

A stack of books is shown from a low angle, with the spines and pages visible. The books are in various colors, including red, orange, and white. A semi-transparent red and orange gradient bar is overlaid on the right side of the image, containing the title and author information.

Hospital-Acquired Infections

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HAI Definition

Infections acquired in the hospital by a patient:

- Admitted for a reason other than infection
- Infection was not present or incubating at admission
- Symptoms - appear
 - > 48 hr of admission (for clinical)
 - 2 calendar days (for surveillance)
- Include
 - Infections appearing after discharge
 - Occupational infections among HCWs



Factors Affecting HAI

- Immune status
- Hospital environment
- Hospital organisms
- Diagnostic or therapeutic interventions
- Transfusion
- Poor hospital administration



Sources of HAIs

- Endogenous source- patient's own flora
- Exogenous source
 - Environmental sources
 - Health care workers
 - Other patients



Microorganisms implicated in HAIs

- The ESKAPE pathogens-
 - *Enterococcus faecium*
 - *Staphylococcus aureus*
 - *Klebsiella pneumoniae*
 - *Acinetobacter baumannii*
 - *Pseudomonas aeruginosa*
 - *Enterobacter species* and *Escherichia coli*



Blood borne infections (BBIs)

- HIV
- Hepatitis B
- Hepatitis C viruses
- ❖ Transmitted by
 - Blood Transfusion
 - Needle /Other Sharp Injury /Splash

Modes of transmission of hospital-acquired pathogens.

Route	Description
Contact transmission	
Direct contact	Skin to skin contact , MC
Indirect contact	Contaminated inanimate objects such as- <ul style="list-style-type: none">• Dressings, or gloves, instruments (e.g. stethoscope)• Parenteral transmission through- NSI, splashes, saline flush, syringes, vials etc

Modes of transmission of hospital-acquired pathogens.

Route	Description
Inhalational mode	
Droplet transmission	<p>Droplets of $>5 \mu\text{m}$ size can travel for shorter distance (<3 feet).</p> <ul style="list-style-type: none">• Generated while coughing, sneezing, and talking• Propelled for a short distance through the air and deposited on the host's body.• E.g -bacterial meningitis, diphtheria, respiratory syncytial virus, etc.
Airborne transmission	<p>Airborne droplet nuclei ($\leq 5 \mu\text{m}$ size) or dust particles Remain suspended in the air for long time and can travel longer distance.</p> <ul style="list-style-type: none">• This is more efficient mode than droplet transmission.• E.g. Legionella, Mycobacterium tuberculosis, measles and varicella viruses.

Modes of transmission of hospital-acquired pathogens.

Route	Description
Vector	<ul style="list-style-type: none">• Via vectors such as mosquitoes, flies, etc. carrying the microorganisms• Rare mode
Common vehicle	such as food, water, medications, devices, and equipment.



MAJOR TYPES OF HAIs

- Catheter-associated urinary tract infection (CAUTI)
- Central line-associated blood stream infection (CLABSI)
- Ventilator-associated pneumonia (VAP)
- Surgical site infection (SSI).



Catheter-associated urinary tract infection (CAUTI)

Risk factors

- Advanced age
- Female gender
- Severe underlying disease
- Placement of a urinary catheter for > 2 days.



CAUTI (cont..)

Organisms

- Gram negative rods -majority of hospital acquired UTIs
- *E.coli* is the MC organism implicated.
- Gram-positive bacteria –may also cause UTI
- *S.aureus*, enterococci - occasionally cause CAUTI.



Central line associated blood stream infection (CLABSI)

- **Organisms**

- CoNS, and *S.aureus* – Most common
- Followed by gram-negative rods and *Candida*.



CLABSI (cont..)

Risk factors

- *Patient related:*
 - Age (<1 yr and >60 yrs), malnutrition
 - Low immunity
 - Severe underlying disease
 - Loss of skin integrity (burn or bed sore)
 - Prolonged stay in ICUs
- *Device related:* presence of central line : multi-lumen, non-tunnelled
- *HCW related:* poor IC practices such as HH.



Ventilator associated pneumonia

Risk factors for VAP

- *Device related:* endotracheal intubation
- *Patient related:*
 - Prolonged ICU stay leading to colonization of hospital MDROs
 - Aspiration of oropharyngeal flora due to various reasons such as semiconscious state, supine position etc
- *HCW related:* poor IC practices such as HH



VAP (cont..)

Organisms:

- Gram-negative rods such as *Acinetobacter* species and *Pseudomonas*
- Other gram-negative
- Gram positive bacteria



Surgical site infections (SSI)

Definition:

- Develop at the surgical site within 30 days of surgery
- Within 90 days for breast, cardiac and joint surgeries)
- Under reported because 50% of SSIs develop after the discharge.

Organisms

Surgical site wounds are classified as clean, clean-contaminated, contaminated or dirty.

- *For clean wound-* The skin flora (MC- *S.aureus.*)
- *For other types-* endogenous flora (anaerobes and GNB) in GI Sx.



SSI (cont)

- **Risk factors for nosocomial wound infection include:**
 - Advanced age, obesity, malnutrition, diabetes
 - Infection at a remote site that spread through blood stream
 - Preoperative shaving of the site
 - Inappropriate timing of prophylactic antimicrobial agent.
- **Note:** The antimicrobial prophylaxis is usually given to the patient to prevent the seeding of organisms on the surgical site. It is given 1 hour prior to the incision, usually along with the induction of anesthesia.



Prevention of HAIs

- The preventive measures for HAIs can be broadly categorized into
 - Standard precautions
 - Transmission-based or specific precautions.



Standard precautions

- Set of work practices used to minimize transmission of HAIs.
- Measures to be used when providing care to/handling –
 - All individuals
 - All specimens (blood or body fluids)
 - All needles and sharps



Components of standard precautions

- Hand hygiene
- Personal protective equipment
- Biomedical waste including sharp handling
- Spillage cleaning
- Disinfection
- Respiratory hygiene and cough etiquette



Hand Hygiene

- Hands are the main source of transmission of infections during healthcare.
- Hand hygiene is therefore the most important measure to avoid the transmission of harmful microbes and prevent healthcare-associated infections.



Types of Hand Hygiene Methods- Hand Rub

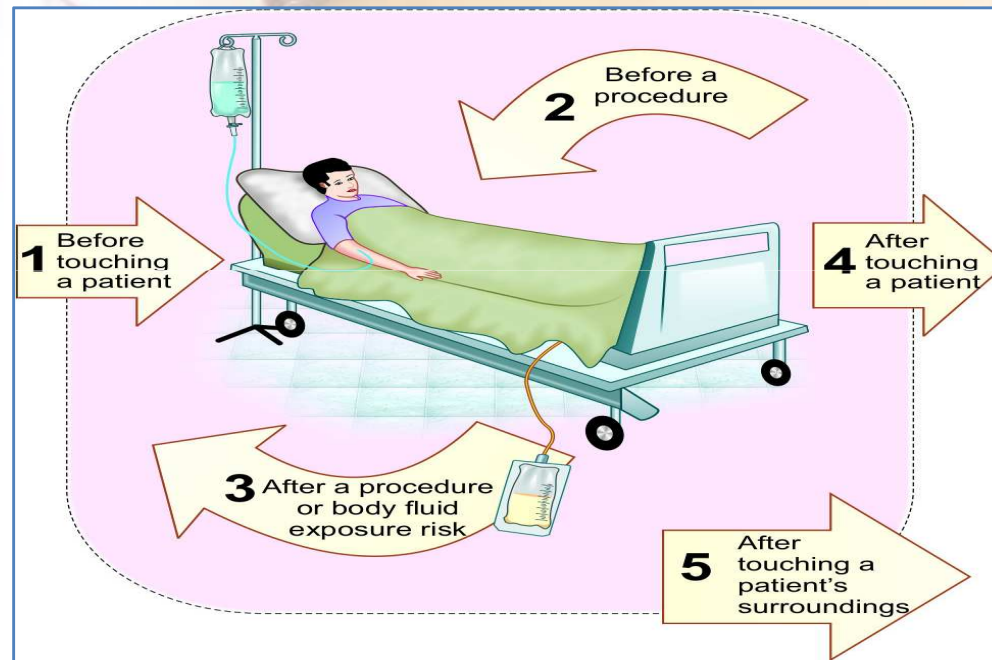
- Alcohol based (70–80% ethyl alcohol) and chlorhexidine (2–4%) based hand rubs are available.
- **Duration** - 20–30 seconds.
- **Advantage:** After a period of contact, it gets evaporated of its own hence drying of hands is not required separately
- **Indications:**
 - Indicated during routine rounds in the wards or ICUs
 - In all the moments or situations requiring hand hygiene, except when the hands are visibly dirty or soiled, when it will be ineffective.



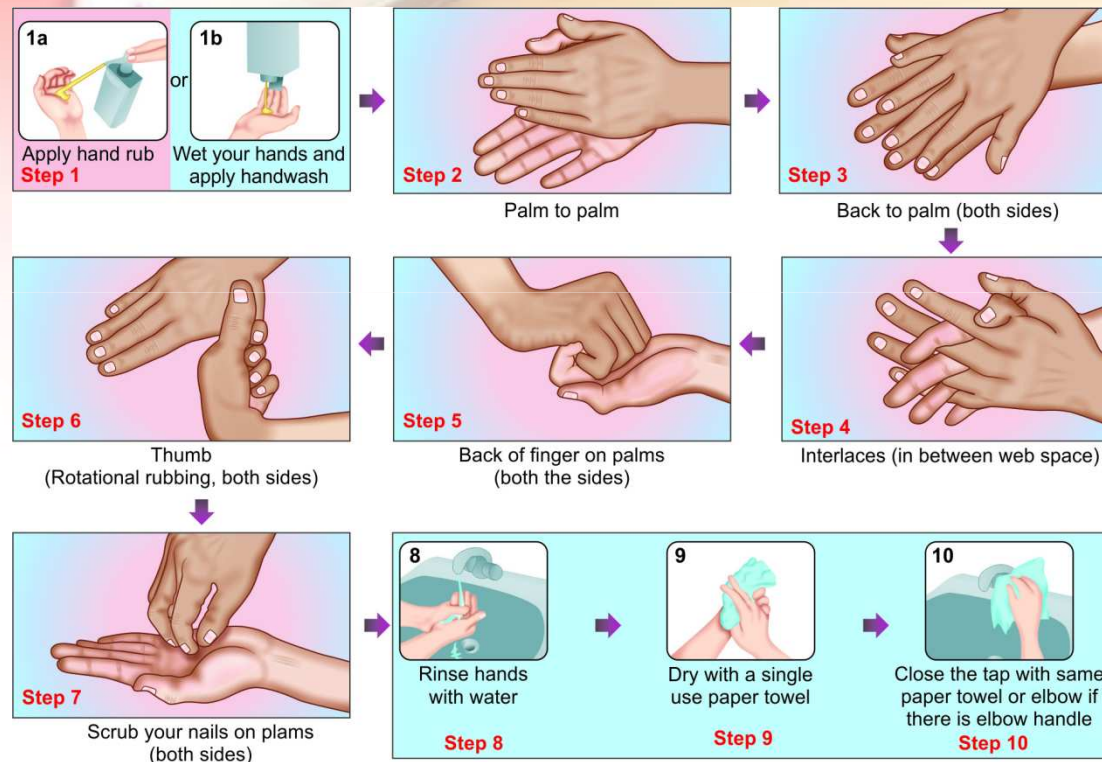
Types of Hand Hygiene Methods- Hand Wash

- Antimicrobial soaps (liquid, gel or bars) are available.
- If facilities are not available, then even ordinary soap and water can also be used.
- **Duration** - 40–60 seconds.
- **Indications:**
 - When the hands are visibly soiled with blood, excreta, pus, etc.
 - Before and after eating
 - After going to toilet
 - Before and after shift of the duty.

Five Moments for Hand Hygiene



Steps of hand rubbing and hand washing (WHO)





Personal Protective Equipment (PPE)

- Used to protect the skin and mucous membranes of HCWs from exposure to blood and/or body fluids
- From the HCW's hands to the patient during sterile and invasive procedures.

Personal protective equipment (PPE)

Gloves (non-sterile)	Used when there is a risk of infection to HCWs (e.g. while touching blood, body fluids, secretions, excretions of patients, items/equipment or environment).
Gloves (sterile)	Used when there is a risk of infection to HCWs as well as to the patients (during surgeries /invasive procedures).
Plastic apron	Used during surgeries
Gown	Used during surgeries and when soiling is likely to be expected.

Personal protective equipment (PPE)

Surgical mask	Used during surgeries and while handling patients on droplet precautions
N95 mask	Used while handling patients on airborne precaution (tuberculosis).
Cap, face shield, goggles	Used when spillage of blood is suspected, e.g. during major cardiac surgeries etc.
Surgical shoes	Used mainly in ICUs and operation theatres to protect HCWs and environment from transmission of organisms.

Personal protective equipment (PPE)



Personal protective equipment (PPE):

- A. Gloves;
- B. Plastic apron;
- C. Gown;
- D. Surgical mask;
- E. N95 mask;
- F. Cap;
- G. Face shield;
- H. Goggles;
- I. Surgical shoes



Selection of appropriate PPE

- Level of risk associated with contamination of skin, mucous membranes, and clothing by blood and body fluids during a specific patient care activity or intervention
- Route of transmission of suspected organisms— contact, droplet and inhalation

Donning and Doffing

Donning (wearing)

Gown

Mask or
respirator

Goggles or
face shield

Gloves

Doffing (removing)

Gloves

Goggles or
face shield

Gown

Mask or
respirator



Spill management for blood and body fluids

- **Spill management of blood and body fluids: Bring the spill kit to the site of spillage,** wear appropriate PPE (gloves and gown); put no entry sign board near the spill area.
- **If spillage is small (<10 mL):**
 - Wipe up spill immediately with absorbent material and discard into appropriate bin
 - Wipe the area with 10% sodium hypochlorite and allow to dry
 - Remove PPE and perform hand hygiene
- **If spillage is large (>10 mL):**
 - Place disposable paper towels over spill to absorb the spillage
 - and then pour 10% sodium hypochlorite on top of absorbent paper towels and leave for 15 minutes.
 - Remove the absorbent papers; put fresh disposable paper towels to clean the area and then discard these into appropriate waste bin.




Respiratory hygiene and cough etiquette

- Should be followed by anyone with signs and symptoms of a respiratory infection, regardless of the cause.
 - Cover the nose/mouth with single-use tissue paper when coughing, sneezing, wiping and blowing noses
 - If no tissues are available, cough or sneeze into the inner elbow rather than the hand
 - Follow hand hygiene after contact with respiratory secretions and contaminated objects/materials
 - Keep contaminated hands away from the mucous membranes of the eyes and nose



Respiratory hygiene and cough etiquette

- In high-risk areas of airborne transmission such as pulmonary medicine OPD:
 - Give mask to the patients with cough and make separate queue away from the general queue
 - Sputum collection should be done in an open space or in a well-ventilated room



Transmission-based precautions (specific precautions)

1. Contact Precautions
2. Droplet Precautions
3. Airborne Precautions

Specific precautions

Type	Indication	Isolation	Gloves	Gown	Mask	Eye protection	Handling of equipment	Visitors
Contact	MDROs, C.difficile Diarrheal pathogens Highly contagious skin infections	Essential	Essential	Essential	Surgical mask- Required if infectious agent is also transmitted by droplet	As required**	Single use or reprocess before reuse on next patient	Same precautions as for staff

Specific precautions

Type	Indication	Isolation ¹	Gloves	Gown	Mask	Eye protection	Handling of equipment	Visitors
Droplet	Respiratory syncytial virus, Mycoplasma Parainfluenza Pertussis Plague, Meningococcus	Essential	As required*	If soiling likely	Surgical mask is essential	As required**	Same as contact	Restrict visitor numbers and precautions same as for staff

Specific precautions

Type	Indication	Isolation ¹	Gloves	Gown	Mask	Eye protection	Handling of equipment	Visitors
Airborne	Pulmonary TB, Chicken pox Measles SARS	Essential (negative pressure)	As required*	If soiling likely	N95 respirator essential	As required**	Same as contact	Restrict visitor numbers and precautions same as for staff

Hospital infection control committee

Core Committee members

1. Chairperson: MS
2. Member Secretary: HOD, Dept. of Microbiology
3. Hospital Infection Control Officer
4. Nursing Superintendent
5. Infection Control Nurses
6. Infection Control Lab technician
7. Data entry operators

Other Committee members

- HODs of all clinical departments
- Biomedical waste management in-charge
- ART Clinical In Charge
- CSSD in-charge
- Linen and Landry in-charge
- Central store in-charge
- Engineer representative
- Pharmacy in-charge
- Sanitary Superintendent
- Kitchen in-charge



HICC Activities

1. Education
 2. HAI Surveillance
 3. Staff Health Care (Needle stick injury & hepatitis B vaccination)
 4. Hand Hygiene Audit
 5. Bundle care audit
 6. Antimicrobial Stewardship Programme
 7. Environmental Surveillance (water, air , surface and milk)
 8. Staff Surveillance for MRSA and other MDROs
 9. AMR Surveillance
 10. Formulating Disinfectant policy
- HICC Meeting, once monthly