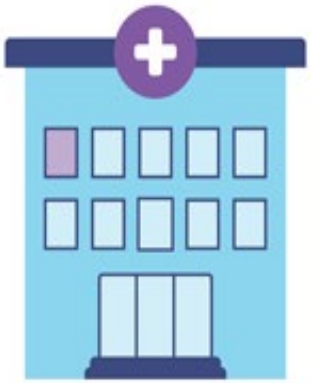
Healthcare Associated Infections (HAI)

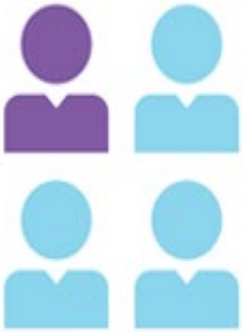
Prof Dr Najlaa Fawzi
Family and community medicine Dept.
College of Medicine

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.

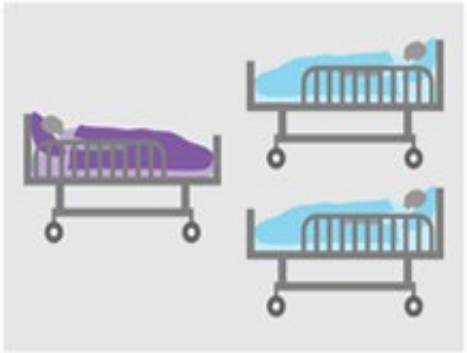


1 in 4

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

Healthcare Associated Infections: The Unknown Killer

Healthcare Associated Infections (HAIs) affect millions of people and add billions of dollars to healthcare costs in the U.S. annually. HAIs are an unintended consequence of care delivered by healthcare organizations. Scientific evidence suggests that most HAIs are preventable.

If you are admitted to a hospital, you **have a 5% chance of contracting an HAI**

Your length of stay in the hospital increases by **17.6 days** if you get an HAI

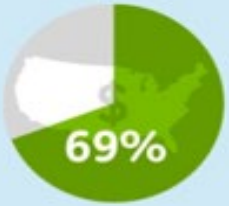
1.7 million people per year get an infection during a hospital stay

98,987 people in the U.S. die annually from HAIs

System
$35 Billion/yr

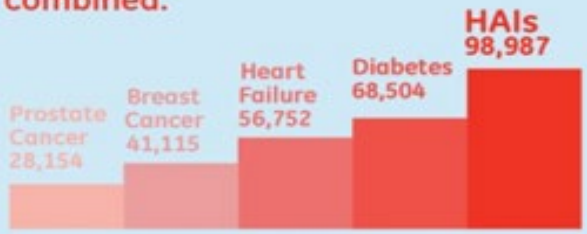
Patient
$1,100 per admission

9.4% of total inpatient costs are HAI-related



More than ⅔ of HAIs affect people with Medicare or Medicaid

HAIs kill more people each year than Breast Cancer and Prostate Cancer combined.



imagination at work

Sources: Estimating HAIs and Deaths in US Hospitals, Klevens 2002
The Direct Medical Costs of HAIs in US Hospitals and the Benefits of Prevention, R Douglas Scott, CDC, Mar 2009

healthymagination

Objectives:

- Define HCAIs
- List the major types of HCAIs
-Describe the chain of HCAIs (source, susceptible patients, modes of transmission)
- Outline the impact of HCAIs.
- Illustrate the principles of prevention and control of HCAIs.

Health care-associated infection (HCAIs)

Health care-associated infections (HCAIs) are those infections that patients acquire while receiving health care.

The term HCAIs initially referred to those infections linked with admission to an acute-care hospital (earlier called nosocomial infections), but the term now includes infections developed in various settings where patients obtain health care (e.g., long-term care, family medicine clinics, home care, and ambulatory care).

Definition & Timing

An infection is classified as an HAI if it meets these criteria:

- **Onset:** Symptoms typically appear 48 hours or more after hospital admission.
- **Condition at Admission:** The infection was neither present nor incubating at the time of admission.
- **Post-Discharge:** It can include infections appearing up to 30 days after discharge (or 1 year for implants).
- **Occupational:** Includes infections acquired by healthcare workers via occupational exposure, such as needle-stick injuries.

HAIs cover any infection contracted:

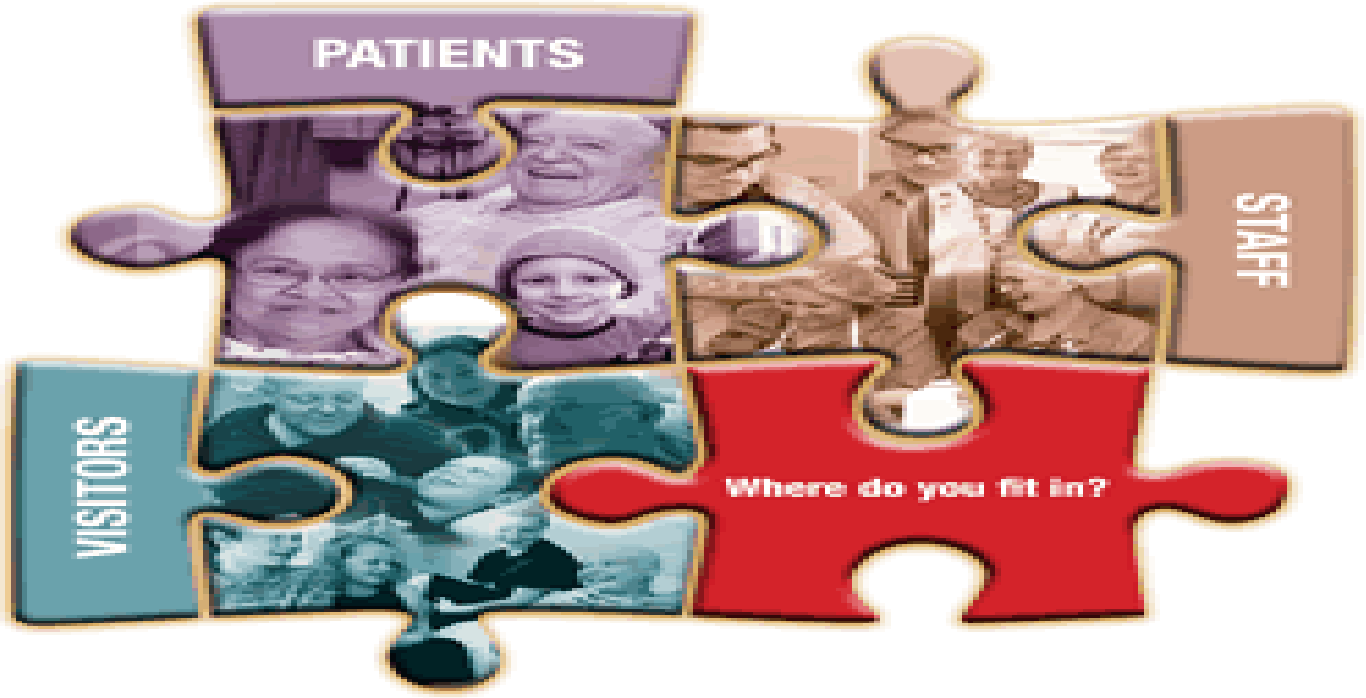
- **As a direct result of treatment in, or contact with, a health or social care setting**
- **As a result of healthcare delivered in the community**
- **Outside a healthcare setting (for example, in the community) and brought in by patients, staff or visitors and transmitted to others**

PERSONS AT RISK OF INFECTION IN HEALTHCARE FACILITIES

1-Healthcare workers (HCWs)

2- Patients

3-Visitors



Major Types of HCAIs

There are four major types of HCAIs, 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.**

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

Types of HCAI 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. **Bacteremia 8%**
5. **Skin and soft tissue Infection 6%**

Risk factors of important healthcare-associated infections

- **Urinary tract infection**

prolonging the duration of the catheter, female sex, older age, diabetes mellitus, the absence of systemic antibiotics cover , catheter insertion outside the operating room. *E. coli* **being the main infecting pathogenic microorganism**

- **Pneumonia**

Pneumonia is the second commonest HCAI in ICUs, affecting more than one-quarter of patients

Extremes of age, Underlying disease (COPD, Adult Respiratory Distress Syndrome), Head trauma ,Use of antacids, Re-intubation, Receiving of enteral nutrition

- **Surgical site infection(SSIs)**

SSIs are defined as infections arising up to 30–90 days after surgery in patients receiving an organ, group of cells, or device and affecting both the incisional site and deeper tissues around the surgery location.

Extremes of age, Obesity ,Smoking, Diabetes mellitus, Existing infection, Trauma ,Shock ,Prolonged procedure

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.

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

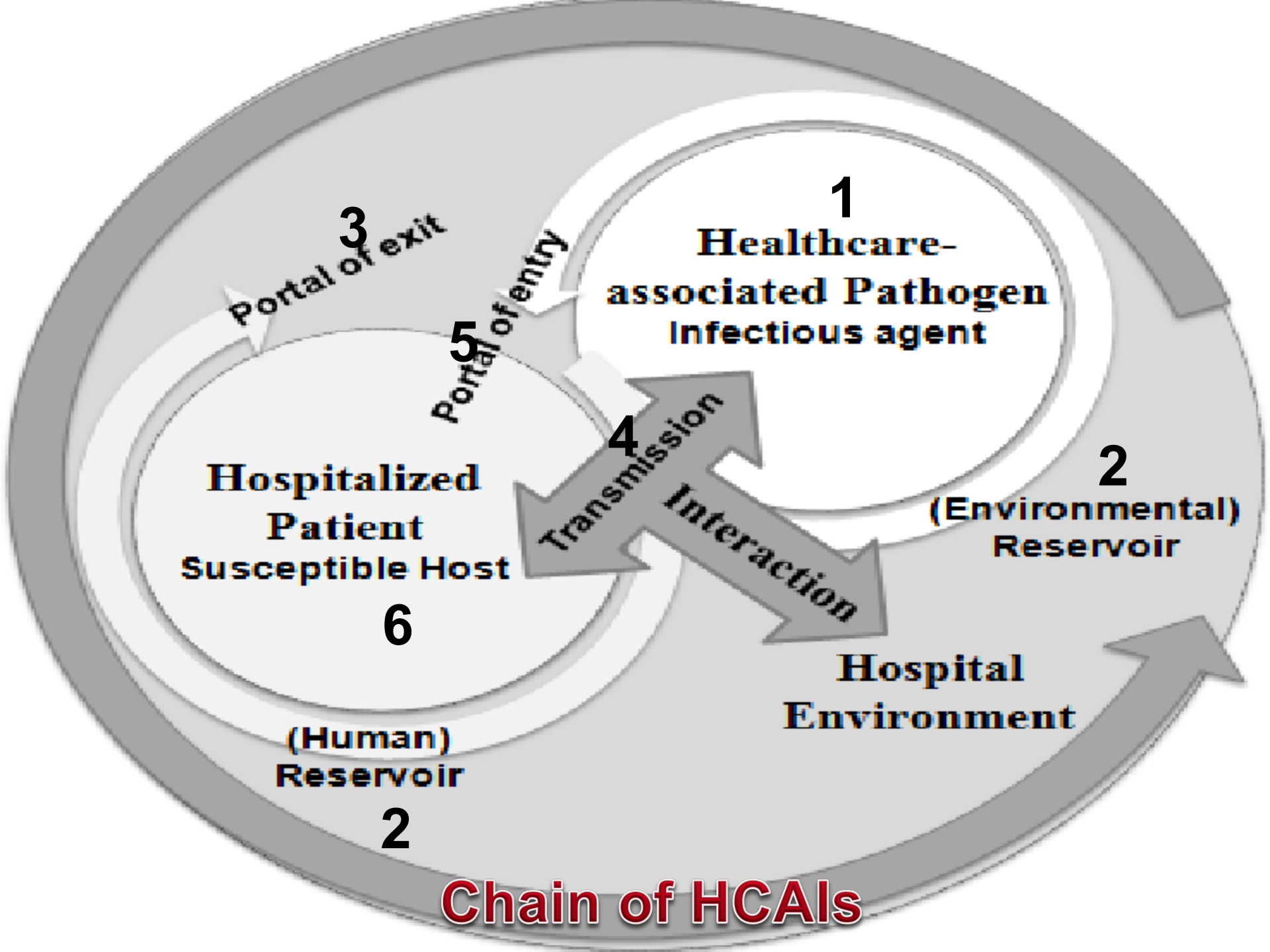
- **Medical procedures and antibiotic use**

Antibiotic-resistant microorganisms are responsible for most of HCAIs

- **Organizational factors**

- **Patient characteristics.**

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



Chain of HCAIs

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

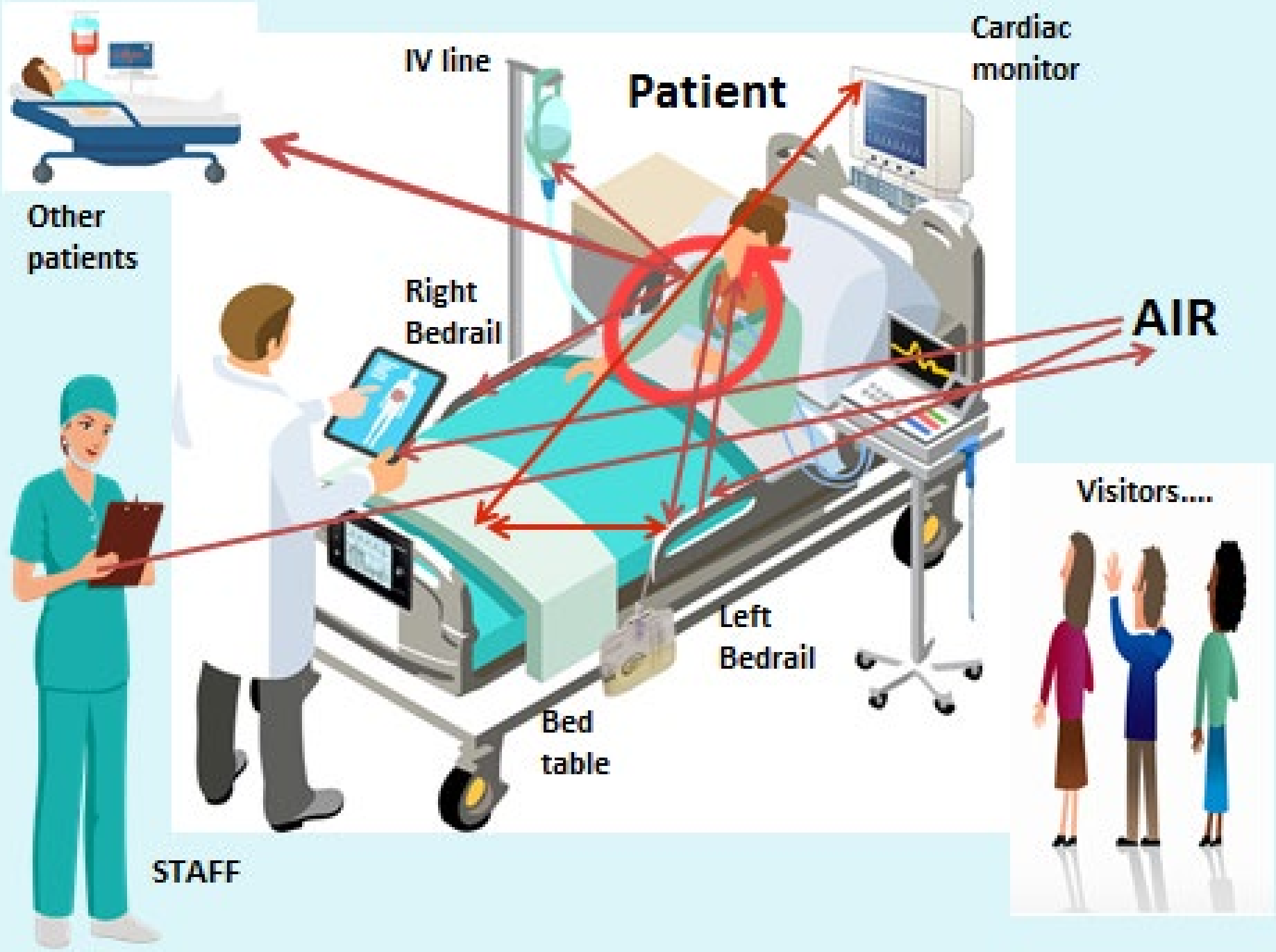
1-Source of infecting microorganisms.

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.


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

The term HCAI covers a wide range of infections.

Around 12–17 microorganisms cause 80%–87% of HCAIs:

An infectious agent can be a bacterium, virus, fungus, or parasite.
The majority of HCAIs are caused by bacteria; viruses, viruses of hepatitis, Covid -19,HIV and fungi are occasionally involved, while parasites rarely cause HCAIs.

There are two major types of bacteria that cause HCAIs, Gram positive (e.g., staphylococci, streptococci, C. diffile) and Gram negative (e.g., Acinetobacter, Pseudomonas, Enterobacter, K. pneumoniae and Klebsiella oxytoca.

- **Among these pathogens, 16%–20% include multidrug-resistant (MDR) phenotypes**

- **Many of these pathogens can survive on surfaces for a long period of time.**

ظهور البكتريا العراقية المقاومة acineto bummanni خلال شهر ال12 في مدينة الصدر الطبية –ردهة ال RCU وهنا يجدر الاشارة الى تسجيل سبع حالات اصابة ببكتريا ال Acineto bummani (بنفس الوقت ولنفس المريض) متزامنة مع اصابة ببكتريا ال Klebsiella pneumonia حيث تكون البكتريا الاخيرة شديدة المقاومة ومقاومة كلية في اغلب الحالات وحسب الجدول المرفق لكم طيا وهذا يشير الى مدى خطورة التفشي وضرورة السيطرة عليه بجدية تامة ..

جدول يوضح تفشي البكتريا المقاومة بشكل مزدوج في ردهة ال RCU لشهر الاول عام 2024

ت	اسم المريض	المكان	العزلة	نوع البكتريا المتفشية	الملاحظات
1	عبد الحسين علي	RCU	SPUTUM	ACIN+KLEB	KLEBحساسة فقط للMINO
2	احسان حبيب	RCU	SPUTUM	ACIN+KLEB	
3	هدية صالح	RCU	SPUTUM	ACIN+KLEB	KLEBمقاومة لكل المضادات
4	عبد الزهرة ظافر	RCU	SPUTUM	ACIN+KLEB	KLEB حساسة للOFLOX
5	احسان حبيب2	RCU	SPUTUM	E.COLI	ECOLI مقاومة لكل المضادات
6	عويد ريشان	RCU	SPUTUM	ACIN+KLEB	KLEB حساسة للGENT
7	هند سعيد	RCU	SWAB	ACIN+KLEB	KLEB مقاومة لكل المضادات

الملخص:

ظهور تفشي متزامن لكل من ACINETOو KLEB في ردهة ال RCU وتنوع المقاومة لبكتريا KLEB وظهور حالات مقاومة تامة لها

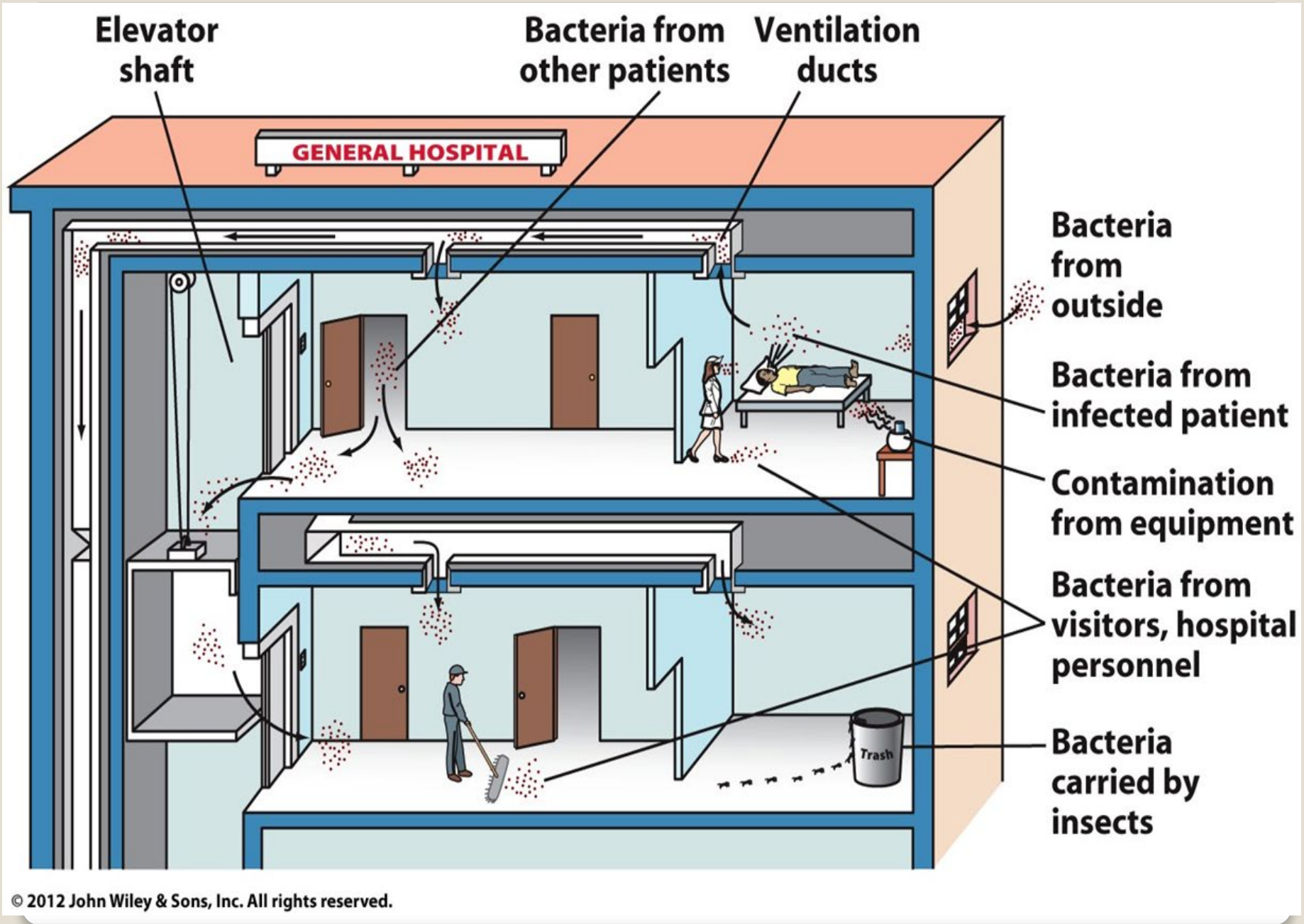
الالتوصيات:

1-متابعة اي حالات تفشي جديدة خلال الاشهر القادمة لاتخاذ كافة الاجراءات اللازمة للسيطرة على التفشي

2-قيام باعلام الادارة بهذه المستجدات ونشر تحليل بيانات لكافة الاستشاريات والوحدات العلاجية والالتزام بكافة التعليمات الخاصة للسيطرة على التلوث

3-توعية كافة الكوادر الطبية والصحية بخطورة الموقف لاخذ الموضوع بعين الاعتبار والجدية اللازمة لمواجهة هذا الخطر .واعتماد اختبار ال culure and sensitivity في وصف المضادات الميكروبية قبل الدخول للردهة كنوع من التقصي حول هذا التزامن قد استجد من

S No	Types of Infections	Organism
1.	Surgical wounds	Staphylococcus aureus, Escherichia coli,Staphylococcus fecalis
2.	Pneumonia	Klebsiella pneumoniae, Pseudomonas aerusinosa, Staphylococcus aureus, Escherichia coli, Enterbacter Spp
3.	Intravenous catheter	Staphylococcus aureus,Staphylococcus fecalis, Staphylococcus epidermis, Candida Spp
4.	Urinary catheter	Klebsiella Spp, Pseudomonas aerusinosa, Steptococcus faecalis, Escherichia coli



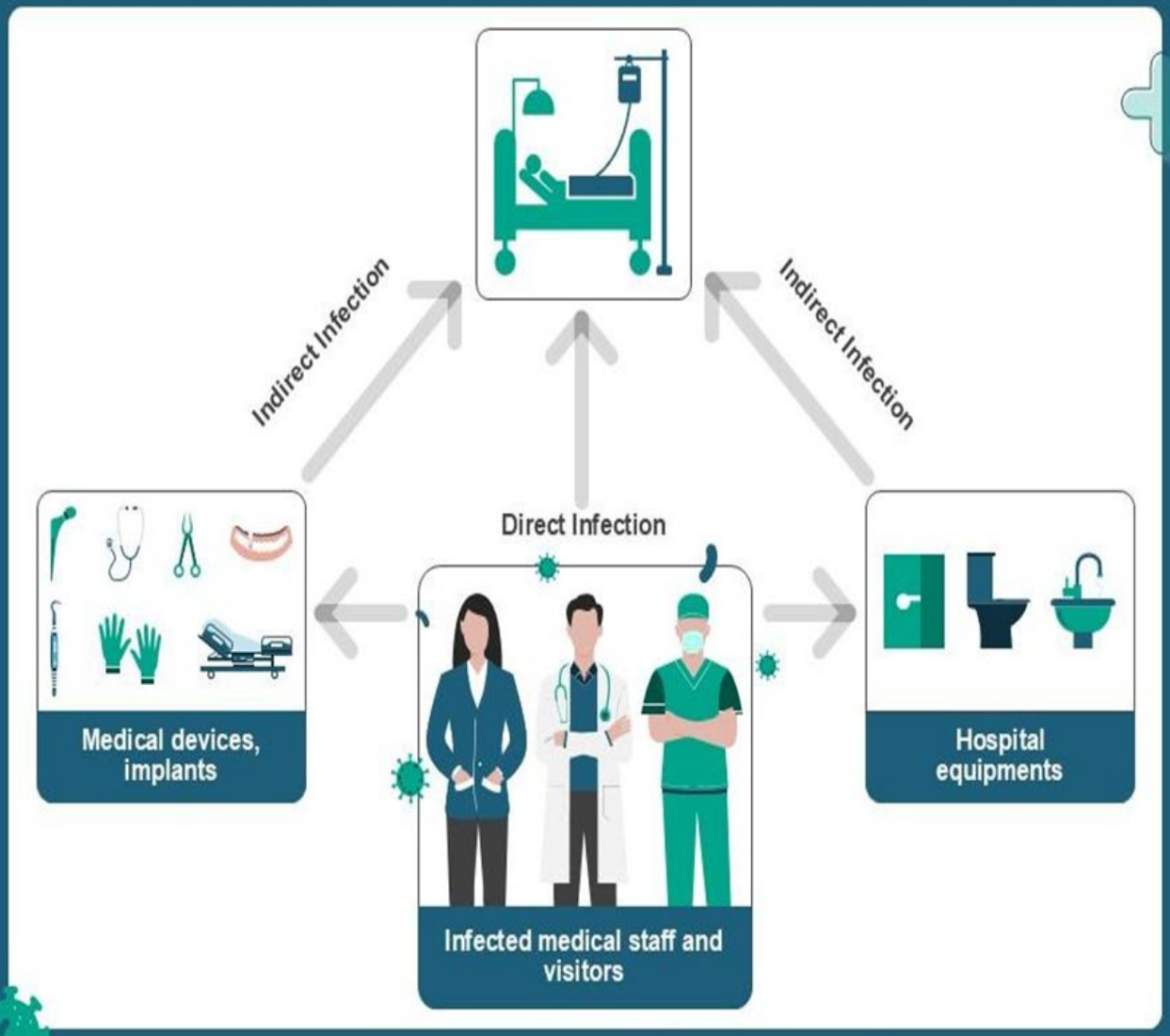
Means of Transmission

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**

Flowchart of healthcare-associated infection transmission channels

The purpose of this slide is to highlight pathways through which infections spread, including direct and indirect routes. It includes elements such as indirect infection, direct infection, hospital facilities, etc.



Key insights:

01 Pathogens are transferred from one patient to another through:

- Physical contact

02 Add text here

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 HCAI. If patients are very sick or have had surgery, they have an increased risk. Some people are more vulnerable than others, including:

- **premature babies**
- **very sick children**
- **elderly people**
- **weak 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.**

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 (HCAIs) treated?

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

Prevention of Health Care Associated Infections

Goals for prevention and control of HCAIs 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**

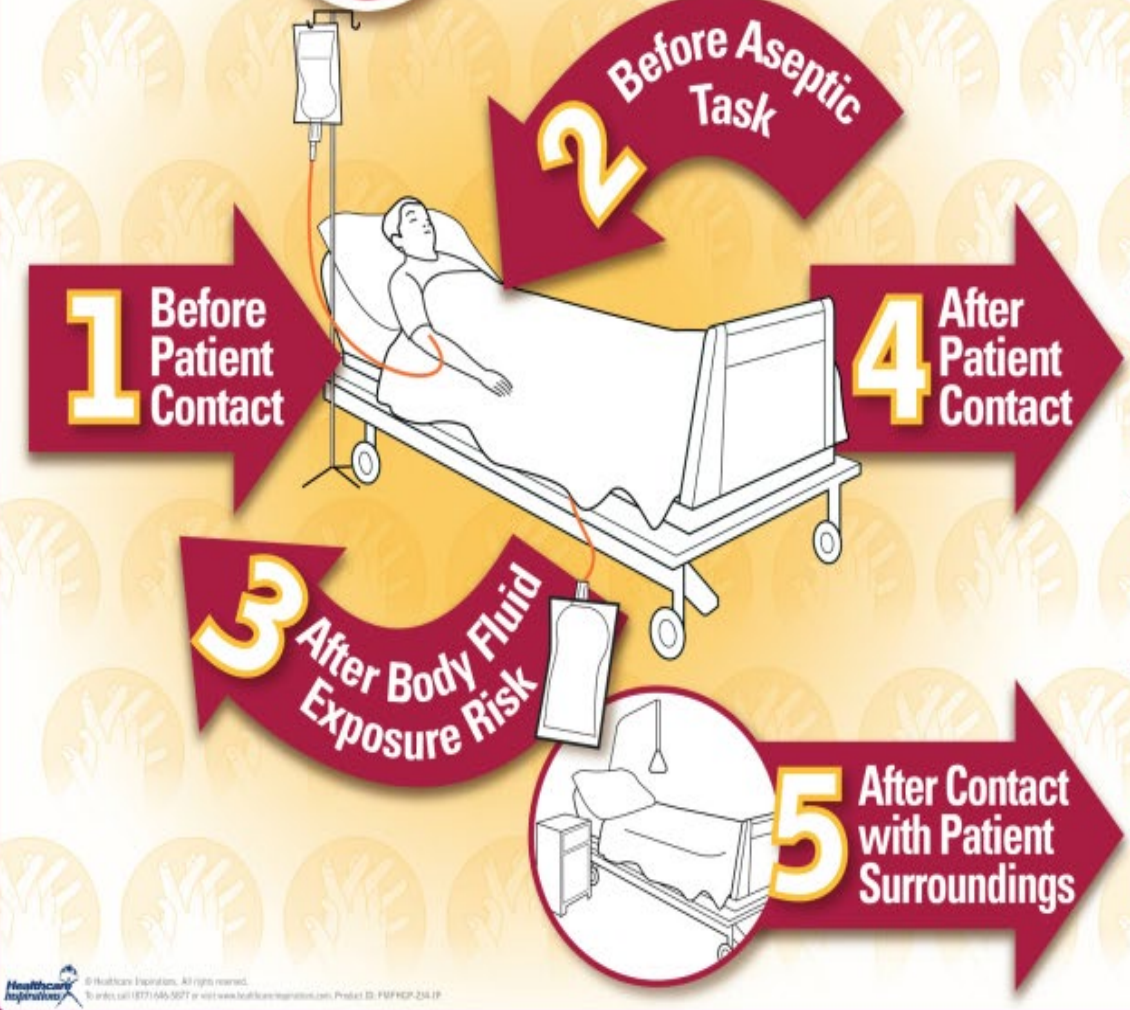
- **Hand washing, according to the WHO is the single most important means of preventing the spread of infection.**

Several studies suggest that simple infection-control procedures such as cleaning hands with an alcohol-based hand rub can help prevent HCAIs and save lives, reduce morbidity, and minimize health care costs.

Routine educational interventions for health care professionals can help change their hand-washing practices to prevent the spread of infection.

Clean Hands Save Lives! Are Yours Clean?

5 Moments for Hand Hygiene



1. Before Patient Contact

WHEN? Clean your hands before touching a patient.
EXAMPLES: Examinations, helping a patient to move, checking name bands.

2. Before an Aseptic Task

WHEN? Clean hands before and after an aseptic task.
EXAMPLES: Oral care, secretion aspiration, wound care, catheter placement, patient feeding, medication administration.

3. After Body Fluid Exposure Risk

WHEN? Clean your hands immediately after an exposure to a bodily fluid and after removing gloves.
EXAMPLES: After contact with any bodily fluids to include urine, saliva, sputum, feces, blood, etc..

4. After Patient Contact

WHEN? Clean your hands after any patient contact.
EXAMPLES: After activities of daily living, handling of a patient's personal effects, after positioning a patient for an exam or procedure.

5. After Contact with Patient Surroundings

WHEN? Clean your hands after you have had contact with a surface that a patient may have touched.
EXAMPLES: After cleaning up the patient's bedside and over bed table, making up the bed, moving wheelchairs or walkers.

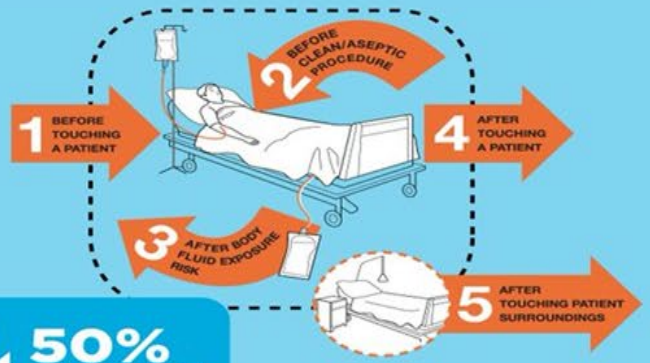
- **keeping the healthcare environment and equipment clean**
- **Complying with standard sterile techniques when performing surgery, caring for wounds or inserting and caring for medical devices such as intravenous cannulas and urinary catheters**
- **Using antibiotics appropriately to prevent and treat 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.

What are Healthcare Workers Doing to Prevent HAIs?

Wash
their hands frequently

Clean
and disinfect surfaces

Isolate
patients who have HAIs

Make
hand sanitizers and tissues available

Implement
no-touch decontamination technologies

Wear
personal protective equipment

Follow
guidelines

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

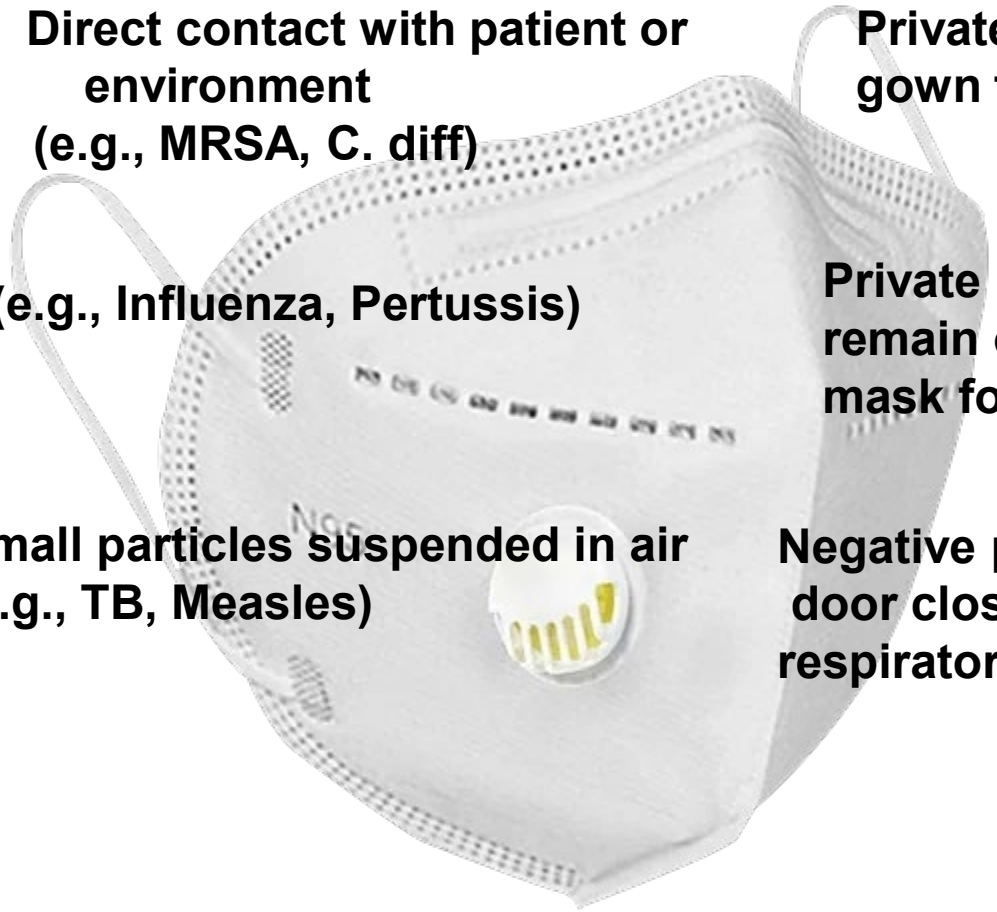
- **Preventive measures such as vaccination of the staff against i.e. hepatitis B, or other diseases .**
- **Proper health behavior & clean habits**

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

Transmission-Based Precautions

Used in addition to standard precautions when a patient is known or suspected to be infected with a highly transmissible pathogen

Precaution Type	Mode of Transmission	Required Interventions
Contact	Direct contact with patient or environment (e.g., MRSA, C. diff)	Private room, gloves and gown for all contact.
Droplet	(e.g., Influenza, Pertussis)	Private room (door can remain open), surgical mask for HCWs.
Airborne	Small particles suspended in air (e.g., TB, Measles)	Negative pressure room, door closed, P2/N95 respirator required.



Special Considerations for Medical Students

- **Student Risk:** Students have increased contact time with patients through ward rounds and clinical history taking, making them vectors for transmission if hygiene is poor.

- **Equipment Hygiene:** Frequently neglected items like stethoscopes and white coats can harbor pathogens; stethoscopes should be cleaned with 70% alcohol after every patient.

- **Needlestick Injuries:** Avoid recapping needles and use puncture-proof sharps containers immediately after use

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

"Preventing HAIs requires teamwork. From vaccination to proper use of medical devices, everyone in the healthcare setting plays a vital role."

• **Caring for Care**

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