and symptoms of the disease appear).*

HAI covers both the nosocomial infections (which occur in hospital environment only) as well as the ones occurring while any care given even outside of the hospital.

HAI can affect patients in any type of setting where they receive care and can also appear after they left the health facility. They can affect patients as well as care takers and health care workers.

HAI are responsible for death, prolonged hospital stays, creation of long-term disability, increase of the antimicrobial resistance (AMR) burden and high cost for treatment.

→ **HAIs can be avoided!**

Based on data from several countries, it can be estimated that each year, hundreds of millions of patients around the world are affected by HAI.

Although HAIs are the most frequent adverse event in health care, its true global burden remains unknown because of the difficulty in gathering reliable data: most countries lack surveillance systems for HAI and those that do have them struggle with the complexity and the lack of uniformity of criteria for diagnosing it.

Each year, hundreds of millions of people contract an infection related to healthcare :

HAI rates range from 5-7 % in high income countries in Europe to an estimated 10-20 % in low-resources settings. The most frequent HAI are:

- Surgical Site Infections (SSI)
- Catheter-related bloodstream Infections (CR-BSI)
- Hospital-Associated pneumonia (HAP), including tuberculosis
- Hospital-Associated Urinary Tract Infections (CAUTI)
- Gastro-enteritis

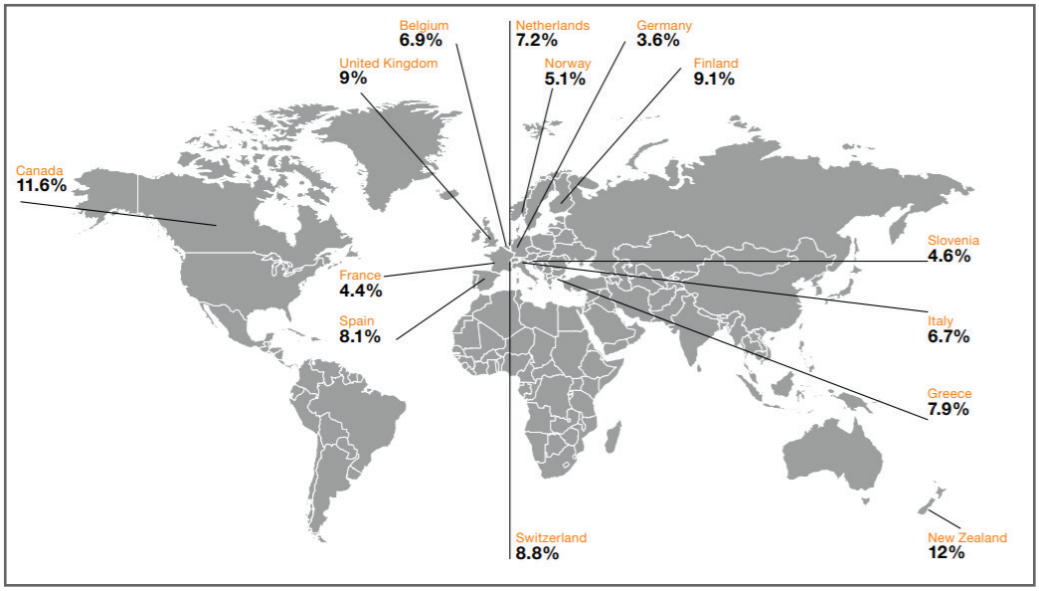


Figure 1: Prevalence of health care-associated infection in high-income countries, 1995-2010 (WHO).

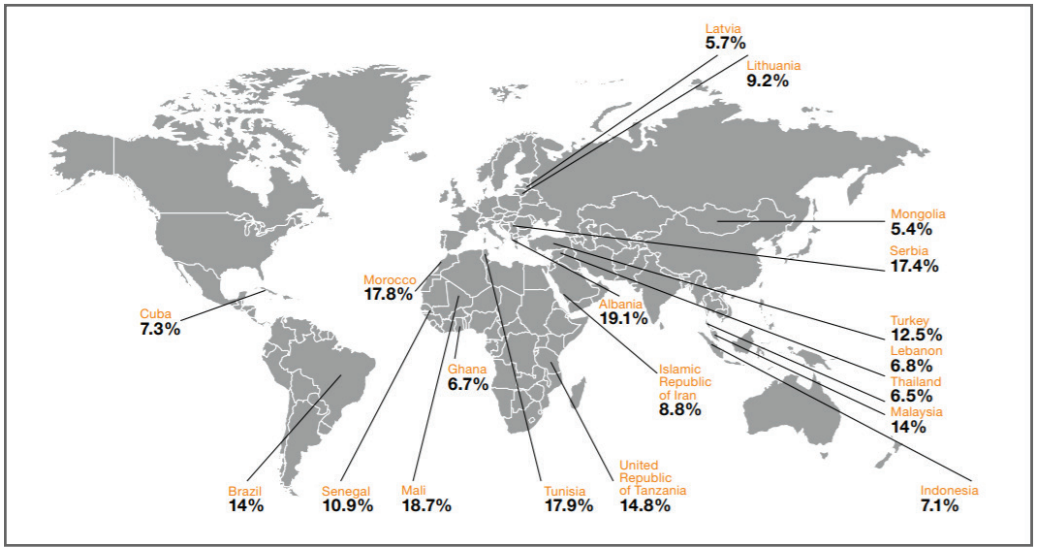


Figure 2: Prevalence of health care-associated infection in low- and middle-income countries, 1995-2010 (WHO).

Most germs that cause serious infections in healthcare are spread **BY PEOPLE'S ACTIONS**.

- Hand hygiene is a great way to prevent infections. However, studies show that on average, healthcare providers perform hand hygiene less than half of the times they should.
- This contributes to an increased risk of HAIs that affect 1 in 25 hospital patients on any given day.
- Every patient is at risk of getting an infection while they are being treated for something else.
- Even healthcare providers are at risk of getting an infection while they are treating patients.

→ PREVENTING THE SPREAD OF GERMS IS ESPECIALLY IMPORTANT IN HOSPITALS AND OTHER FACILITIES

HAI CAN BE AVOIDED BY SYSTEMATIC APPLICATION BY EVERYONE (ESPECIALLY HCW) OF GOOD PRACTICES TO PREVENT AND CONTROL INFECTION DURING A HEALTH-CARE. It is the only way to break the chain of transmission of Microorganisms during health care acts.

B. THE ANTIBIOTIC RESISTANCE :

Ability of bacteria (and other microorganisms) to resist effects of an antibiotic to which they were once sensitive

It is due to many reasons including inappropriate use of broad spectrum antibiotics in humans and animals

Antibiotics are medicines used to prevent and treat bacterial infections. Some of bacterias started to develop mutations or acquire plasmids (specific molecules) that increase their capacity to survive by becoming able to resist the action of antibiotics, thus making the antibiotics less effective. It is called the antibiotic resistance and it can occur more easily in use of antibiotic rich environment like a healthcare facility. This resistance can be passed from one bacteria to the other and proliferate creating entire colony of multi-resistant bacteria.

Resistants bacteria may infect humans and animals, and the infections they cause are harder to treat than those caused by non-resistant bacteria.

Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.

There is now a worldwide consensus that urgent actions are needed to prevent and control the spread of antibiotic resistant organisms such as:

- Behaviour changes in way to prescribe and use antibiotics in a more rational way (not all disease need antibiotics for treatment)
- Actions to reduce the spread of infection such as vaccination, hand hygiene, good food hygiene, practicing safer sexual encounter, ...

C. WHAT IS THE CHAIN OF TRANSMISSION OF MICROORGANISMS ?

The chain of transmission of microorganisms is the series of stages through which microorganisms *(causal agent)* pass from their living environment *(reservoir)* to a living being (host recipient) to contaminate it and cause an infection. We can think of each part of the process as a separate 'link' in the chain. And if we can break a link at any part of the chain, we can stop infection arising.

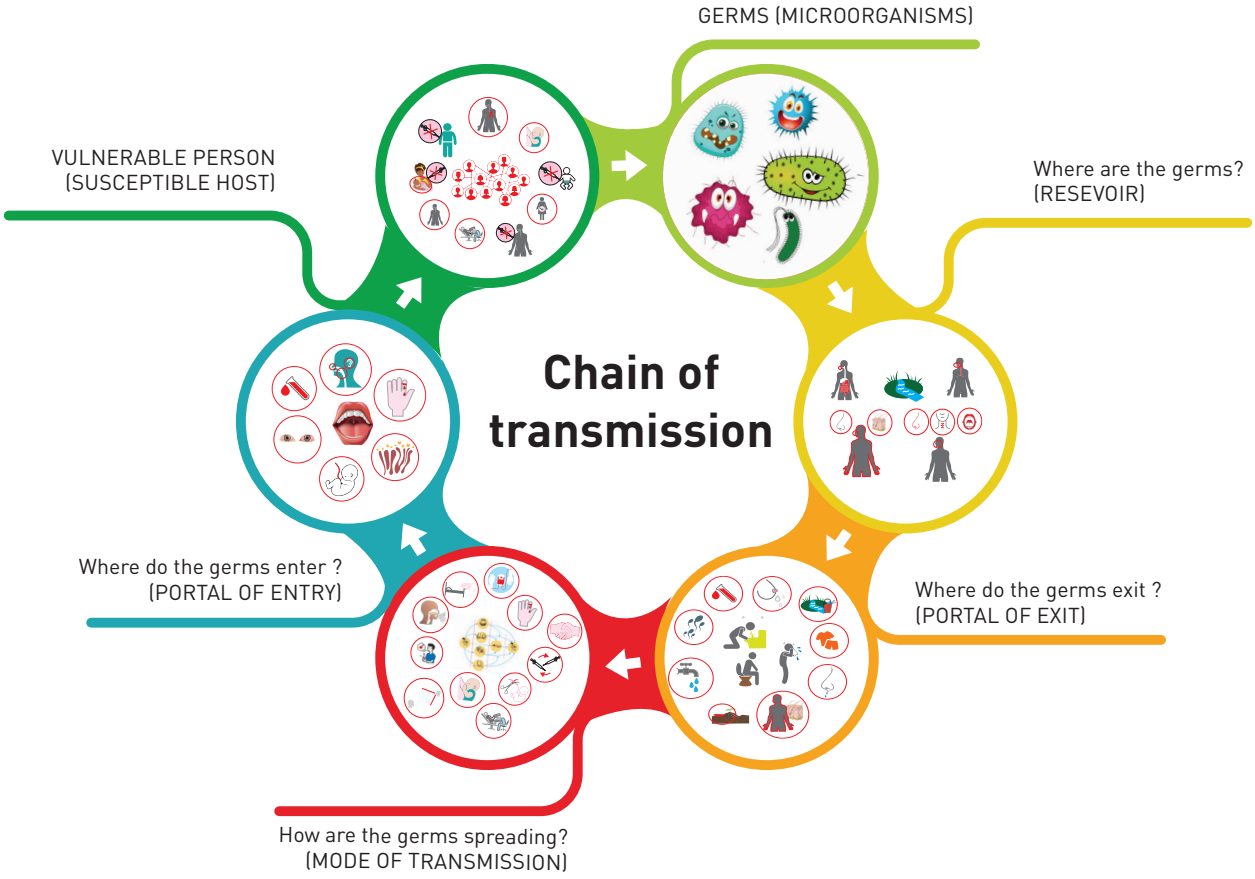


Figure 3: Chain of transmission

AGENT: MICROORGANISMS OR GERMS

The infectious agent is simply the germ that causes the infection. Germs are all around us and within us and many play very important roles in keeping us healthy. We call them commensal microorganisms.

→ The problem comes when a microorganism leaves its usual place to go elsewhere in the body

Eg. bacteria from commensal intestinal flora will cause infection if they move to the urinary system.

= endogenous infection *(infecting microorganism is already present on or in the human body)*

→ There are also many microorganisms which are harmful for the body by causing disease. Entry of any of these into the body is likely to cause problems. We call them pathogenic microorganisms.

Eg. the vibrio cholerae is a bacteria which can cause severe digestive infections if ingested by humans.

= exogenous infection *(infecting microorganism comes from the external environment)*

MAIN MICROORGANISMS:

- Bacteria
- Viruses
- Fungus
- Parasites

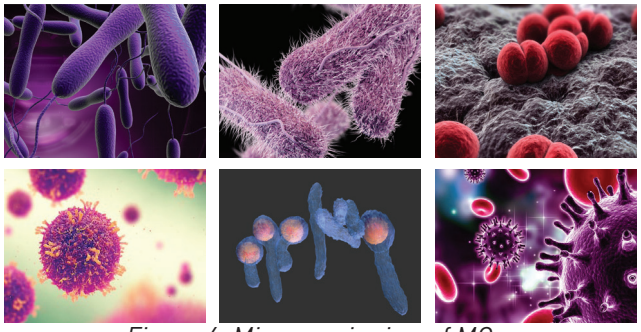


Figure 4: Microscopic view of MO.

The infection will depend on the **VIRULENCE** *(degree of aggressiveness of the organism to counterbalance with the ability of the host to resist the aggressor)* and the **RESISTANCE** of the microorganisms (*ability to reside in the external environment and resist antibiotics)*.

N.B. :

- Antibiotic-resistant bacteria will be more difficult to treat and will increase the risk of morbidity and mortality
- An individual whose immune defenses *(immunocompromised)* are diminished will be more lat risk of developing an infection. A very virulent bacterium will be more likely to cause infections

THE RESERVOIR: « WHERE GERMS LIVE ? »

By 'reservoir', we mean a place where germs can live and multiply.
The 'reservoir' can be a person – a patient/client or a member of staff – but it can also be any part of the surrounding area of a health care setting, furnishings in the patient's/client's room, the equipment we use in health care, door handles, water, ...

→ LIVING RESERVOIR : **HUMAN** *(healthy or sick carrier)* & **ANIMAL**.

N.B. : Zoonosis are the diseases caused by pathogenic microorganism from an animal reser-voir that can be transmitted to humans. They can either be pathogenic indistinctly for animals and humans or pathogenic to humans, with animals being their main reservoir. Domestic animals are the most common source of zoonoses because they live in close contact with humans. Insects are the most important reservoirs of pathogenic microorganism and serve as vectors of the disease.

→ NON-LIVING RESERVOIRS : **SOIL** *(tetanus bacteria, botulism)*, **WATER** *(cholera vibrio)*, **FOOD** *(salmonella, shigella, cholera)*, **OBJECTS, AIR**.

Figure 5: Examples of reservoirs.

THE PORTAL OF EXIT: « HOW GERMS GET OUT ? »

This is the way out for the microorganism to leave the reservoir.
The portal of exit would be the anatomic part the microorganism would use as a way out where the reservoir is associated to a host. In short, a "living" portal of exit is any anatomic site that would discharge contaminated biologic fluid *(blood, saliva, feces, urines, vomit, sputum, semen, vaginal discharge, sweat, exudate such as the mouth, a wound, the anus, the urethral orifice, ...)* Those "living" portals of exit can be for instance:

- The airway from which contaminated secretion would be spitted while coughing or sneezing.
- A bleeding or exuding wound

The portal of exit can be different from one infection to the other *(eg. diarrhoeic syndrome is usually transmitted from patient faeces).*

The "non-living portal" of exit for microorganisms includes medical equipment of environment that are not cleaned and disinfected properly such as cupboards, mattresses, pillows, and medical devices.

MODE OF TRANSMISSION : « HOW GERMS GET AROUND ? »

This is how the germs move, or spread, from one place to another. It is the transfer of the microorganisms from its environment *(reservoir)* to an individual. This is how the host becomes exposed - e.g. direct or indirect contact; droplet, airborne, vector, and vehicle

Microorganisms can even be spread around on the tiny flecks of skin that peel off our bodies throughout the day and which form part of the dust that settles on all kinds of surfaces that haven't been properly cleaned, such as commodes, bed mattresses, pillows and reusable equipment.

This can happen in a number of ways, such as health care workers' hands touching dirty equipment or contaminated medical instruments, or through the air *(coughs, sneezes)*.

There are several **MODES OF TRANSMISSION**:

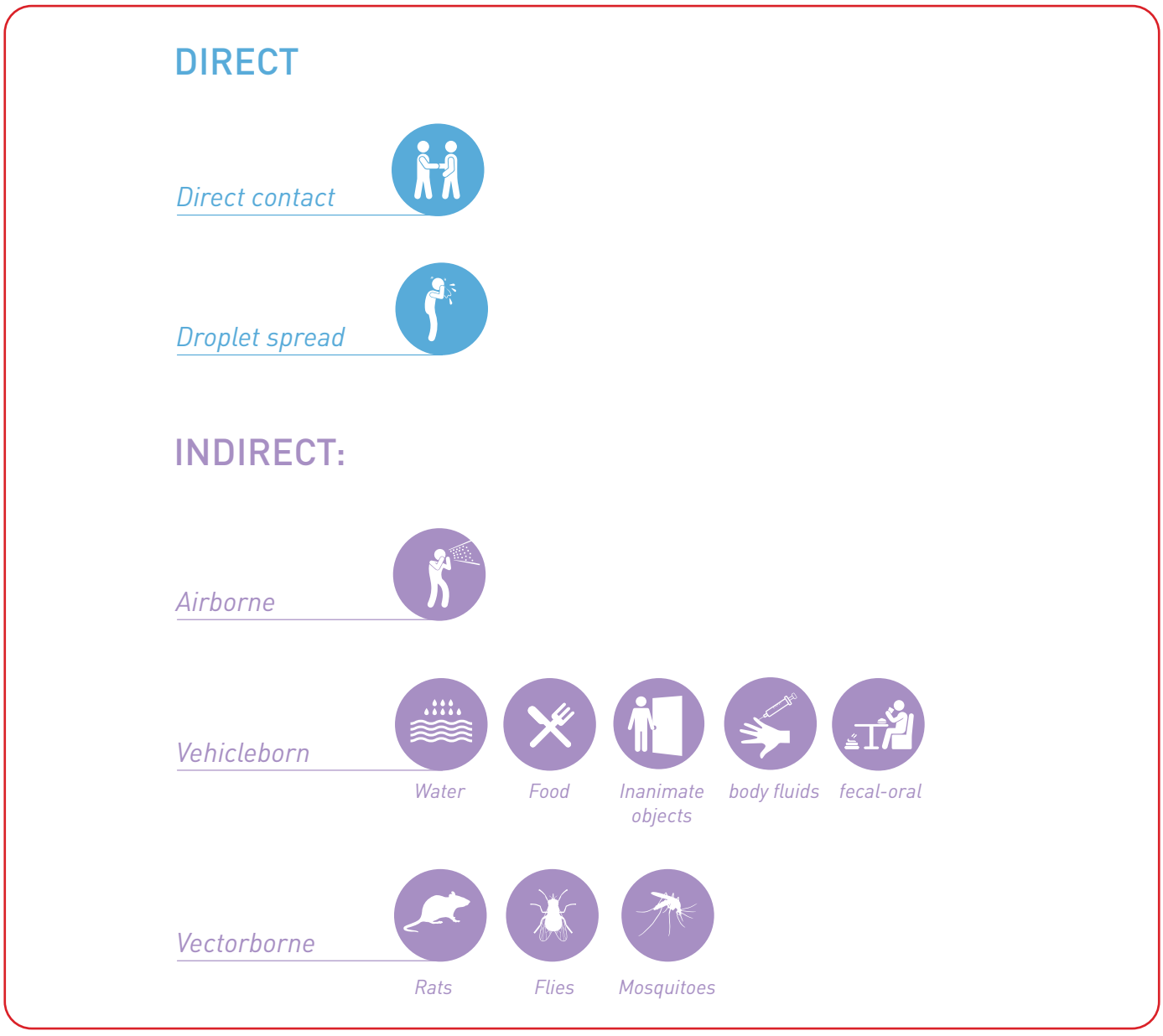


Figure 6: Modes of infectious disease transmission

EXOGENOUS TRANSMISSION

DEFINED AS A TRANSMISSION THROUGH ANOTHER LIVING BEING OR THE ENVIRONMENT

DIRECT TRANSMISSION	 DIRECT CONTACT	**Between human beings** (Anthroponosis) *(by touching, kissing, sex, contact between health care workers and patients during treatment).* Zoonosis : between humans and animals *(contact with saliva, hair, secretions, product ingestion of an infected animal).*
	 DROPLETS	**Microorganisms** (> 5 microns in size) **are expelled into droplets** when the contaminated individual speaks, coughs, sneezes, etc. These droplets travel less than one meter between the reservoir and the host. N.B.: Some micoorganisms inside the droplets can survive a long time on surfaces and tranmission to a vulnerable person can occur via indirect contact.
INDIRECT TRANSMISSION	 AIRBORNE	**Microorganisms** (< 5microns in size) **expelled via micro droplets** able to remain suspended in the air for a long time and able to travel long distances *(eg. tuberculosis).*
	VEHICLEBORN TRANSMISSION  INANIMATE OBJECTS	Through **an object contaminated** by an infected person or animal that serves as a passive vector. High transmission mode in the hospital environment via soiled objects *(containers, bandages, needles, bedding ...).*
	 WATER & FOOD	• Waste **water** *(that contains stool or urine from people)* carries diseases such as polio or cholera and can infect people if reused without being treated *(boiling, chlorination, ...)* • Contaminated **food** *(through dirty hands, flies, animals excreta)* can infect people if ingested without being cooked enough or washed properly *(with clean water).*
	 FECAL-ORAL	When **infected stools** enter the digestive tract of a person *(eg. A person eats food contaminated by another person with infectious diarrhea who has not washed his / her hands before preparing food).* • *Untreated wastewater carries diseases such as polio or cholera* • *Contaminated food (it is more of a contamination during the preparation or the harvest than the food itself which presents a risk of contagion)*
	 BODY FLUIDS	When microorganisms come into contact with the mucosa, the injured tissue of a person, or blood circulation. *(eg. puncture with contaminated needle, splashing in the eyes, transfusion of contaminated blood, ...).*
	 VECTOR TRANSMISSION	**Carry pathogenic MO from one host to another** : • **Mechanical vectors**: Passively propagate the pathogen by recovering the pathogen from one reservoir and transporting it to another *(a fly that has landed on excrement and then will land on food).* • **Biological vectors** : play a key role in the development of the pathogen that is forced to go through the vector to complete its development cycle before being able to infect a host *(eg. malaria).*

ENDOGENOUS TRANSMISSION

WHEN SOMEONE GETS INFECTED BY HIS OWN MO

(eg. the bacteria Escherichia Coli which is harmless inside intestines would become pathogenic whether it would get to come into the urinary system and the blood stream).

5 THE PORTAL OF ENTRY: « HOW GERMS GET IN ? »

This is the area in the host through which microorganisms penetrate the tissues :

- **Mucocutaneous entry portal** : entrance of the microorganisms through the mucous or the skin *(wounds, broken skin, invasive acts, cuts, punctures, burns, eye contact, ...).*
- **Breathing entry portal** : by inhalation of dust, aerosols, droplets into the respiratory tract, etc.
- **Portal of digestive entry** : through ingestion via food, contaminated water, through dirty hands.
- **Genito-urinary portal of entry** : through sexual intercourse, during a urinary catheter insertion, by inadequate hygiene care.
- **Placental entryway** : transmission from mother to child.
- **Parenteral entryway** : insect sting, injection with a syringe, contaminated needle, transfusion of contaminated blood, with in place medical device to a patient *(eg. peripheral venous catheter)*

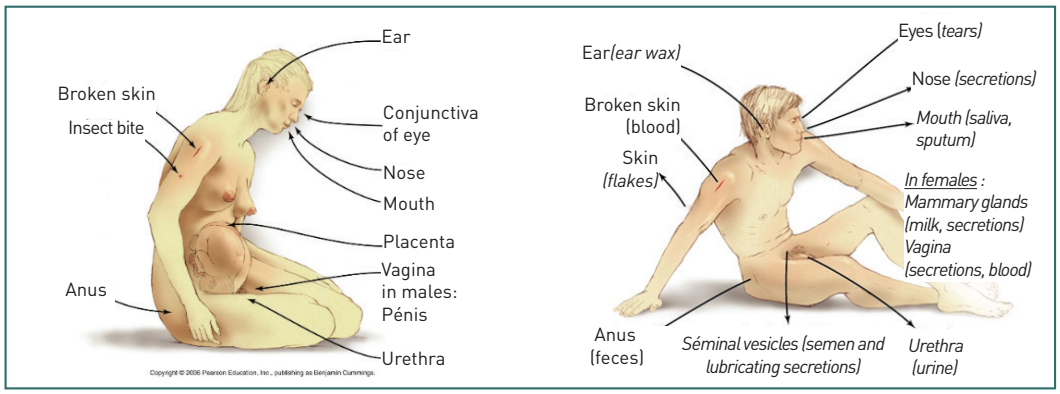


Figure 7: Portal of entry for microorganisms

N.B. : some pathogens require a specific gateway to multiply and infect the host

(eg. pathogens responsible for pneumonia need to enter the respiratory tract to cause infection (inhaled), they would be destroyed by digestive enzymes if they were ingested)

This means that the germs that have left the reservoir now invade the person *(the 'host')*.
They can do this by entering wounds and cuts, being swallowed and being breathed in.

For example; patients who are having treatments that involve cutting the skin or using medical instruments or devices medical instruments inside the body, such as a catheter being placed into the bladder or a feeding tube being passed down the throat, are also at risk of infection throug.

THE SUSCEPTIBLE HOST: « VULNERABLE PERSON »

It is the one who will get contaminated by the microorganism.

In the hospital setting, the most common chain of contamination is the TRANSMISSION OF PATHOGENIC MO from reservoir A *(the patient and his environment)* to host B *(another patient and his environment)* THROUGH HEALTH CARE WORKERS, who move from one patient to another by carrying these pathogens.

Once the microorganism contaminated the host it will multiply (proliferate) into the organism.

At first, the presence of the microorganisms into the host will not cause any damage although it keep multiplying. It is called the **colonization**.

During the colonization the presence of the microorganisms within the host will not cause any damage although it keeps multiplying.

This period of colonization where the host remains **asymptomatic** (not sick, doesn't feel any symptom) is called the **incubation period**.

Within the incubation period although the host remains asymptomatic he can still for some disease give the microorganisms to someone else. This is the reason why outbreak can occur. He is considered as **healthy carrier** or carrier.

The incubation period ends when the microorganisms will start to cause damage into the host who will start to fight against the microorganisms and become sick. This is the infection. the susceptibility of the host to get infected and ill will depend on several factors:

- Genetic factors (eg. people with a certain abnormality in the structure of their red blood cells cannot get sick of malaria) .
- Age (eg. young children have an immature immune system and will get sick more easily as well as older people whose immune system has lost efficiency).
- Gender (eg. men are more likely to develop infections). this is not usually listed as it's only for some infections that gender appears to play a role in risk
- Physiological conditions (eg. pregnancy, illness, poor nutritional status, alcoholism, surgery increase the risk of infection).
- Emotional factors (eg. emotional shock or stress can disrupt the functioning of the immune system).
- Lifestyle (eg. overpopulation, unsanitary housing, insecurity, poor hygiene).
- Geography (eg. microorganisms are not found everywhere in the world but in very specific areas favorable to their development). Being a patient - this can cause higher exposure to microorganisms, plus likely to have co-morbidity, especially if stay is extended or bed occupancy is high/bed spacing low

A sick person is in most case contagious et can give his disease to someone else through the specific mode of transmission for the disease.

D. WHAT IS AN INFECTION AND HOW IS IT MANIFESTED ?

The infection is the result of the invasion of a pathogenic microorganisms in a living being, causing in this living being an inflammatory reaction *(defense of the immune system)* which will manifest itself by a **SERIES OF SYMPTOMS**, for example:

- A local inflammatory response at the infected site *(eg. skin in case of wound)*. It will appear red, swollen, warm to touch, and painful. Some purelent *(yellow, brown, green, turbid)* and smelly discharge can be observed.
- Lymphatic nodes can appear tender/painful and inflammed/enlarged *(which means the infection spreads into other part of the body)*
- Gastro-intestinal infection; abdominal pain, nausea, vomiting and diarrhea can occur
- Urinary tract infection; urinate small quantity in high frequency, odour,
- In case of respiratory infection, cough, expectoration, and respiratory distress can occur
- The infected person can feel weak, drowsy, experiences fever, pain *(which means the infection spreads in the general body)*

E. HOW DO OUR DEFENCES (IMMUNITY) WORK?

The lymphatic and immune systems work together against disease-causing agents.

The two systems share main organs and they both rely on each other for their functions :

- **The lymphatic system** carries white blood cells and filters/cleanses circulation of blood and nutrients throughout the body
- **The immune system** is activated by antigens, fighting the foreign bodies to protect its host.

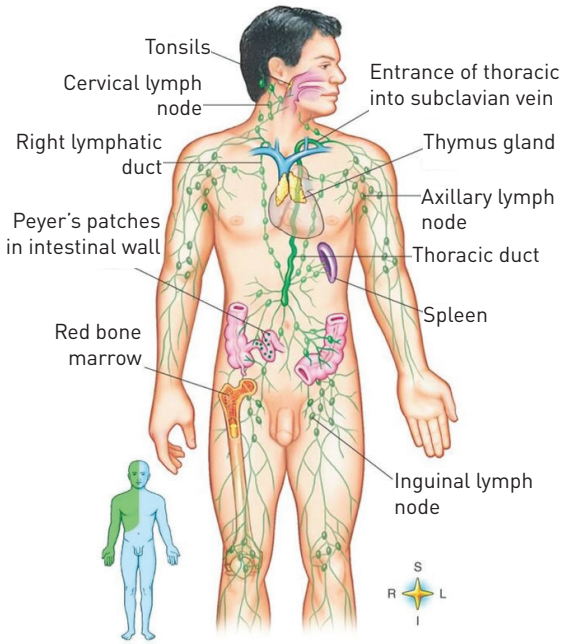
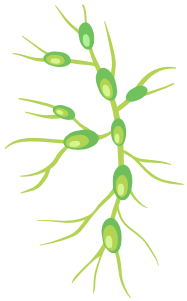


Figure 8: The lymphatic system.

MAIN ORGANS :

- **Lymph nodes**

  → Collect the fluid from between tissues and organs throughout the body
  → Filters the lymphatic fluid *(fluid leaked from blood vessels - circulates through the body in lymphatic vessels)*
  → Trapping bacteria, viruses, fungi, and cell fragments
  → Phagocytes, immune cells, ingest the "waste" of fluids, then the lymph goes back into the circulatory system.



- **Lymphatic vessels**

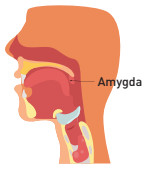
  → Carry lymphatic fluid through the body. Contains valves *(like the circulatory system)* to prevent "dirty" lymph to go back into the vessels.

- **Adenoids and Tonsils**

  → **Adenoids** are located in the back of the nasal cavity, where the passage of the cavity meets the pharynx.

  → **Tonsils** are located in the back of the mouth.

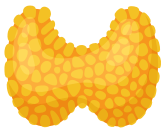
  Together they serve as first line of defense by trapping bacteria and other disease-causing agents from entering the body through the nose or mouth.



- **Thymus Gland**

  → Secretes hormone, thymosin, that stimulates the action of lymphocytes.

  → Produces T-cells (*see "White Blood Cells" below*).

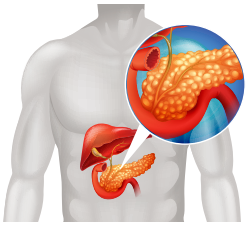


- **Spleen**

  → Destroys old and surpassed erythrocytes *(red blood cells)* and also stores blood.

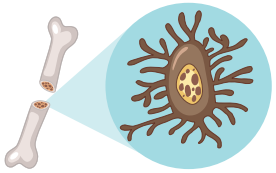
  → Contains the immune system cells, such as T-cells, B-cells, and killer cells.

  → Cleanses the blood through activation of these cells.



- **Bone Marrow**

  All immune system cells are made in the bone marrow through a process called HEMATOPOIESIS, which produces the different cells made in the bone marrow.



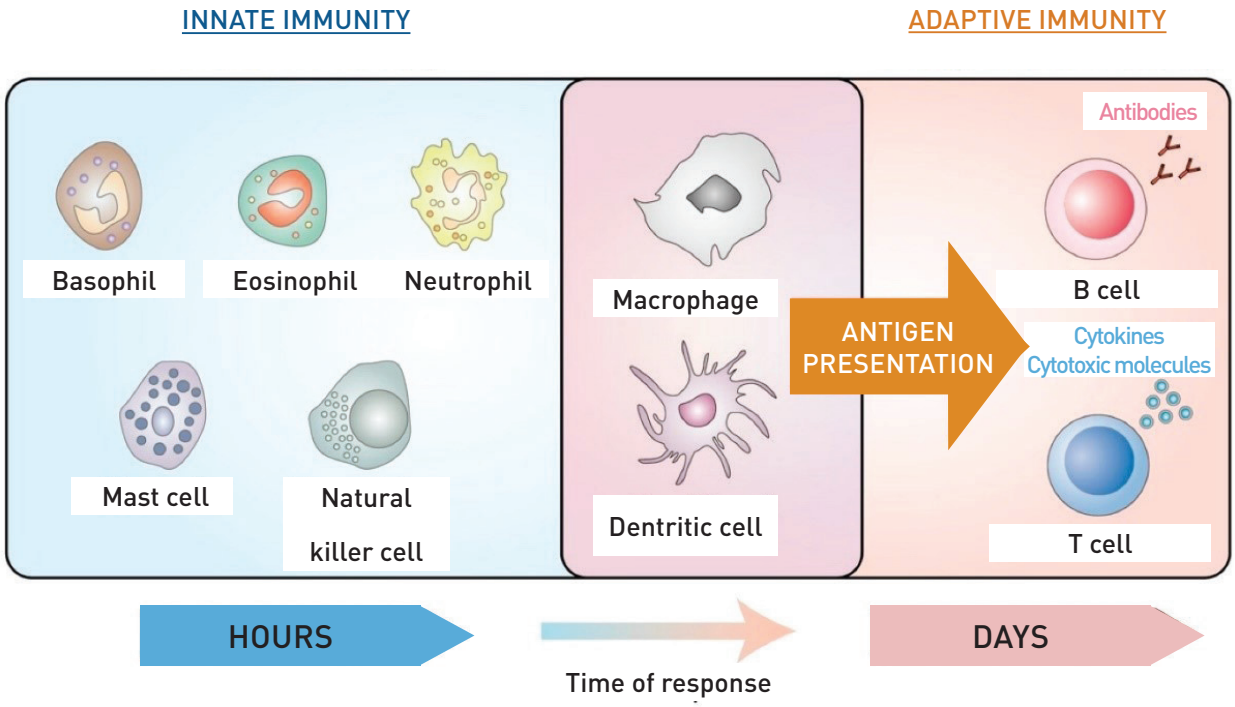
THE IMMUNE SYSTEM CELLS

- Also called leucocytes or white blood cells -

→ White blood cells are part of the defense system within the organism

→ They are involved in the innate and adaptive immune response

→ They play in important part in the defense of the organism against infectious microorganisms



THE INNATE IMMUNE RESPONSE :

- **Monocytes (*Macrophages*):** They ingest foreign substances and then present them to T-cells and B-cells so they can fight the substance in the host
- **Natural Killer Cells :** directly destroy harmed cells in the body *(T-cells do not directly battle the foreign cells)*.
- **Granulocytes** *(Neutrophil, Basophil, Eosinophil)* **:** remove parasites and bacteria by engulfing and dissolving them.

Our innate immunity is composed by :

→ External defense : The skin, mucous membranes or glandular secretions *(tears, saliva)* are the first barriers that pathogenic microorganisms have to overcome. They are populated by commensal bacteria *(cutaneous-mucosa)*.

→ Internal defense : The internal defense of the organisation is carried out in several stages.

If we take as an example a wound in the leg, let's see how the body will defend itself against microbial penetration.

We notice **DIFFERENT INNATE IMMUNE RESPONSE STEPS :**

1. **LOCAL** : activation of the white blood cells *(granulocytes)* at the site of microbial penetration. An inflammatory reaction occurs, it is characterised **4 SYMPTOMS** : **redness, pain, heat, swelling**. We can say that the white blood cells function as the first bodyguards to which the microbes meet. To eliminate them GB proceed to a phagocytosis *(includes, kills and digests)*.
2. **LYMPHATIC** : the microbes pass into the lymphatic vessels and are then stopped at the level of the inguinal lymph nodes which become hard and painful.
3. **BLOOD** : if the two previous steps were not enough to destroy the microbes, they then pass into the blood and can trigger a general infection known as **sepsis** *(a serious disease depending on the infectious agent involved and the receiving organism).*

There is still a defender of the body: **THE LIVER** that can neutralize microbes and slow down the progression of infection with the specific antimicrobial substances it contains.
It is the last intervener of natural immunity.

THE ADAPTIVE IMMUNE RESPONSE :

It follows the innate immune response and occurs after a delay and in a specific way unlike the innate immune response.

The response is **ADAPTIVE** because based on the **recognition of the pathogenic microorganisms** and to remember them in way to specifically target them whether they would invade the body again.

This defense system requests the action of **2 TYPES OF WHITE BLOOD CELL** :

1. **T-LYMPHOCYTES** *(T-CELLS)*: to maintain the immune response and destroy infectious microorganisms.
2. **B-LYMPHOCYTES** *(B-CELLS)*: to produce antibodies *(= complex protein which is able to recognize and destroy a specific infectious microorganisms).*

Each infectious microorganisms attacking the body is carrying a specific antigen. These antigens when present in the blood will activate the production of antibodies by the B lymphocytes. Each antibody (also called "immunoglobulins") corresponds to a specific antigen, that is to say it is able to recognize it and to suppress it.

This defense system is slower to set up (at least 15 days), but it persists for a long time in the body.

Most of the "early childhood" diseases can activate this specific immunity that will become naturally acquired.

> *Eg. if someone has had measles, rubella or whooping cough, it is rare that he has it a second time in his life. He keeps antibodies in his blood that will protect him from further microbial attack.*

It should be noted that specific immunity can be acquired preventively by means of vaccinations *(through vaccines)* or through serotherapy *(through serums)*.

F. HOW TO FIGHT AGAINST HAI?

To prevent or reduce the occurrence of HAI, each hospital structure should have a functional **INFECTION PREVENTION CONTROL (IPC)** strategy, providing appropriate recommendations in terms of good hospital hygiene practices to adopt and maintain as well as providing adequate resources to enable the implementation of these practices.

Each organisation and care organisation have its recommendations on IPC, but in general they deal with similar issues.

Non-exhaustive list of issues addressed by an IPC program

1. The need for an active IPC committee to discuss hygiene practices and ensure the control and prevention of healthcare-associated infections
2. Improved compliance with regard to hand hygiene
3. Cleaning and disinfection of the patient's environment and reusable material
4. Personal protective equipment
5. Waste Management
6. Performing invasive care procedures with asepsis
7. Prevention and management of accidents of exposure to blood or body fluids
8. Additional isolation measures and precautions adapted to the different modes of transmission
9. Antibiotic resistance of certain microorganisms contribute to antibiotic stewardship and rational prescribing

STANDARD AND TRANSMISSION-BASED PRECAUTIONS

From all these issues will arise good hygiene practices that will constitute barriers to the transmission of microorganisms between patients, their environment and health care workers and all those involved directly or indirectly with patients. These practices must be respected systematically by all the caregivers *(and also visitors)* in all the places of care and for all the patients whatever their status or their condition.

This is called **STANDARD PRECAUTIONS**. It includes :

1. Hand hygiene at the 5 moments defined by WHO *(see Unit "Hand hygiene")*
2. Wear gloves when risk of contact with bodily fluids *(see Unit: "Gloves handling")*
3. Wear appropriate work clothing according to the unit of care where we are working & preventing bodily fluid exposure *(see Unit "PPE")*
4. Appropriate segregation and treatment of waste *(see Unit "Waste Management")*
5. Perform invasive procedures with aseptic technique *(see Unit: Aseptic care technique)*
6. Handle needles and sharps safely eliminating it directly after use into a specific sharp container *(see Unit: Needle Stick Injury prevention & PEP)*
7. Cleaning & disinfection of the environment
8. Safe reprocessing of reusable medical devices and equipment, including sterilization *(see Unit:"Safe processing of reusable medical devices & equipment")*
9. Cleaning and disinfection of linen *(see Unit: "Safe processing of reusable medical devices & equipment")*
10. Respiratory hygiene and cough etiquette to prevent respiratory disease contamination *(see Unit:"Respiratory hygiene")*

In some situations, **TBP PRECAUTIONS** for the control of infection transmission should be taken *(eg. suspect or confirmed patient with infection or colonisation by microorganisms highly virulent or resistant)*. These additional precautions will depend on the mode of transmission of these *microorganisms (see Unit: Patient care: transmission-based precautions)*

SUMMARY

1. Microorganisms **are** presents everywhere **in the environment and particularly in healthcare settings.** Some microorganisms are path-ogenic and can spread infections

2. Health Care-associated infection **=** HAI **is** an infection that develops during patient management when it was not present or incubating before the patient's arrival in the health facility. It occurs because of poor IPC practices such as inappropriate or absent hand hygiene *(hand rubbing or hand washing)*, the use of dirty or contaminated equipment, the mismanagement of waste that contributes to the chain of transmission of microorganisms.

3. The CHAIN OF TRANSMISSION of a microorganisms is the series of steps by which the microorganisms must pass from its reservoir to the individual that will be contaminated

4. The MODES of TRANSMISSION are varied some of the most important ones are those by :

- **CONTACT** direct *(person-to-person)* & indirect *(from person to objects of the environment, contaminated food, ...)*
- **DROPLETS** *(projection of droplets when the contaminated person speaks, coughs or sneezes within a radius of 1.50 meters)*
- **AIRBORNE** *(projection of particles capable of remaining suspended in the air over a long distance) which can be inhaled).*

5. IN HOSPITALS, the most common chain of contagion is the **cross-transmission** of microorganisms from patient A to patient B through caregivers (*especially their* HANDS).

6. The LYMPHATIC AND IMMUNE SYSTEMS are essential to fight against infection

7. In case of infection, an INFLAMMATORY REACTION will occur, characterized by:

- LOCAL: redness, pain, heat, swelling at the infected site
- LYMPHATIC: lymph nodes will be hard, swollen and painful
- SYSTEMIC *(when reaches the blood stream)*: fever, weakness, drowsiness, also known as septicemia

8. TO PREVENT and reduce the occurrence of healthcare-associated infections, it is important to have an infection prevention and control program in place within the health facility to implement recommendations for standard precautions and TBP precautions to be applied during care activities.

9. STANDARD PRECAUTIONS are practices aimed at reducing the transmission of microorganisms between patients, careers and anyone present in the health care facility. These practices must be followed systematically by everyone and for all patients who know or do not know their status or condition regarding their infectious risk.