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Ministry of Health & Family Welfare
Government of India

Procedures and practices for infection prevention and control

Training Session – IV

National Center for Disease Control, New Delhi

Outline

- Standard precautions
  - Hand hygiene
  - Personal protective equipment (PPE)
  - Respiratory hygiene and cough etiquette
  - Prevention of injuries from sharps
  - Safe handling of patient-care equipment – injection safety
  - Principles of asepsis
  - Environmental infection control
- Transmission-based precautions
  - Airborne precautions
  - Droplet precautions
  - Contact precautions
  - Placement of patient with transmissible disease

Standard Precautions

Standard precautions

- Primary strategy for minimizing the risk of transmission of microorganisms in healthcare facilities (HCFs)
- Breaks the chain of infection transmission
- Should be followed for all patients, irrespective of infection status at all times
- Should be used to avoid contact with blood, body fluids, secretions and excretions regardless of whether
  - contaminated grossly with blood or not
  - non-intact skin
  - mucous membrane

Standard precautions – Key components

1. Hand hygiene
2. Personal protective equipment (PPE)
3. Respiratory hygiene and cough etiquette
4. Prevention of injuries from sharps
5. Safe handling of patient-care equipment
6. Principles of asepsis
7. Environmental infection control
    a. Patient placement
    b. Environmental cleaning
    c. Linen and laundry
    d. Waste disposal

1. Hand hygiene

- Single most important measure for prevention of infection
- Hands can become contaminated with infectious agents through contact with a patient, patient surroundings, the environment, or other healthcare workers (HCWs)
- Hand hygiene removes dust/soil, organic material and transient microorganisms from the skin and reduces the risk of cross-contamination
- Hand hygiene is not completed till drying hand with clean dry towel/ tissue paper

Studies show a direct correlation between an increase in adherence to hand hygiene with a decrease in HAIs

1. Hand hygiene

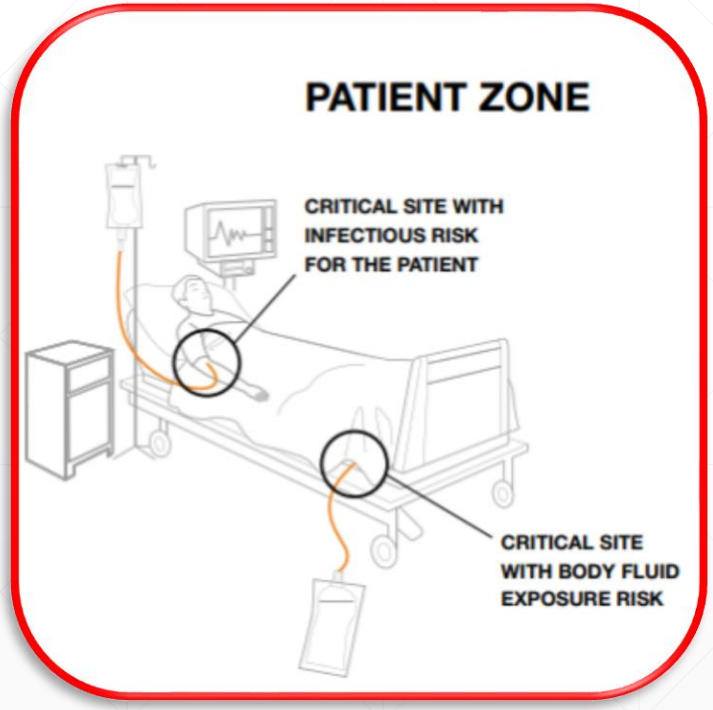
Hand decontamination

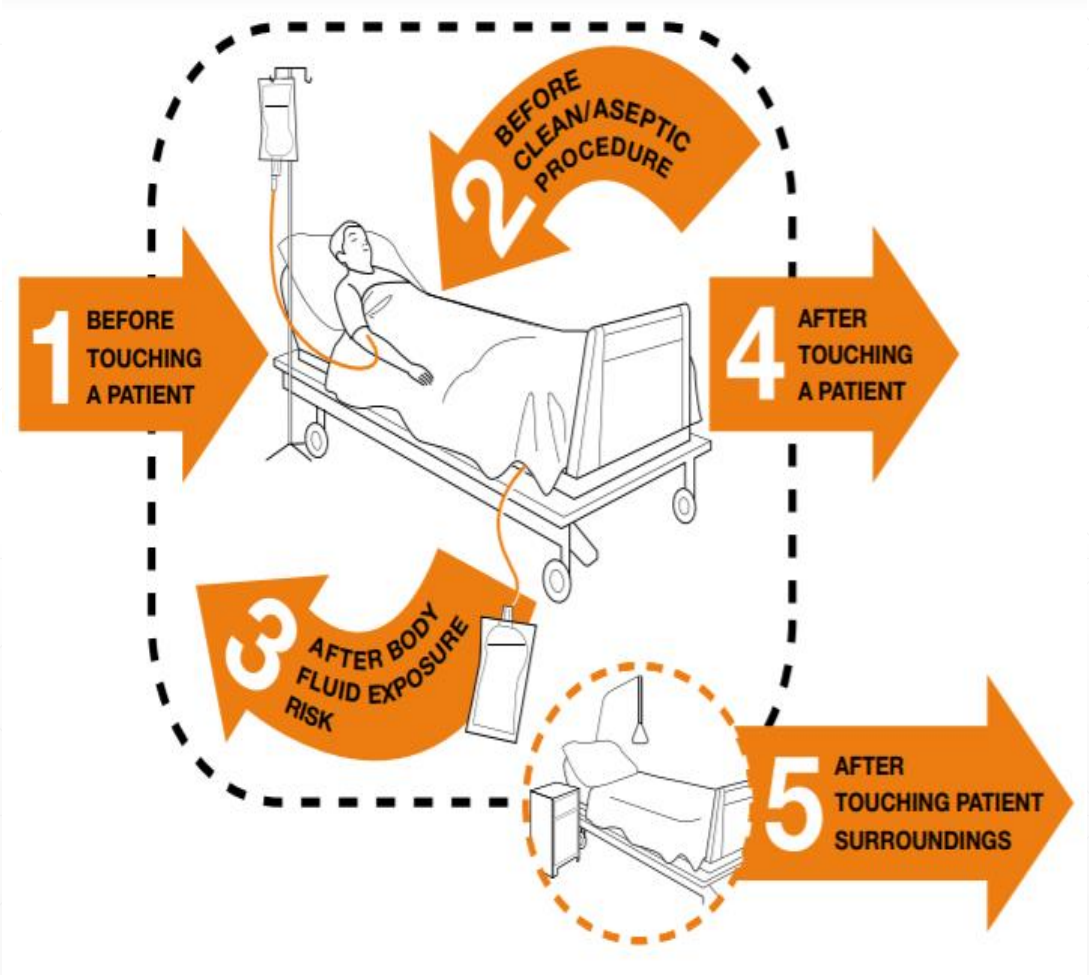
- Routine hand hygiene
  - Handwashing with soap & water preferred when the hands are visibly dirty or soiled with blood or other body fluids or after using the toilet
  - Hand rubbing with an alcohol-based preparation is the preferred method for routine hygienic antisepsis if the hands are not visibly soiled
- Surgical hand scrub

When to wash hands contd.

Source: https://www.mohfw.gov.in/pdf/Handwash.pptx

5 moments of hand hygiene



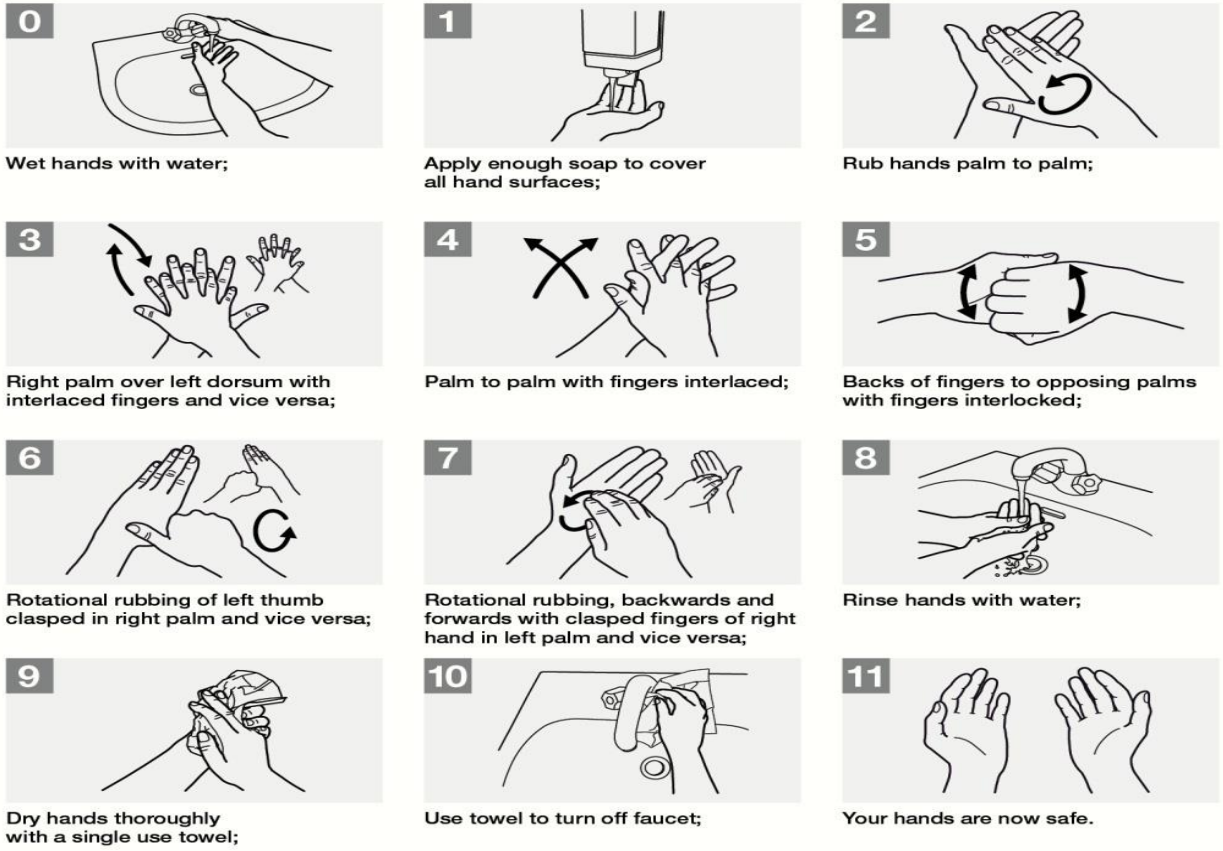


Source:WHO IPC Training tools

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the entire procedure: 40-60 seconds

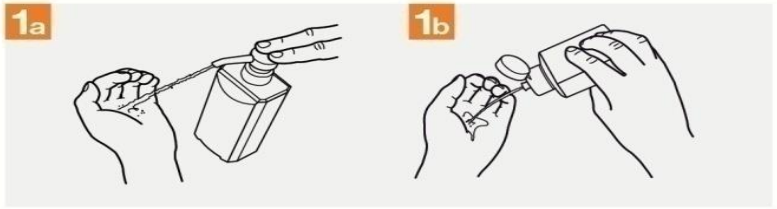


Clean hands frequently with soap and water: 40–60 seconds

How to Handrub?

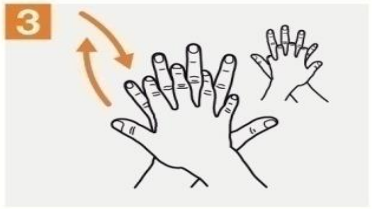
RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

Duration of the entire procedure: 20-30 seconds

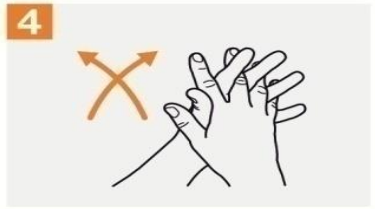


Apply a palmful of the product in a cupped hand, covering all surfaces;

Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;

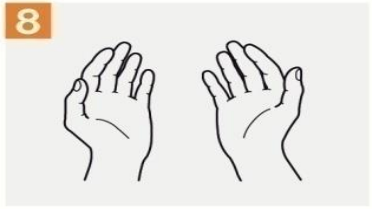


Palm to palm with fingers interlaced;

Backs of fingers to opposing palms with fingers interlocked;

Rotational rubbing of left thumb clasped in right palm and vice versa;

Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



Once dry, your hands are safe.

World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

If you are using an alcohol based hand rub : 20–30 seconds

Surgical hand scrub

- Hand scrubbing with an antiseptic agent before beginning a surgical procedure reduces the number of microorganisms, and inhibits the growth of microorganisms on the hands under gloves
- Chlorhexidine or povidone-iodine containing soaps are most commonly used
- A preoperative surgical hand scrub should be done for at least 5 minutes using an appropriate antiseptic scrub
- Antimicrobial efficacy of alcohol-based formulations is superior to that of all other currently available methods of preoperative surgical hand preparation

Surgical site infection (who.int)

2. Personal protective equipment (PPE)

Physical barriers, used alone or in combination, to protect mucous membranes, airways, skin and clothing from contact with infectious agents

PPE should be used by:

- HCWs who provide direct care to patients and who may come in contact with blood, body fluids, excretions, and secretions
- Laboratory staff who handle patient specimens
- Support staff including cleaners, laundry staff, mortuary staff, etc.
- Family members who provide care to patients

PPE includes gloves, masks, aprons and gowns, facial protection, footwear (gum boots) and hair cover or cap

Commonly used PPEs in Healthcare

Face Mask

Nose + mouth

N95 Mask

Nose + mouth

Face shield

Eyes + Face

Goggle

Eyes

Gown

Body

Apron

Body

Gloves

Hands

Head cover

Head + hair

Shoe cover

Feet

2. PPE – gloves

- Always wear gloves when contact with blood, body fluids, secretions, excretions, mucous membranes, non-intact skin is expected
- Not required for routine care activities in which contact is limited to a patient's intact skin
- Change gloves between patients as well as tasks and procedures on the same patient
- Perform hand hygiene before wearing and after removing gloves
- Immediately change gloves if torn or soiled
- Remove gloves immediately after completion of care or a specified task, at the point of use, before touching non-contaminated items and clean environmental surfaces or using a mobile phone

Please Note : Gloves are not a substitute for hand hygiene

Glove pyramid

Sterile gloves- Indications
Surgery, vaginal delivery, invasive radiological procedure, vascular access, TPN, Chemotherapy

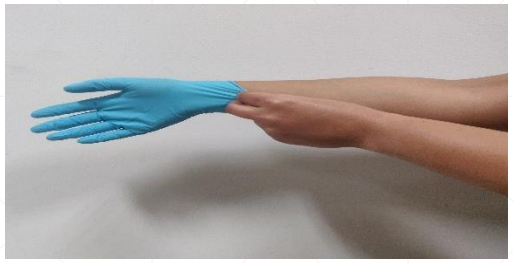
EXAMINATION GLOVES INDICATED IN CLINICAL SITUATIONS
Potential for touching blood, body fluids, secretions, excretions and items visibly soiled by body fluids
Direct patient exposure : contact with blood, mucous membrane and non-intact skin; potential presence of highly infectious & dangerous organism; epidemic/emergency; IV insertions and removal; drawing blood; discontinuation of venous line; pelvic & vaginal examination; suctioning non-closed systems of endotracheal tubes
Indirect patient exposure: Emptying emesis basins, handling/cleaning instruments; handling waste; cleaning up spills of body fluids

GLOVES NOT INDICATED (except for CONTACT precautions)
No potential for exposure to blood/body fluids/contaminated environment
Direct patient exposure: Taking blood pressure, temperature & pulse; performing SC & IM injections; bathing & dressing the patient; transporting patient; caring for eyes & ears; any vascular line manipulation in absence of blood leakage
Indirect patient exposure: Using telephone, writing patient chart, giving oral medications; distributing or collecting patient dietary trays; removing & replacing linens for patient bed; placing non-invasive ventilation equipments and oxygen cannula

2. PPE –gloves (How to don gloves)

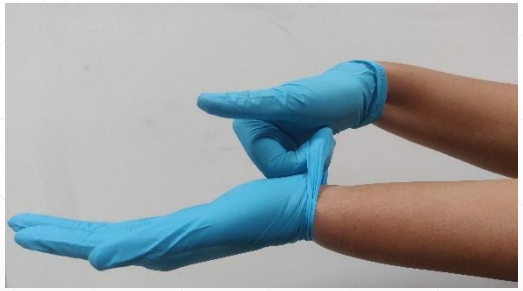
1. Take out a glove from its original box

2. Touch only a restricted surface of the glove corresponding to the wrist



3. Don the first glove

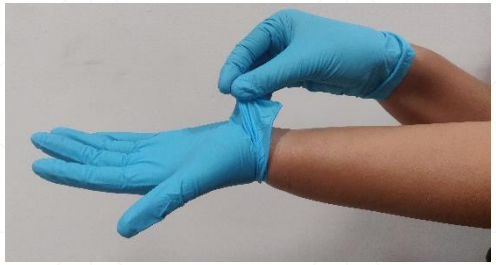
4.Take the second glove with the bare hand and touch only a restricted surface of glove corresponding to the wrist



5. To avoid touching the skin of the forearm with the gloved hand, turn the external surface of the glove to be donned on the folded fingers of the gloved hand, thus permitting to glove the second hand

6. Once gloved, hands should not touch anything else that is not defined by indications and conditions for glove use

2. PPE – gloves (How to remove gloves)



1. Pinch one glove at the wrist level to remove it, without touching the skin of the forearm, and peel away from the hand, thus allowing the glove to turn inside out

2. Hold the removed glove in the gloved hand and slide the fingers of the ungloved hand inside between the glove and the wrist. Remove the second glove by rolling it down the hand and fold into the first glove

3. Discard the removed gloves

2. PPE – aprons and gowns

To be worn by all HCWs when

- Close contact with the patient, materials or equipment leading to contamination of skin, uniforms or other clothing with blood, body substances, secretions or excretions (except sweat) and infectious agents
- Type of apron or gown depends on the degree of risk, including the anticipated degree of contact and penetration with infectious material. E.g. a fluid-resistant apron or gown should be worn when procedures are likely to generate splashing or sprays of blood or body substances
- A clean non-sterile apron or gown is generally adequate to protect skin and prevent soiling of clothing during procedures and/or patient-care

PPE – facial protection

- Includes a medical/ surgical mask (triple-layer) and eye protection (face shield or goggles), to protect the conjunctivae and the mucous membranes of the nose, eyes and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions
- Eye protection should also be used while providing care to patients with respiratory symptoms such as coughing and sneezing

Surgical Mask

- Disposable face masks are widely available.
- They are sometimes referred to as surgical masks or medical procedure masks
- A mask becomes ineffective as a barrier if its integrity is damaged or if it becomes wet (i.e. from perspiration, or if splashed with blood or other potentially infectious material)
- If this occurs, remove the mask and replace with another

- **It is NOT recommended to use face shields or goggles as a substitute for masks**
- **Goggles or other eye protection may be used in addition to a mask**
- **Do NOT put a plastic face shield (or a mask) on newborns or infants**

2. PPE – respirators

- Filters particles >0.3 microns in diameter
- Protect from inhalation of infectious aerosols (e.g. M. tuberculosis)
- Should be used in aerosol-generating procedure
- Types: particulate respirators, half- or full-face elastomeric respirators, and powered air-purifying respirators (PAPRs)
- Most commonly used respirator: N95 (NIOSH)
- Others include FFP 3, 2 (European Standards)

How to Perform a User Seal Check with an N95 Respirator - YouTube

Aerosol generating procedures (AGP)

- Aerosols generated by medical procedures are one of the route for the transmission of infections. The following Aerosol-generating procedures (AGPs) are considered to be potentially infectious:
  - Intubation, extubation & related procedures
  - Tracheostomy/tracheotomy
  - Manual ventilation
  - Open suctioning
  - Bronchoscopy
  - Surgery & post-mortem procedures in which high speed devices are used
  - Non-invasive ventilation (NIV) e.g. Bi-level Positive Airway Pressure (BIPAP) & Continuous Positive Pressure Ventilation (CPAP)
  - High Frequency Oscillating Ventilation (HFNO)
  - Induction of Sputum
  - Some dental procedures (e.g. high speed drilling)

Footwear and Hair cover

- Closed toed shoes with impervious soles, easily cleaned and disinfected must be used
- Whenever work processes or environments could cause foot injuries or spillage of blood or body fluids - gum boots shall be used
- Hair cover worn to protect the hair and to protect the patient from falling hair
- Long hair must be secured with a rubber band

PPE – protocols

- HCWs should be trained on the use of PPE based on protocols adopted by a specific facility and include practicing both putting on and taking off procedures
- Competency of the HCWs in using PPE should be assessed and documented
- Adequate resources (human, material and financial) must be made available
- If resources are limited and disposable PPE items are not available, use reusable items (e.g. cotton gowns) and disinfect properly after each use
- Critically assess the risk for which PPE is indicated to avoid wastage

PPE – protocols contd.

- Management of resources include stock management, availability of different sizes and shapes of PPE, placement of items for easy access, quality of items purchased and line management for reporting shortages
- Written protocols should be in place for step-wise procedures in putting on and taking off PPE, management of used and potentially contaminated PPE and associated medical devices, including safe discard and decontamination
- Appropriate spaces designated for donning and doffing of PPE

3. Respiratory hygiene and cough etiquette

- Measures taken by a person having signs and symptoms of respiratory infection to contain respiratory secretions and prevent the transmission of the infection
- Following information must be displayed in patient-care areas for educating patients, staff and visitors
  - Cover mouth and nose with a tissue when coughing or sneezing
  - Dispose of the tissue after use in the nearest infectious waste container /bin
  - Perform hand hygiene after contact with respiratory secretions and contaminated objects or materials
  - In the absence of handkerchief or tissues, instruct patients to cover their nose and mouth with their arm during coughing and sneezing

Infographic: COVID-19. Cover your cough - PAHO/WHO | Pan American Health Organization

4. Prevention of injuries from sharps

- Handling sharps (needles, scalpels, etc.) is one of the most hazardous activities carried out by HCWs
- Handle sharps with extreme caution to avoid injuries during use, disposal or reprocessing (incase of re usable sharps)
- While handling sharps, the sharp end of instruments should be positioned away from oneself and others
- Used needles must not be recapped
- Used sharps should be discarded in puncture proof containers and disposed of as per BMW rules
- If injured by sharps, contact the ward, clinic or unit supervisor immediately for further management

5. Safe handling of patient-care equipment

- A new, serviced and repaired equipment or an equipment that has been in contact with a patient should be cleaned, disinfected or sterilized as appropriate to prevent transfer of microorganisms to other patients and the environment
- Formulate a hospital disinfection policy for effective and safe handling of medical equipment and ensure strict compliance
- Accountability and responsibility should be assigned
- Heavy duty or strong utility gloves must be worn during decontamination, cleaning and disinfection of instruments

5. Safe handling of patient-care equipment contd.

Injection Safety

- Syringe and needle are single use devices and must not be reused
- Use a new injection device for each procedure, including for the reconstitution of a unit of medication or vaccine
- Whenever possible, use a single-dose vial for each patient to reduce cross-contamination between patients

5. Safe handling of patient-care equipment contd.

When administering an injection:

- Perform hand hygiene
- Wipe the top of the vial with 70% alcohol (isopropyl alcohol or ethanol) using a swab or cotton-wool ball
- Use a sterile syringe and needle, withdraw the medication from the ampoule or vial

While reconstituting:

- Withdraw the reconstitution solution from the ampoule or vial using a sterile syringe, insert the needle into the rubber septum in the single or multi-dose vial and inject the necessary amount of reconstitution fluid
- Remove the needle and syringe and discard them immediately
- Mix the contents of the vial thoroughly until all visible particles have dissolved

5. Safe handling of patient-care equipment contd.

Multidose vials

- Before use, examine the vial for turbidity, particulate matter or discoloration, and discard if any of these is present
- Mention the date and time of the opening of a multi-dose vial
- Discard a multi-dose vial:
  - If the sterility of the contents is compromised
  - If the expiry date or time has passed
  - If found to be without a specific date or time, improperly stored or contaminated regardless of the expiry date

5. Safe handling of patient-care equipment contd.

DO NOT:

- Allow the needle to touch any contaminated surface
- Reuse a syringe, even if the needle is changed
- Touch the diaphragm after disinfection with 70% alcohol (isopropyl alcohol or ethanol)
- Use the same needle and syringe for several multi-dose vials
- Use the same mixing syringe to reconstitute several vials
- Use alcohol skin disinfection for administration of live attenuated vaccines

5. Safe handling of patient-care equipment contd.

DO NOT:

- Use bags or bottles of intravenous solution as a common source of supply for multiple patients (except in pharmacies using laminar flow cabinets)
- Use a single loaded syringe to administer medication to several patients (ensure one needle, one syringe, one patient)
- Change the needle to reuse the syringe
- Store leftover medications for later use
- Keep alcohol pre-soaked cotton wool in a container as these can become contaminated
- Carry medication vials, syringes, alcohol swabs, or supplies in pockets

5. Safe handling of patient-care equipment contd.

In haemodialysis units

- Scrub the hub of intravenous (IV) tubing and medication vials prior to accessing using friction and 70% alcohol, iodophor, or chlorhexidine/alcohol agent
- Allow to dry prior to accessing
- Never use infusion supplies such as needles, syringes, flush solutions, administration sets, or IV fluids on more than one patient
- Never use IV solution containers (e.g. bags or bottles) for the purpose of IV flush solutions (or other purposes) for more than one patient

6. Principles of asepsis

These principles are discussed in detail in Session IV

7. Environmental infection control – (a) patient placement

General principles

- Spacing between beds
- In open plan wards, there should be adequate space between each bed to reduce the risk of cross-contamination/infection occurring from direct or indirect contact or droplet transmission
- The space between beds should be 1–2 meters

Appropriate placement of patients is important in preventing the transmission of infections in the hospital setting

7. Environmental infection control – (a) patient placement contd.

- **Single rooms:** Single rooms reduce the risk of transmission of infection from the source patient to others by reducing direct or indirect contact transmission; single rooms should have:
  - Hand-washing facilities
  - Toilet and bathroom facilities
- **Anterooms:** Single rooms used for isolation purposes may include an anteroom to support the use of PPE

7. Environmental infection control – (a) patient placement contd.

- Patient room should be cleaned before admitting a patient.
- There should be a policy for cleaning the room (i) after patient discharge (terminal cleaning) and (ii) before admission
- All patient-care items used by the previous patient should be removed and replaced with clean items, e.g. bed linen, waterproof covering, oxygen humidifiers, face mask, etc. as per the housekeeping policy
- Patient-care equipment and articles should be cleaned, disinfected or sterilized according to the disinfection policy

7. Environmental infection control – (a) patient placement contd.

Transport of patients

- Appropriate precautions should be taken during transportation to reduce the risk of transmission of microorganisms to other patients, HCWs or the hospital environment (surfaces or equipment) e.g. place a surgical mask on the face of a patient with pulmonary tuberculosis during transit
- Movement and transportation of patients from the isolation room or area should be restricted to essential purposes only
- This will reduce the possibility of transmission of microorganisms in other areas of the HCF

7. Environmental infection control – (a) patient placement contd.

Transport of patients contd.

- Care should be taken of drains, shunts and IV lines (e.g. cover with sterile dressing) as these are potential sources for contamination of the environment, trolleys, etc. during transportation, and also a source of infection for the patient
- Closed sterile drainage is to be maintained at all times
- Transportation trolley should have the facility for hanging IV bottles, tying of urine bags below bladder level which helps in proper drainage of urine and prevents stagnation of urine
- Change trolley cover between patients
- Spills of blood and body fluids should be taken care of immediately
- Routine cleaning schedules for trolleys and wheel-chairs should be maintained

7. Environmental infection control – (a) patient placement contd.

Policy for visitors

- The HCF should have a visitors' policy depending upon the type of services and the type of patients in the hospital
  - Visiting hours
  - Hand hygiene and cough etiquettes
  - Safety measures
  - Personal items and valuables
  - Cleanliness in patient rooms and surroundings

Measures to improve adherence to standard precautions

- Staff education in hand hygiene, standard precautions
- Ready access to PPE
- Visual reminders at the patient's bedside in the form of posters, along with verbal reminders from supervising staff
- Bundling of supplies in designated supply carts or pre-organized packs to provide immediate access to PPE and facilitate their use in resuscitation settings
- Monitoring through "safety" rounds
- Possible disciplinary action if there are repeated lapses in adherence

7. Environmental infection control

(b) Environmental cleaning

(c) Linen and laundry

(d) Waste management

Discussed in Session V

Transmission-based Precautions

Transmission-based precautions

These precautions for aseptic techniques and device management for clinical procedures are applied in addition to standard precautions, depending upon the epidemiology and route of transmission of the agent/disease

Airborne precautions

- The airborne route of infection occurs through droplet nuclei of
  < 5 micron that are disseminated through the air
- These droplet nuclei can remain suspended in the air for varying periods of time and can travel long distances (>1 metre) and from room to room
- Droplet nuclei arise from the drying of suspended droplets carrying the infectious agent

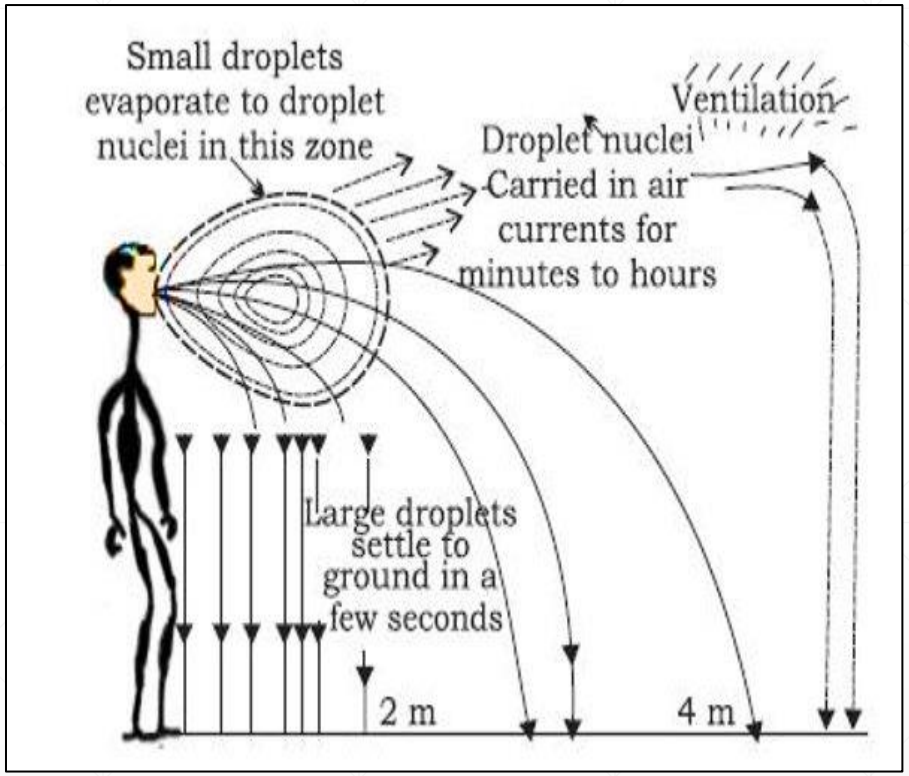


Image- Class IX Science Why do we fall ill Handout Module 2_3.pdf (aees.gov.in)

Airborne precautions contd.

- Diseases that spread by the airborne route include: pulmonary or laryngeal tuberculosis, measles, chicken pox, pulmonary plague and viral haemorrhagic fever with pneumonia
- Transmission of droplet nuclei within a short range may occur with SARS-CoV, human influenza, and other viral respiratory infections, during performance of aerosol-generating procedures

Airborne precautions contd.

Persons caring for patients with airborne infections should take the following precautions besides those related to patient placement and transport:

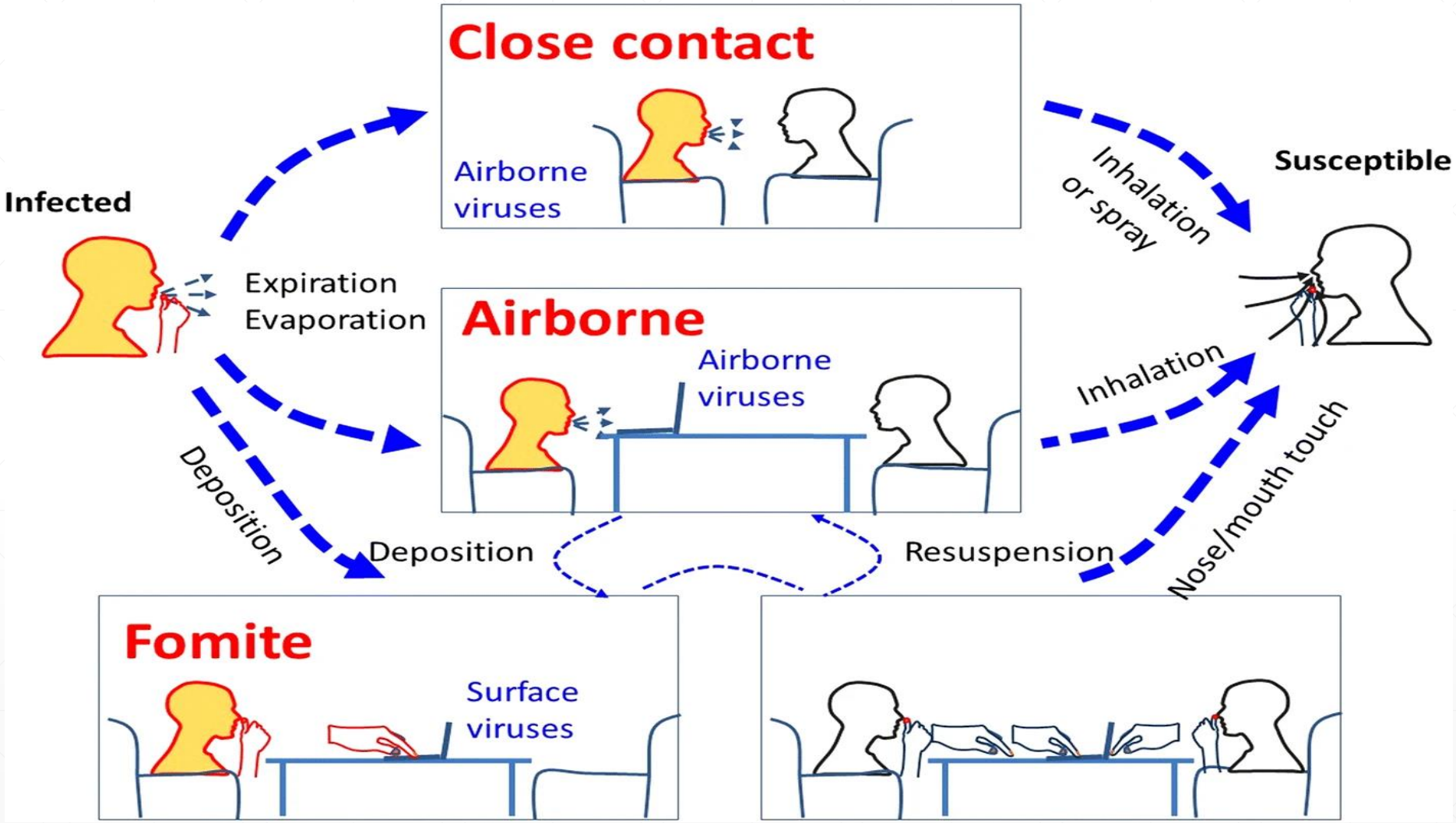
- Respiratory protection: persons entering the airborne infection isolation room should wear a particulate respirator, e.g. an N95 mask with a proper fit
- Restricted entry: susceptible healthcare personnel should be restricted from entering the room of patients known or suspected to have airborne infections
- Protection during aerosol-generating procedures: for aerosol-generating procedures associated with pathogen transmission, appropriate PPE should be used in an airborne infection isolation room

Droplet precautions

- Droplet transmission occurs through large respiratory droplets >5 microns in size
- Transmission occurs when infectious respiratory droplets are expelled by coughing, sneezing or talking, and come into contact with another person's mucosa (eyes, nose or mouth), either directly or via contaminated hands
- Since these microorganisms do not travel over long distances, special air handling and ventilation are not required

Droplet precautions contd.

- Infections transmitted through droplets include pneumonia, meningitis, group A streptococcal disease, pertussis, diphtheria and influenza, mumps
- During an influenza pandemic, the circulating human virus is expected to be transmitted in the same manner as seasonal influenza viruses
- Droplet Precaution include
  - **Patient placement:** keep a minimum of 1 metre bed distance
  - **Cough etiquette:** explain the importance of respiratory hygiene and cough etiquette to patients
  - **PPE:** wear appropriate PPE based on the risk involved



https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-019-3707-y/figures/1

Contact precautions

Direct transmission

- Direct transmission occurs when infectious agents are transferred from one person to another without a contaminated intermediate object or person
- For example, blood or other body substances from an infectious person may come into contact with a mucous membrane or breaks in the skin of another person

Contact precautions contd.

Indirect transmission

- Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object (fomite) or person
  - Hands of HCWs
  - Clothing after care of a patient colonized or infected with an infectious agent, which can then be transmitted to subsequent patients
  - Patient-care devices that are shared between patients without cleaning and disinfection
  - Environmental surfaces that are inadequately disinfected

Contact precautions contd.

- Diseases transmitted through contact include:
  - Colonization or infection with multidrug-resistant organisms, enteric infections and skin infections
  - Hand hygiene is important since contact transmission can occur in respiratory viral infections when respiratory secretions or droplets contaminate surfaces, which can contaminate the hands of HCWs

Contact precautions contd.

Combination of contact, droplet and airborne precautions

- Contact, droplet and airborne precautions may be combined for diseases that have multiple routes of transmission or in case of epidemiologically important organisms, risk group 4 organisms or where transmission routes are unknown
- Combined precautions are recommended in case of Ebola and Nipah virus disease
- Combined precautions are always to be used in addition to standard precautions and should be applied to all suspects, probable and confirmed cases

Contact precautions contd.

Triage and patient placement

- A high index of suspicion is needed to identify potentially infectious individuals (including colonization of MDRO) in order to ensure their safe and timely placement
- Specific triage policies such as provision of visual alerts to remind patients to inform staff of fever or respiratory symptoms should be developed for early detection and isolation, so as to minimize transmission of communicable diseases to other patients and HCWs in the outpatient setting

Contact precautions contd.

Placement in protective environment and isolation

- To minimize airborne particles, air must be circulated in the room with a velocity of at least 0.25 m/s through a HEPA filter
- The HEPA filter removes particles of up to a certain defined size
- If particles >0.3 microns in diameter are removed, the air entering the room can be classified as being clean and free of bacterial contamination

A protective environment with ultra clean unidirectional air may be required for neutropenic patients and in units such as transplant and oncology according to the level of immunosuppression of the patients

Placement of patient with infections transmitted by airborne route

- Appropriate patient placement is a significant component of isolation precaution
- A patient with a highly transmissible disease (e.g. chicken pox, TB, measles) should be placed in a single airborne isolation room with dedicated hand washing and toilet facility
- If a single room is not available, then arrangements can be made for isolating such patients at the corner of a ward where ventilation is adequate
- Patient's relatives/attendants should be educated on the mode of transmission, hand hygiene and PPE
- Cohorting patients: When a single room is not available, an infected patient is placed with another patient infected with the same microorganism
- Only assigned HCWs must take care of those patients, especially during outbreaks

Summary points

- Approach to and importance of precautions
- Standard precautions
  - Hand hygiene
  - PPE
  - Respiratory hygiene and cough etiquette
  - Prevention of injuries from sharps
  - Safe handling of patient-care equipment
  - Principles of asepsis
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Questions?