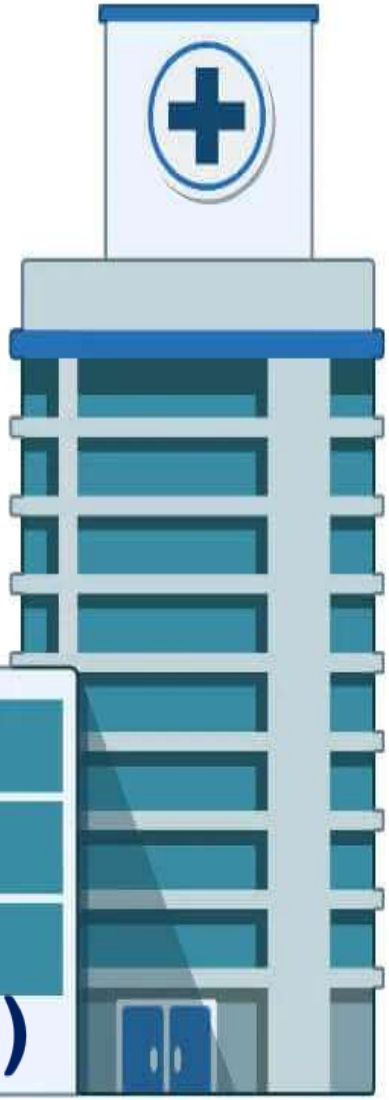
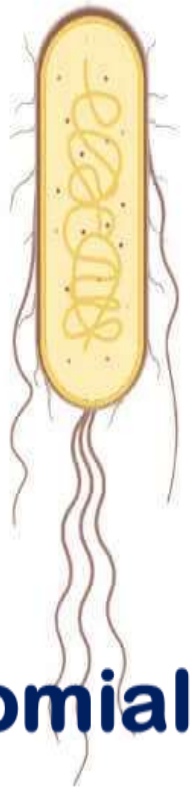
Healthcare-associated infections (HCAIs)





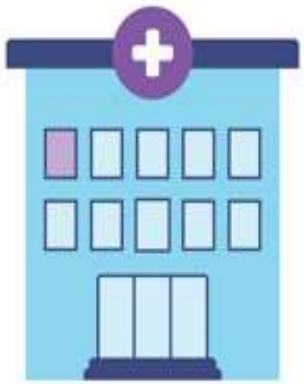
(Nosocomial Infections)

Prof Dr Najlaa Fawzi
Family and Community Medicine Dept.

HEALTH CARE-ASSOCIATED INFECTIONS (HCAI)

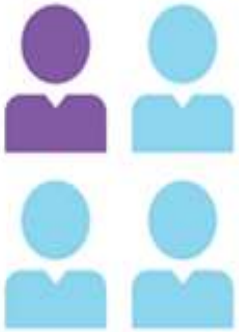
Health Care-Associated Infections (HCAI) were earlier known as "Noso-comial infections" and the term was derived from Greek words "**nosus**" meaning **disease** and "**komeion**" meaning **to take care of**

HEALTHCARE-ASSOCIATED INFECTIONS ARE A CONCERN IN ALL COUNTRIES



7 to 10%

Of every 100 hospitalised patients, 7 in high-income and 10 in low and middle-income countries, will acquire at least one healthcare-associated infection.

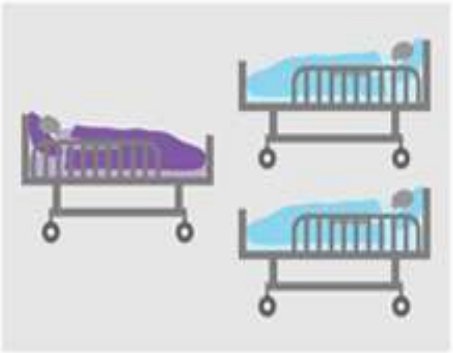


1 in 4

A quarter of healthcare-associated infections in long-term acute care settings are caused by antibiotic-resistant bacteria.

1 in 3

A third of patients in intensive care units (ICUs) in high-income countries are affected by at least 1 healthcare-associated infection.



Sources: WHO Healthcare-Associated Infections, Fact Sheet, 2014, WHO, The Burden of Health Care-Associated Infection Worldwide: A Summary, 2010, and CDC, Vital Signs Report, March 2016.

Review on Antimicrobial Resistance

Objectives:

- Define HCAIs
- Designate major types of HCAIs
- Describe chain of HCAIs (source, susceptible patient, modes of transmission)
- Identify the principles of prevention and control of HCAIs.

Definitions of Health Care-Associated Infections

HAIs were defined as infections people get while they are receiving health care for another condition, but are neither present nor incubating upon the patient's admission to the hospital; generally for those infections that occur more than 48 to 72 hours after admission and within 10 days after hospital discharge.

WHY???

Within hours after admission, a patient's flora begins to acquire characteristics of the surrounding bacterial pool. Most infections that become clinically evident after 48 hours of hospitalization are considered hospital-acquired.

Infections that occur after the patient is discharged from the hospital can be considered healthcare-associated if the organisms were acquired during the hospital stay.

HAIs cover any infection contracted:

- As a direct result of treatment in, or contact with, a health or social care setting
- As a result of healthcare delivered in the community
- Outside a healthcare setting (for example, in the community) and brought in by patients, staff

or visitors and transmitted to others

PERSONS AT RISK OF INFECTION IN HEALTHCARE FACILITIES

1-Healthcare workers (HCWs)

2- Patients

3-Visitors

Healthcare-Associated Infection (HAI) Types

HAI

- Pneumonia
  - Ventilator-associated (VAP)
- Urinary tract infection
  - Catheter-associated (CAUTI)
- Bloodstream infection
  - Central line-associated (CLABSI)
- Surgical Site Infection
- Others

Device-associated infections (subtypes)

Target of many prevention efforts

Major Types of HAIs

There are four major types of HAIs, all related to invasive or surgical procedures. They include:

- **Catheter-associated urinary tract infection**
- **Ventilator-associated pneumonia**
- **Surgical site infection (SSI)**
- **Central line-associated bloodstream infection (CLABSI):**

- **Other types of HAIs include endometritis.**

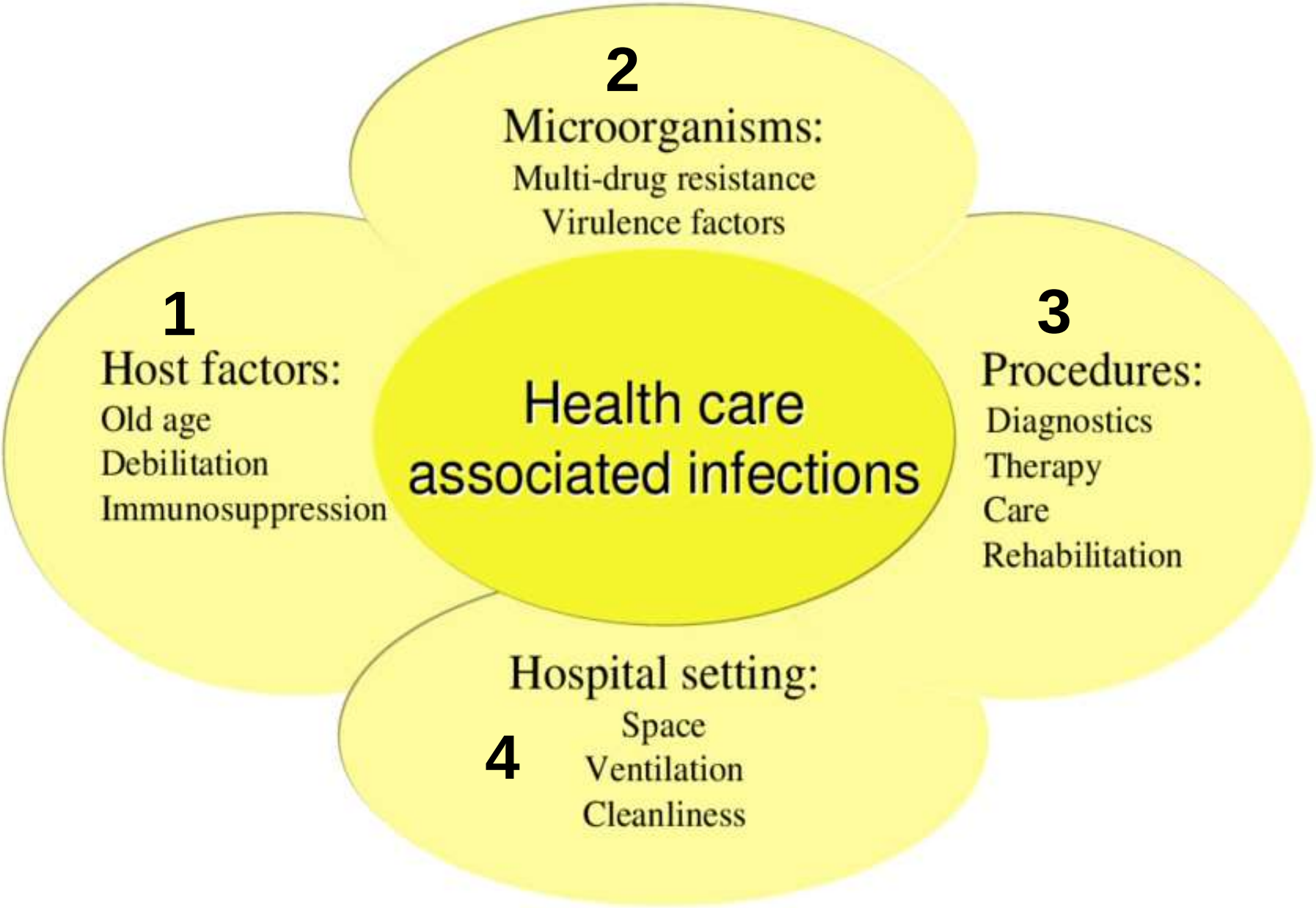
Types of HAI according to magnitude

1 in 20 of hospitalised patients

1. **Urinary Tract Infection 30-40%**
2. **Surgical Wound Infection 17-19%**
3. **Lower resp tract infection16-18%**
4. **Skin and soft tissue Infection 6%**
5. **Bacteremia 8%**

Symptoms that favor an infection include

- **productive cough**
- **shortness of breath**
- **abdominal pain**
- **rebound tenderness**
- **altered mental status**
- **palpitations**
- **suprapubic pain**
- **polyuria, dysuria**
- **costovertebral angle tenderness.**

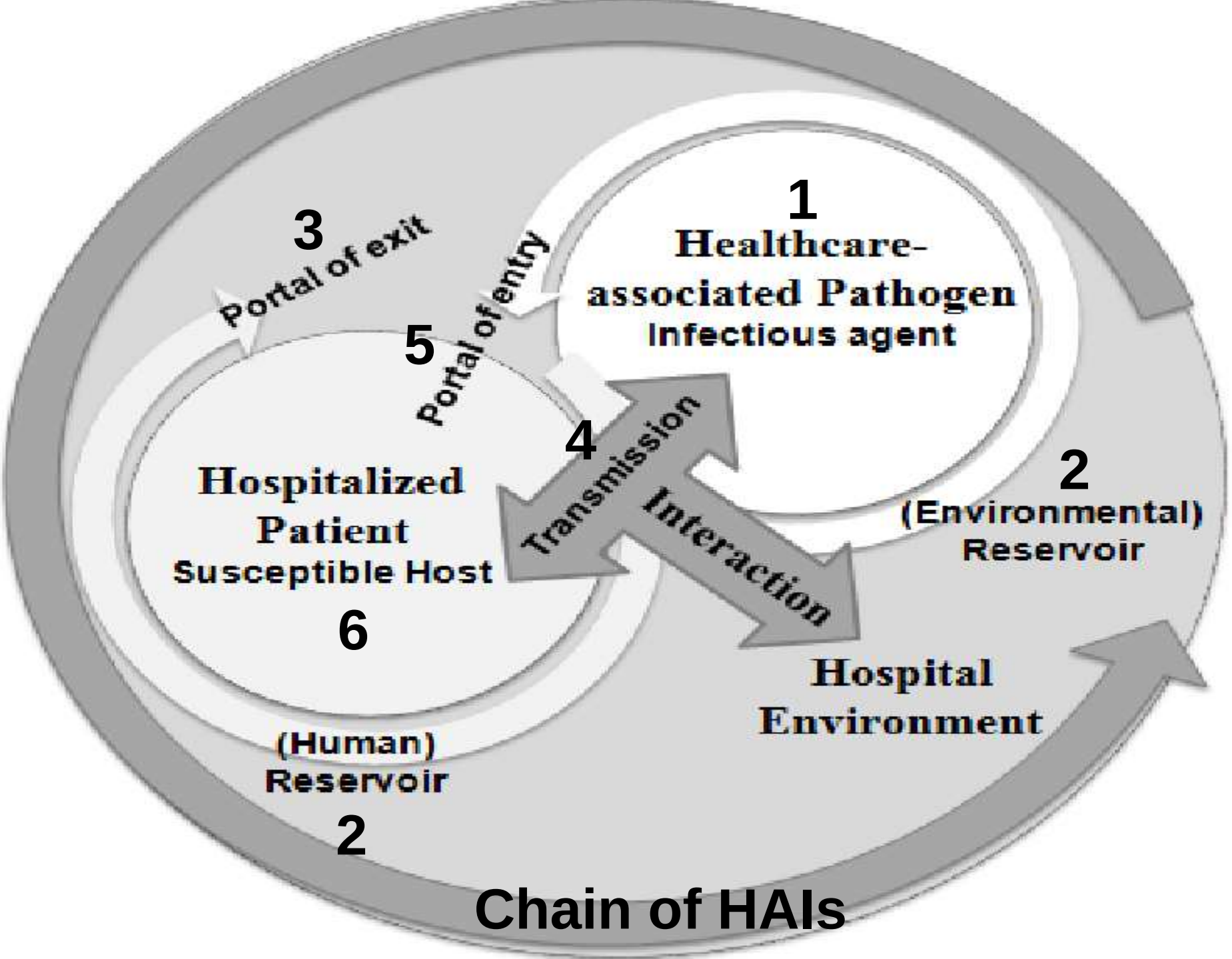


FACTORS INFLUENCING HEALTH CARE ASSOCIATED INFECTIONS

Risk factors for HAIs can be grouped into three general categories:

- **Medical procedures and antibiotic use**
- **Organizational factors**
- **Patient characteristics.**

The behaviors of health care providers and their interactions with the health care system also influence the rate of HAIs.



Chain of HAIs

Transmission of infection within a health care setting requires three elements:

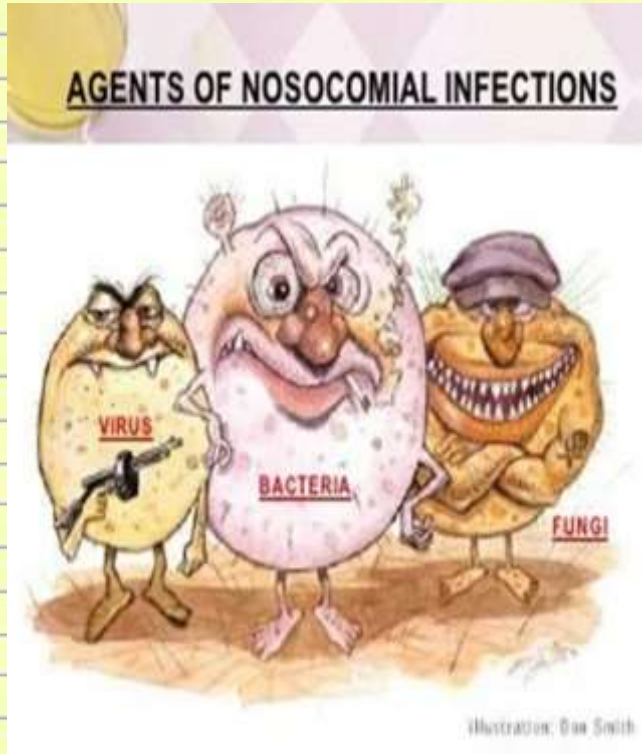
1-source of infecting microorganisms.

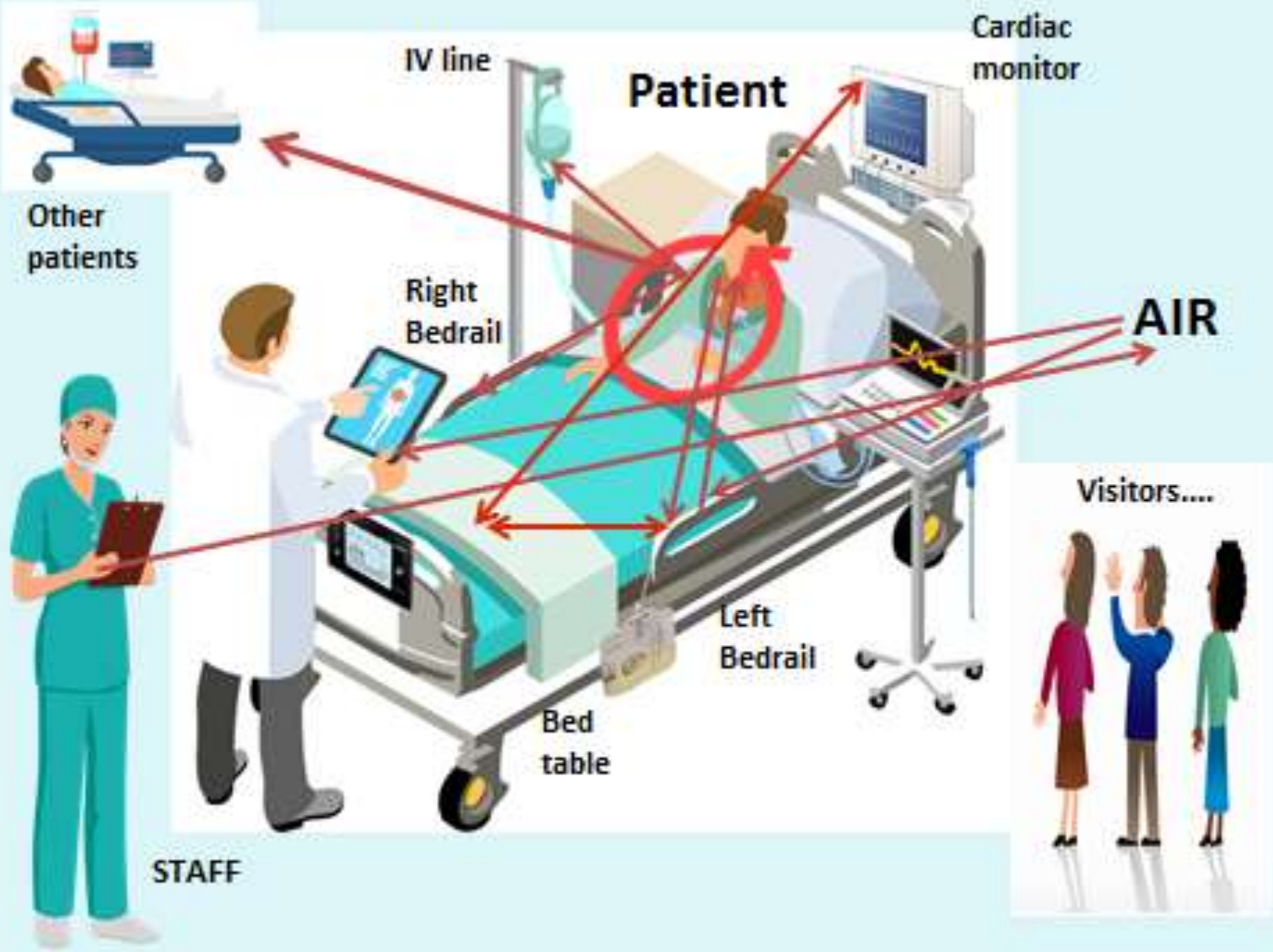
2- susceptible host

3- means of transmission of microorganisms to the host

SOURCE OF MICROORGANISMS

During the delivery of health care, patients can be exposed to a variety of exogenous microorganisms (bacteria, viruses, fungi, and protozoa) from other patients, health care personnel, or visitors.




Other patients
IV line
Patient
Cardiac monitor
Right Bedrail
AIR
Visitors....
Left Bedrail
Bed table
STAFF

The term HAI covers a wide range of infections.

Staphylococcus aures, Streptococcus haemolyticus, viruses of hepatitis, Covid -19,HIV and occasionally Clostridium tetani and other organisms.

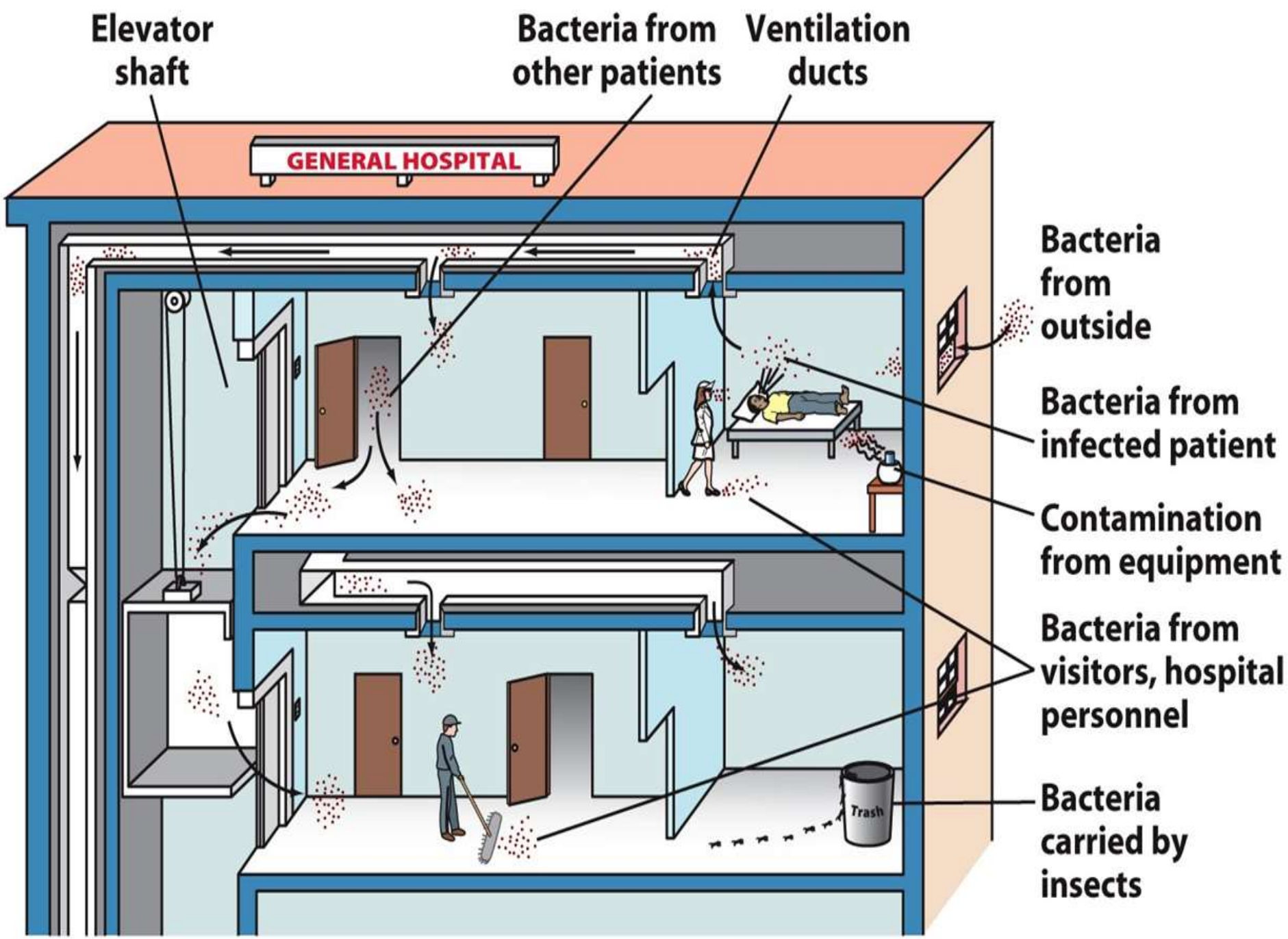
-S. aureus (most frequent cause of pneumonia)

– Enterococcus spp. (Surgical wound infections)

– E. coli (Pneumonia and surgical wound infections)

– P. aeruginosa (Pneumonia and surgical wound infections)

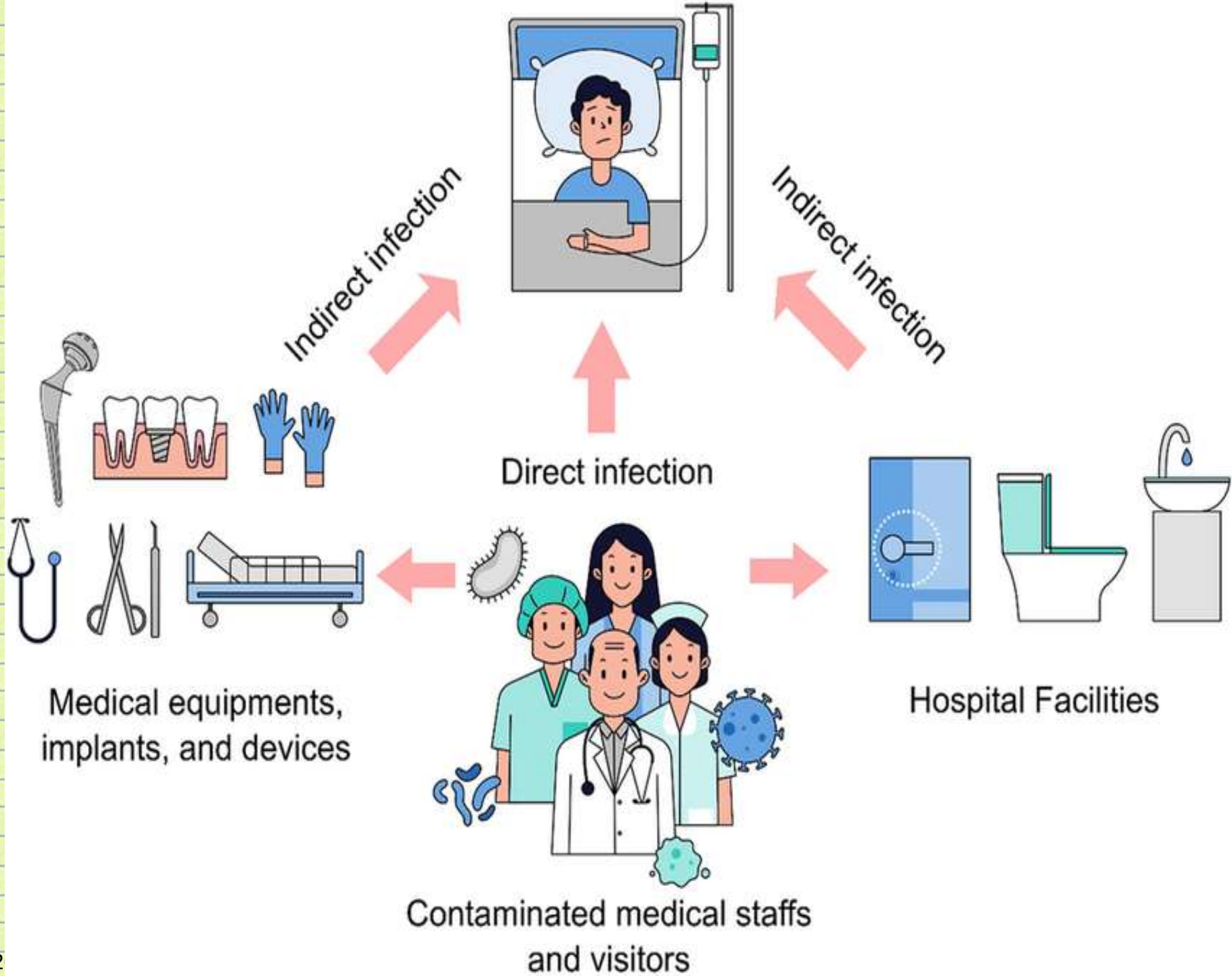
– Candida albicans (Urinary tract infection and sepsis)



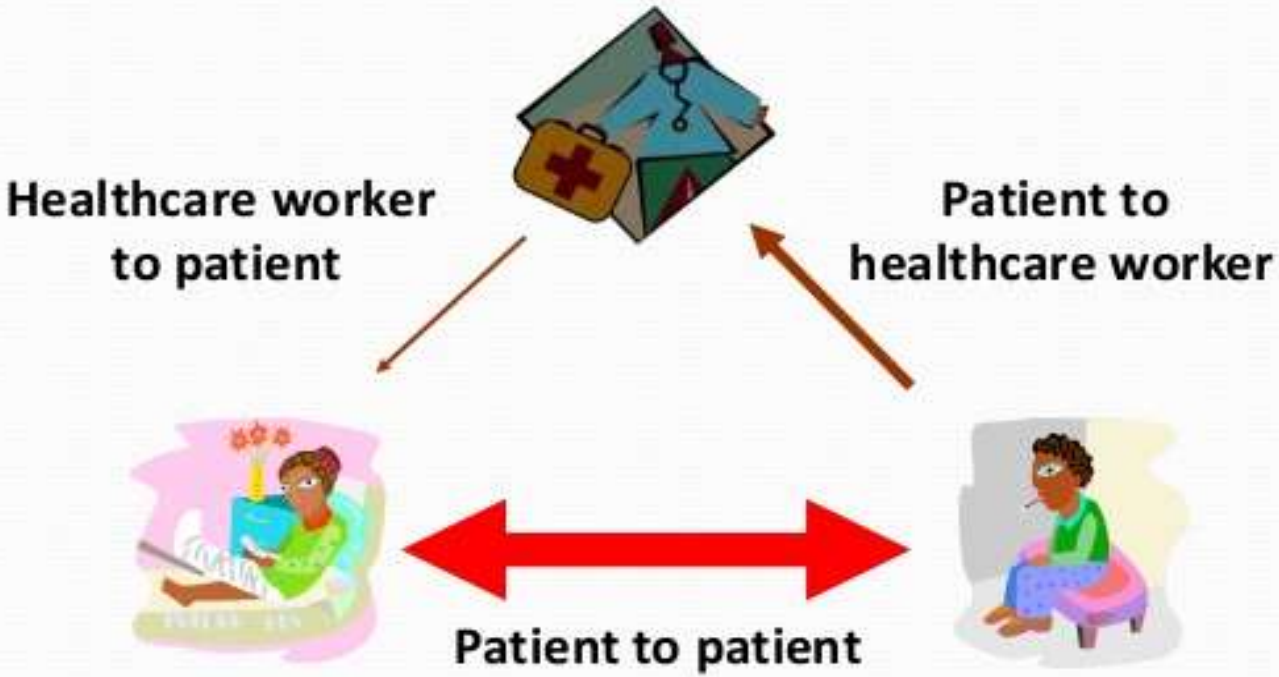
Means of Transmission

Among patients and health care personnel, microorganisms are spread to others through four common routes of transmission:

- **Contact (direct and indirect)**
- **Respiratory droplets**
- **Airborne spread**
- **Common vehicle**


Indirect infection
Indirect infection
Direct infection
Medical equipments, implants, and devices
Hospital Facilities
Contaminated medical staffs and visitors

Transmission of Healthcare- associated Infections



Contact transmission

This is the most important and frequent mode of transmission in the health care setting.

Organisms are transferred through direct contact between an infected or colonized patient and a susceptible health care worker or another person.

Patient organisms can be transiently transferred to the intact skin of a health care worker (not causing infection) and then transferred to a susceptible patient who develops an infection from that organism—this demonstrates an indirect contact route of transmission from one patient to another.

Microorganisms that can be spread by contact include those associated with impetigo, abscess, diarrheal diseases, scabies, and antibiotic-resistant organisms (e.g., methicillin-resistant *Staphylococcus aureus* [MRSA]

Respiratory droplets

Droplet-size body fluids containing microorganisms can be generated during coughing, sneezing, talking, suctioning, and bronchoscopy.

They are pushed a short distance before settling quickly on to a surface.

They can cause infection by being deposited directly into a susceptible person's mucosal surface (e.g., conjunctivae, mouth, or nose) or into nearby environmental surfaces, which can then be touched by a susceptible person who auto inoculates their own mucosal surface.

Examples of diseases where microorganisms can be spread by droplet transmission are pharyngitis, meningitis, and pneumonia.

Airborne spread

When small-particle-size microorganisms (e.g., tubercle bacilli, varicella, and rubeola virus) remain suspended in the air for long periods of time, they can spread to other people.

Common Vehicle

Common vehicle (common source) transmission applies when multiple people are exposed to and become ill from a common non-living vehicle of contaminated food, water, medications, solutions, devices, or equipment.

Bacteria can multiply in a common vehicle but viral replication can not occur.

Microorganisms are transmitted to susceptible hosts from common items:

- Food
- Water
- Medications
- Devices/ equipment

Examples include :improperly processed food items that become contaminated with bacteria, waterborne shigellosis. Bacteremia resulting from use of intravenous fluids contaminated with a gram-negative organism. Contaminated multi-dose medication vials, or contaminated bronchoscopes.

HOST SUSCEPTIBILITY

All people admitted to hospital are at some risk of contracting an HAI. If patients are very sick or have had surgery, theyhave an increased risk. Some people are more vulnerable than others, including:

premature babies
very sick children
elderly people
frail people
people with certain medical conditions, such as diabetes
people with low immunity – such as people with diseases that compromise their immune system or people who are being treated with chemotherapy or steroids.

MAJOR INFECTIOUS RISKS FOR HEALTHCARE WORKERS

Blood borne pathogens

Via percutaneous or mucosal exposure

Major risks: HBV, HCV, HIV

Airborne or droplet transmitted diseases

Varicella, measles, pertussis, meningococcal infection, influenza, other respiratory viruses (e.g., RSV, SARS) and COVID-19.

Contact transmitted diseases (direct, indirect)

***C. difficile*, MRSA, herpes simplex, adenovirus (keratoconjunctivitis)**

VISITORS

Visitors may acquire a communicable disease or serve as a source of infection

Visitors as a source of infection:

Influenza, RSV, measles, varicella, pertussis, SARS,Covid-19

Gaining of colonization/infection by visitors

SARS, MRSA

Visitors may act a vector for transferring infection

What is the impact of health care-associated infections?

As is the case for many other patient safety issues, health care-associated infections create additional suffering and come at a high cost for patients and their families.

- Infections prolong hospital stays
- Increase resistance to antimicrobials
- Represent a massive additional financial burden for health systems
- Generate high costs for patients and their family
- Cause unnecessary deaths.

Such infections annually account for 37 000 attributable deaths in Europe and potentially many more that could be related, and they account for 99 000 deaths in the USA.

Why do Health care Associated Infections Arise?

1-Inadequate environmental hygienic conditions and waste disposal

2-Poor infrastructure
Poor design and planning of hospitals

3-Insufficient equipment
4-Understaffing
5-Overcrowding

6-Poor knowledge and application of basic infection control measures

7-Lack of Aseptic procedure

8-Lack of knowledge of injection and blood transfusion safety

9-Absence of local and national guidelines and policies for the prevention and control of HAIs.

10-A false sense of security about the effectiveness of antibiotics with the corresponding neglect of Aseptic Techniques.

11-Admissions of carriers for unrelated medical conditions

12-Transfer to ,or from specialized hospitals or units with a high usage of antibiotics (e.g. ICU patients or oncology patients). Such patients carry bacteria that are often resistant to antibiotics combat infection.

Infectious Disease Hospital

hospitalized cases may acquire another form of infection on the top of that they have. It is known as "hospital cross – infection ".

Specifics of hospital cross – infection:

Together with the same general characteristics of hospital infection, cross hospital infections have the following particulars:

1- personnel going in-between wards of different infectious diseases may transmit infection from one ward to the other through 3rd person role, when preventive precautions are not taken.

2- undiagnosed cases may be admitted to the ward of suspected disease, and who then proven to have some other disease , with the risk of exposing the other cases to infection.

3- more than one infectious disease may be admitted to one ward where vacant beds are available.

How are healthcare-associated infections (HAIs) treated?

- HAIs can cause illnesses ranging from mild to extremely serious and life-threatening.
- Treatment of HAIs depends on the infection involved.
- Some respond to carefully chosen antibiotic treatments.
- However, some HAIs can be extremely difficult to treat because of their resistance to antibiotics. Because of this, the best treatment for HAIs is **prevention**.

PREVENTION OF HEALTH CARE ASSOCIATED INFECTIONS

Goals for prevention and control of HAIs are

1-Protect the patients.

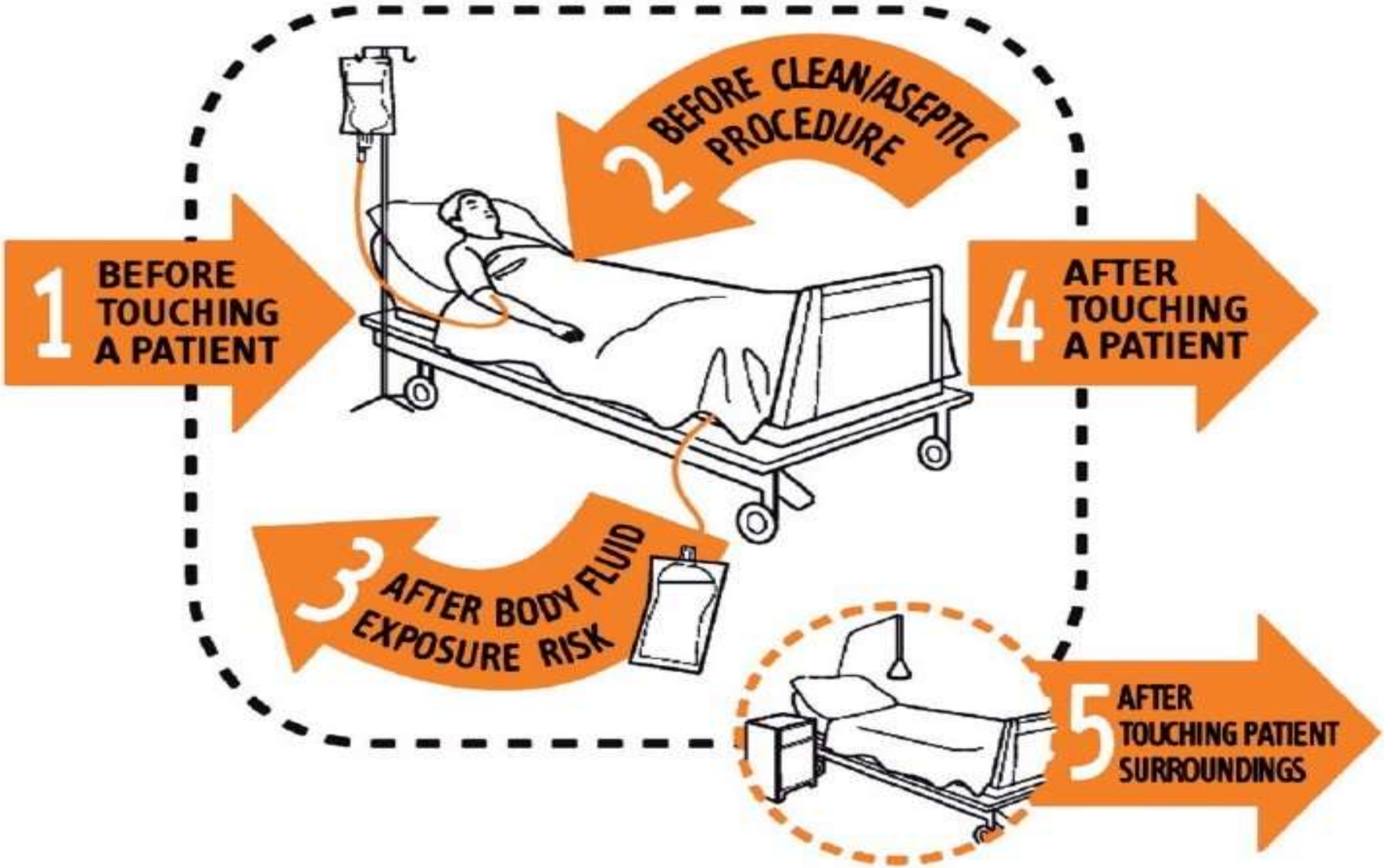
2-Protect the health care workers ,visitors and, Others in the health care environment.

Preventing healthcare associated infections

Healthcare workers use various well established procedures to help prevent infections, including:

- **infection control procedures and policies**
- **correct and frequent hand hygiene measures by all staff and patients**
  - **Hand washing, according to the WHO is the single most important means of preventing the spread of infection.**

My 5 moments for HAND HYGIENE



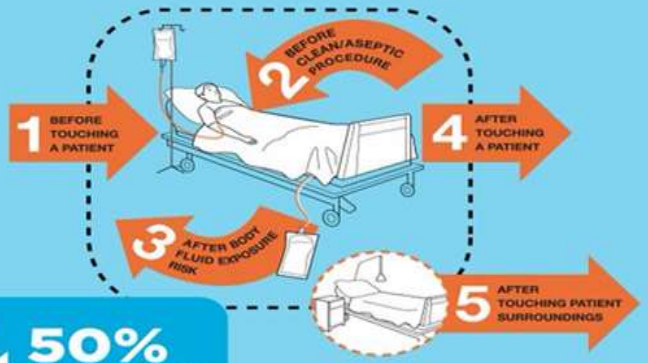
- keeping the healthcare environment and equipment clean
- complying with standard sterile techniques when performing surgery, caring for wounds or inserting and caring for medical devices such as intravenous cannulas and urinary catheters
- using antibiotics appropriately to prevent and treat infections.
- Hospitals will also participate in surveillance programs to monitor infection rates and measure the impact of infection prevention practices.

World Health Organization

HEALTH CARE

The main ways to prevent infection are:

1 Practicing the 5 Moments for hand hygiene



↓ 50% INFECTION

2 A clean, well-functioning environment and equipment

3 Infection prevention and control programmes and teams

↓ 30% INFECTION

5 Safe water and sanitation

4 Infection prevention measures

Medical Care Providers

Health care workers may also be infected ,therefore prevention & control measures increase safety for them, as well as for patients.

Many infection prevention and control measures, such as appropriate hand hygiene and the correct application of basic precautions during invasive procedures, are simple and low-cost, but require staff accountability and behavioral change.

- **Free of infection: pre-employment and periodic examination, including the bacteriological {nose and throat swabbing are particularly important}.**

- **Preventive measures such as vaccination of the staff against i.e. hepatitis B, or other diseases .**
- **Proper health behavior & clean habits**

- **Use of personal protective equipment aprons, face shields, gloves, and effective post-exposure management or treatment must be practiced in all health care facilities.**

Prevention of Hospital Cross- infection

1. Special hospital design, to prevent spread of infection in-between wards.

2. Separate isolation ward (s) for each infectious disease and it not allowed admitting cases of any other disease.

3. Availability of a suitable number of "isolation cubicles", for separate individual isolation of undiagnosed cases.

Precautions for Personnel:

1- Must have basic knowledge, of infection, & how to prevent.

2-Application of specific protection by immunization, chemoprophylaxis, according to potentially expected exposure.

3-Providing facilities of personal cleanliness.

4- Nursing and service personnel; must be responsible for cases of one disease only, and not to go into other wards & units.

5- During the daily round of personnel in hospital, it is necessary to use clean gown & shoes [and also mask & gloves when necessary], to be changed and hands thoroughly washed in-between wards and units, to prevent third – person transfer of infection.

ANY QUESTION ?