

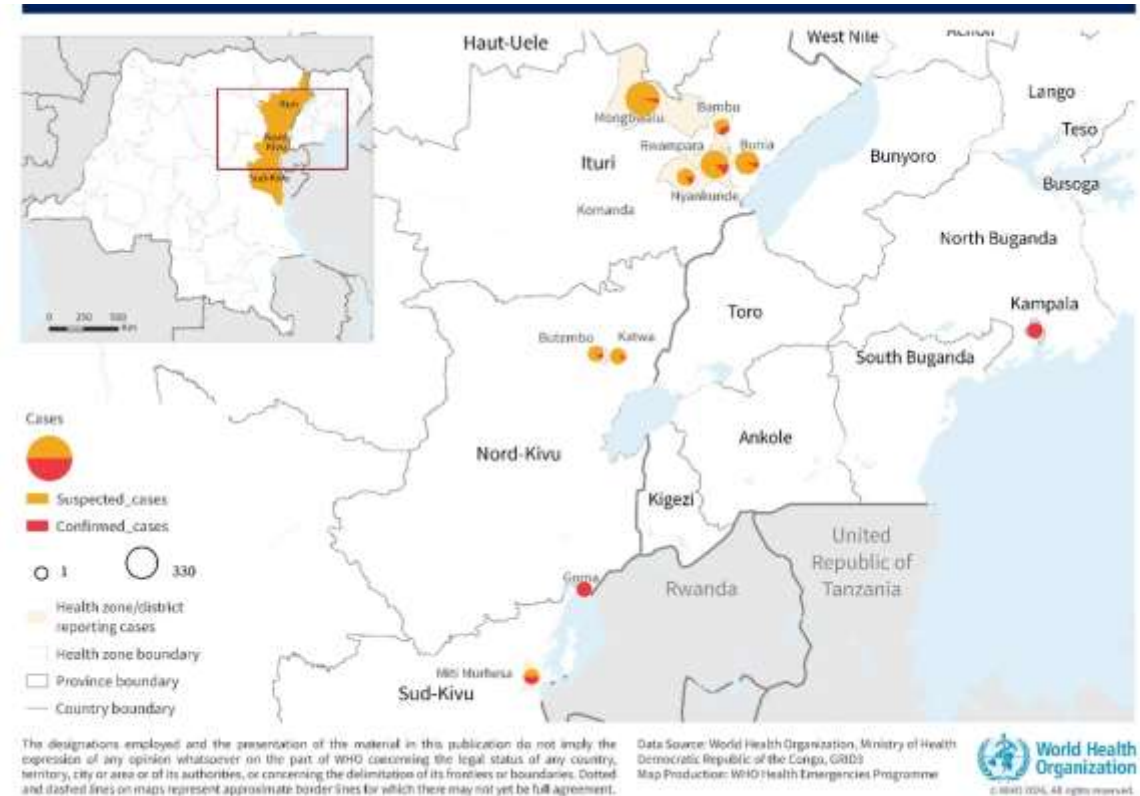
Ebola Virus Disease and Infection Prevention & Control

Dr. Mala Chhabra
Consultant, Microbiology
ABVIMS & Dr. RML Hospital
New Delhi



Introduction

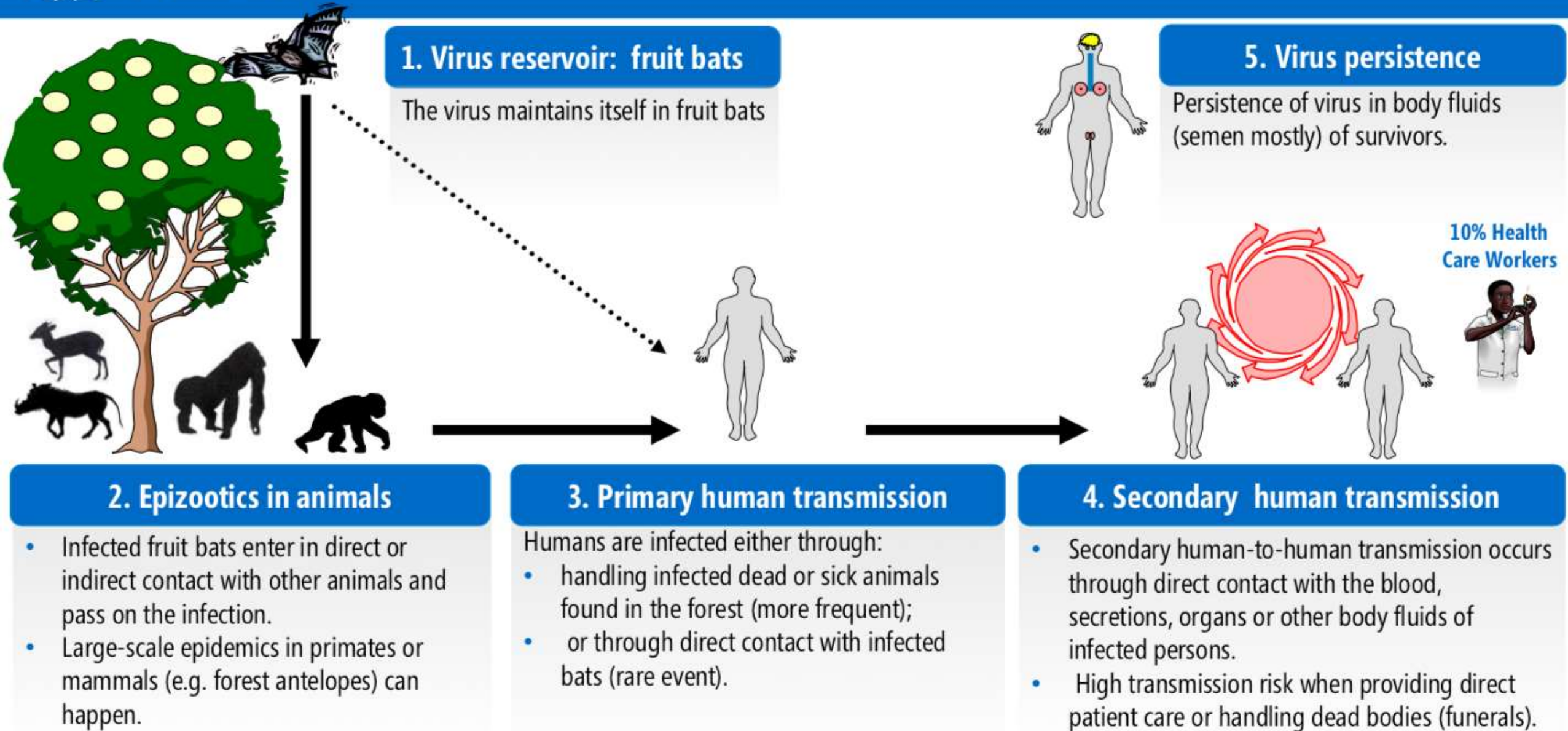
On 17 May 2026, the Director-General of the World Health Organization determined that the epidemic of Ebola disease caused by *Bundibugyo virus* in the Democratic Republic of the Congo and Uganda constitutes a public health emergency of international concern (PHEIC) as defined by the IHR



Introduction

- Ebola disease (EBOD) - severe, often fatal illness caused by viruses belonging to the Orthoebolavirus genus
- Case fatality rates is around 50%, ranging from 25%-90% in past outbreaks
- To date, **6 species of Orthoebolaviruses** have been identified with 3 of them associated with large outbreaks:
 - Bundibugyo virus (BDBV) causing Bundibugyo virus disease (BVD);
 - Ebola virus (EBOV) causing Ebola virus disease (EVD); and
 - Sudan virus (SUDV) causing Sudan virus disease.
- Approved countermeasures, vaccines and therapeutics, are only available against EBOV causing EVD. Candidate products are under development for other virus species

Transmission of Orthoebolaviruses



Virus Transmission

- **Person-to-person transmission - close personal contact** (broken skin or mucous membrane) with an infected individual's blood or body fluids (urine, saliva, sweat, feces, vomit, breast milk & semen) **during the symptomatic stage** of infection or after death
- Nosocomial infections can occur through contact with infected body fluids for example due to the reuse of unsterilized syringes, needles, or other medical equipment contaminated with these fluids
- Humans may be infected by handling sick or dead non-human primates and are also at risk when handling the bodies of deceased humans in preparation for funerals
- **Ebola virus CAN NOT spread to others until a person develops signs & symptoms of EVD**
- **Infected persons are most contagious during the period of peak symptoms**

INCUBATION PERIOD & COMMUNICABILITY

- INFECTIOUS DOSE: 10 or fewer virus particles
- The estimated incubation period is could range from 2-21 days .
- Communicability is only from onset of symptoms & can go up to 82 days or more in view of presence of virus in Semen

SUSCEPTIBILITY TO DISINFECTANTS

- Alcohol-based products
- Sodium hypochlorite 1:10-1:100 for 10 minutes or more of 5.25% household bleach
- Calcium hypochlorite (bleach powder)
- 3% acetic acid
- 1% glutaraldehyde

PHYSICAL INACTIVATION OF EBOLA VIRUS

Moderately thermolabile and can be inactivated

- by heating for 30 minutes to 60 minutes at 60°C,
- boiling for 5 minutes,
- gamma irradiation (1.2 x10⁶ rads to 1.27 x10⁶ rads)
- moderately sensitive to UV radiation.

SURVIVAL OF THE VIRUS OUTSIDE HOST

Dried blood - 5 days

Liquid blood - 14 days

Plastic - 8 days

Stainless Steel - 4 days

Infection prevention and control



Practical, evidence-based approach preventing patients and healthcare workers from being harmed by avoidable infections

To prevent the occurrence of healthcare-associated infections in **health-care workers, patients, and visitors**

To control community-acquired infectious diseases, endemic or epidemic, that may be “amplified” via health care

Minimize the **environmental impact** of these infections or their management

Preventing the **emergence of antimicrobial resistance** and/or dissemination of resistant strains

Procedures and practices for infection prevention and control

A two-tiered approach to precautions

Standard precautions

Refers to work practices that are **applied to all patients** receiving care in health facilities

Transmission-based precautions

Refers to the precautions required to be taken **based on the route of transmission**: contact precautions, droplet, airborne precautions, etc.

Infection prevention - Overview

- Standard Precautions
- Patient Placement
- Laboratory activities
- Non patient care activities
- Waste Management
- Handling of dead body
- Managing exposure to infection
- Guidelines for HCWs

Standard precautions - The key components

1. Hand hygiene
2. Personal protective equipment
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



Hand Hygiene

❖ Routine hand hygiene -

➤ Hand washing with soap and water

- preferred when hands are **visibly dirty or soiled** with blood or other body fluids or after using the toilet.
- Duration: **40-60 sec**

➤ Hand rubbing with an alcohol-based preparation


- preferred method for routine hygienic antisepsis if hands are not visibly soiled.
- Duration: **20-30 sec**

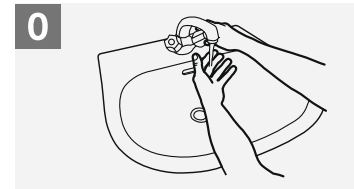
❖ Surgical Hand Scrub



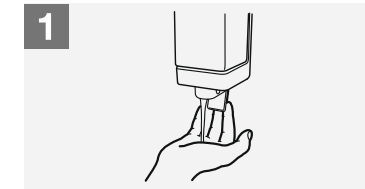
Steps of hand hygiene

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

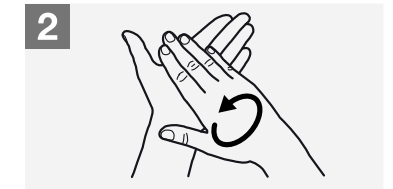
 Duration of the entire procedure: 40-60 seconds



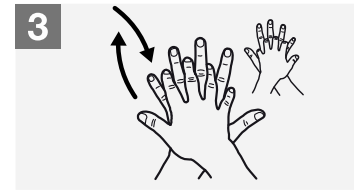
Wet hands with water;



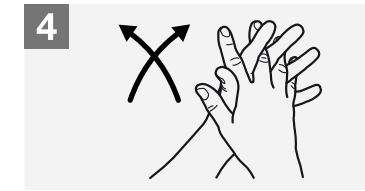
Apply enough soap to cover all hand surfaces;



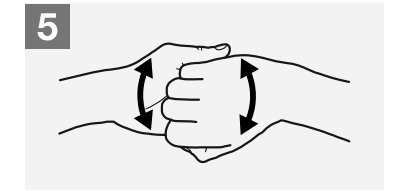
Rub hands palm to palm;



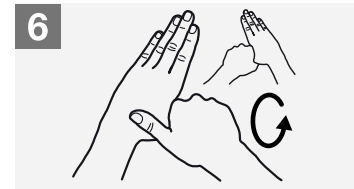
Right palm over left dorsum with interlaced fingers and vice versa;



Palm to palm with fingers interlaced;



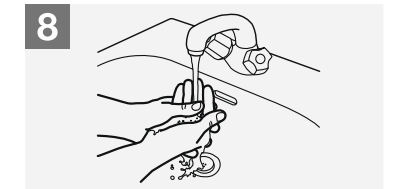
Backs of fingers to opposing palms with fingers interlocked;



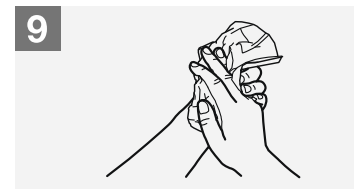
Rotational rubbing of left thumb clasped in right palm and vice versa;



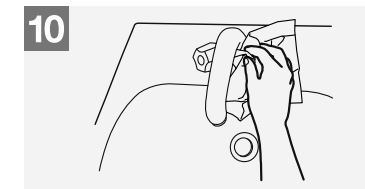
Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



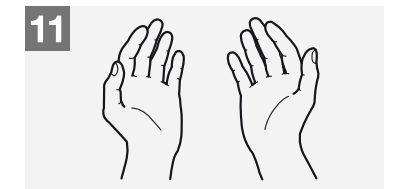
Rinse hands with water;



Dry hands thoroughly with a single use towel;

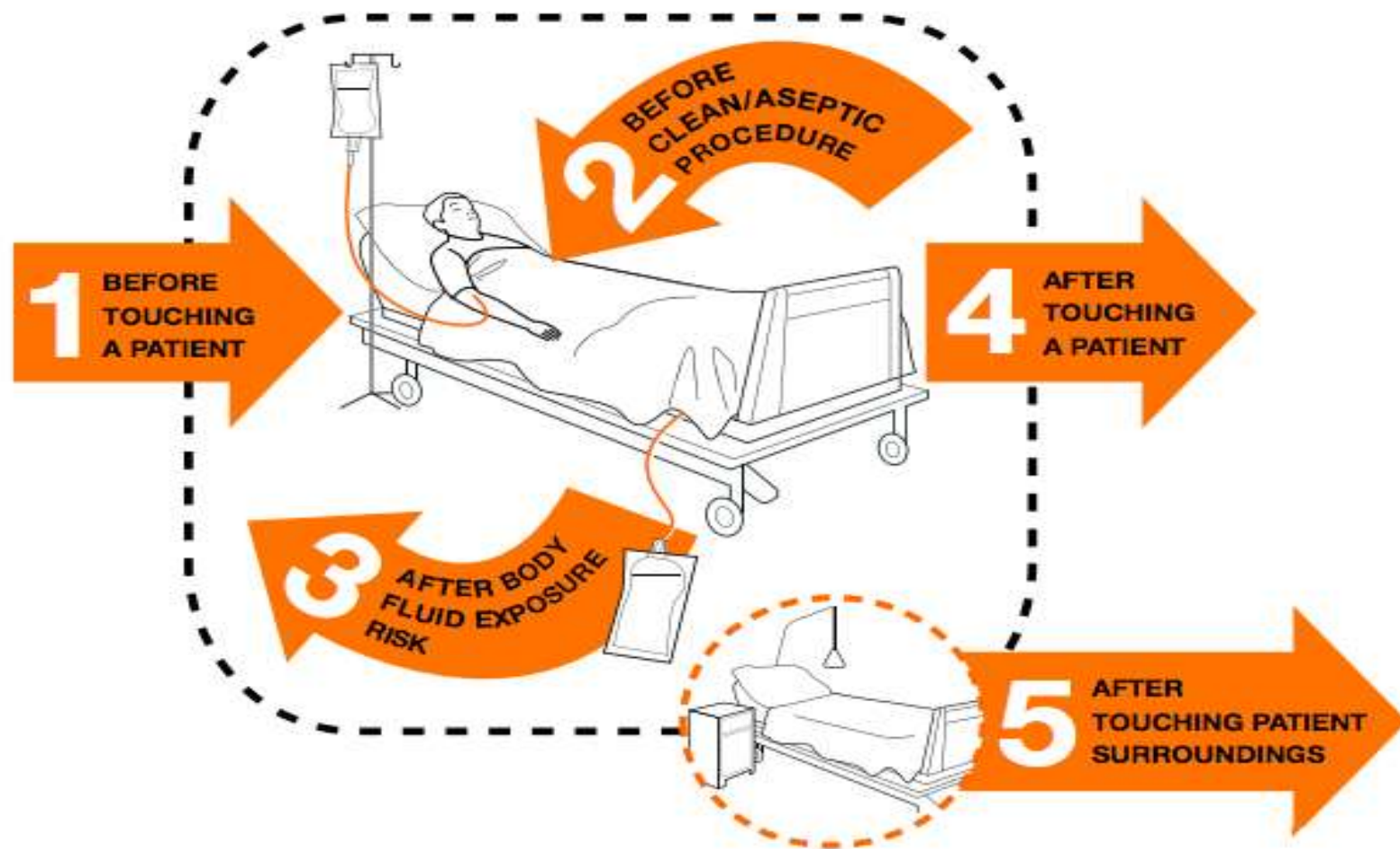


Use towel to turn off faucet;



Your hands are now safe.

My 5 Moments for Hand Hygiene



PPE for contact with patients who have Ebola or Marburg disease

- Medical mask* and eye protection
- Fluid resistant coverall OR a fluid resistant gown and head and neck covering
- Two pairs of gloves –preferably nitrile
- Apron (disposable or reusable) to cover the coverall or gown
- Rubber boots

*Use a respirator for aerosol generating procedures



Coverall



Gown with head and neck covering

General principles when putting on PPE

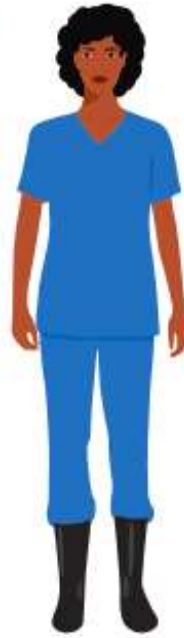
- Should always be done under the supervision of a **trained buddy/in-front of a mirror**
- Check the PPE to ensure it is not damaged or expired
- All personal items (jewellery, watches, cell phones etc.) must be removed prior to putting on PPE
- Hair should be tied back
- Scrubs should be worn under the PPE
- Rubber boots should be worn - if not available, wear slip on shoes that cover the ankle and top of the foot
- **Perform hand hygiene before putting on the PPE**
- Never use tape to secure PPE in place

Always put on PPE under the supervision of a trained buddy. Do not use tape to secure PPE in place.

1. Remove all personal items.



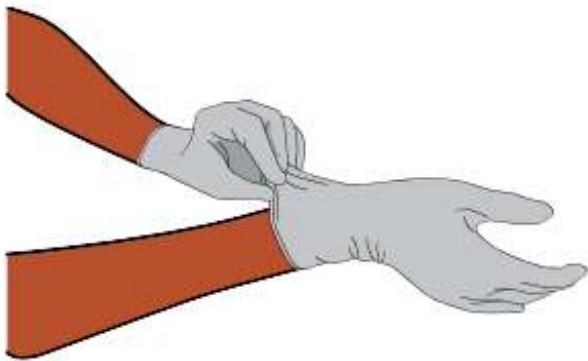
2. Put on scrubs and rubber boots¹. Tie hair back.



3. Select correct size of PPE. Do not use if damaged or expired.

4. Perform hand hygiene with ABHR or soap and water.

5. Put on the inner pair of gloves.



6. Put on fluid resistant gown. Gown sleeves should go over the inner pair of gloves.



7. Put on non-collapsible medical mask.

Use seal-checked respirator if performing aerosol generating procedures.



8. Put on face shield OR goggles.



9. Put on head and neck covering.



10. Put on disposable or reusable waterproof apron.

For hygienists, cleaners, waste handlers and safe and dignified burial teams, use heavy duty apron.



11. Put on second pair of gloves over the cuff. For hygienists, cleaners, waste handlers and safe and dignified burial teams, use heavy duty gloves.



12. Ensure buddy check and name and time of entry are put on PPE.

Name _____
Time _____



¹ If boots are not available, use slip on shoes (no laces) that cover the ankle and the top of the foot.

PPE Donning Tyvek suit

1. Select and Inspect PPE

Choose the correct size PPE and inspect for tears, defects, or contamination.

2. Perform Hand Hygiene

Clean hands thoroughly using alcohol-based hand rub or soap and water.

3. Put on Rubber Shoes / Gum Boots

Ensure the footwear fits properly and provides full protection.

4. Perform Hand Hygiene Again

5. Wear Inner Gloves

Put on the first pair of gloves.



PPE Donning (2)

6. Put on the Tyvek Suit / Coverall

Wear the suit carefully.

7. Zip the Suit Halfway

Keep the zipper partially open to facilitate wearing of mask and eye protection.

8. Wear Medical Mask / Respirator

Secure the mask properly over nose and mouth and check the fit.

9. Put on Face Shield or Transparent Goggles

Adjust comfortably for proper visibility and protection.

PPE Donning (3)

10. Pull Up the Hood of the Tyvek Suit

Cover the head completely.

11. Zip the Tyvek Suit Completely

Ensure full closure of the coverall.

12. Wear the Second Pair of Gloves

Outer gloves should cover the sleeve cuffs completely.

13. Final Check

Always don PPE:

- In front of a full-size mirror, **or**
 - Under observation of a trained buddy/observer – No need of PPE
- The buddy should verify:
 - Proper fitting
 - No exposed skin
 - Correct sequence
 - PPE integrity

Removing the PPE is the highest risk for health and care workers for self - contamination.

This requires practical training with a trained supervisor.

- Taking off PPE should always be done under the supervision of a **trained buddy. Buddy should wear PPE**
- Contaminated hands (bare and gloved hands) are the most common way to transfer contaminated material to the mucous membranes (eyes, nose and mouth).
- Keep gloved hands clean so they can remove PPE without contaminating the skin
- During PPE removal there are several steps that involve glove disinfection
- Goggles should be removed after the coverall to provide protection to the eyes
- Avoid touching the outer areas of the PPE to prevent contamination of gloves

1. Perform glove disinfection of outer gloves with ABHR or soap and water.

2. a. Untie or break apron strap from the back/waist. **b.** Remove apron leaning forward and keeping it away from the body. If disposable apron place safely in waste bin. If reusable/heavy duty apron place safely in bucket for decontamination.



3. Perform glove disinfection of outer gloves with ABHR or soap and water.

4. Remove outer pair of gloves and dispose of them safely in waste bin. If heavy duty gloves used place safely in bucket for decontamination.

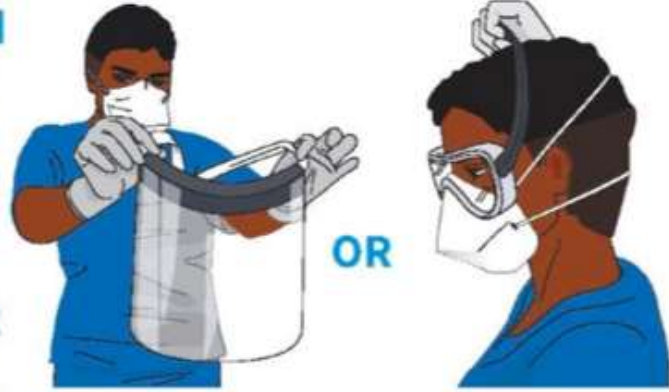
5. Perform glove disinfection of inner gloves with ABHR or soap and water.

6. While wearing inner gloves, remove hood of the coverall. Unzip coverall completely and remove from shoulders to feet. Avoid touching skin or scrubs.



7. Perform glove disinfection of inner gloves with ABHR or soap and water.

8. Remove eye protection by lifting the strap from behind the head and dispose of it safely in waste bin. If reusable eye protection is used, place safely in bucket for decontamination.



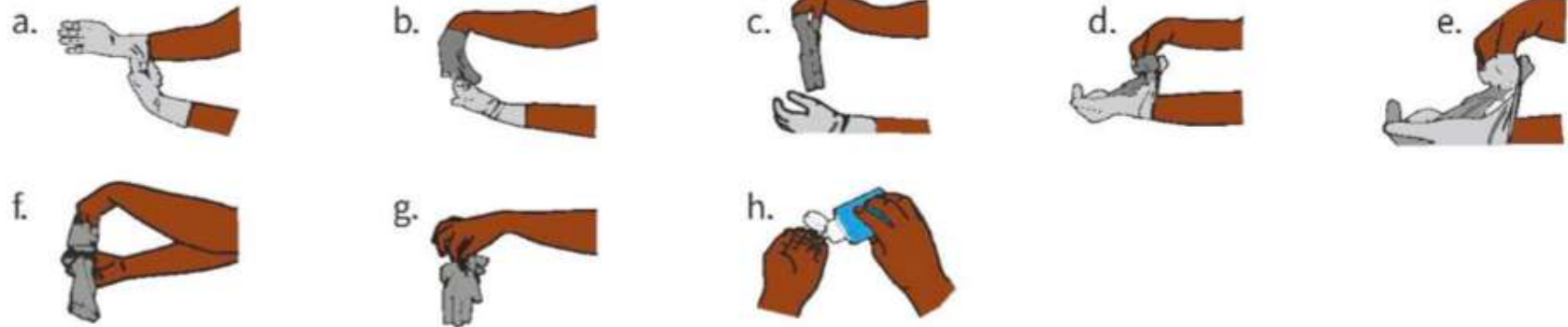
9. Perform glove disinfection of inner gloves with ABHR or soap and water.

10. Remove mask from behind the head by first lifting the bottom strap above the head and leaving it hanging in front; and then lift the top strap from behind head and dispose of it safely in waste bin.



11. Perform glove disinfection of inner gloves with ABHR or soap and water.

12. Remove inner gloves and perform hand hygiene with ABHR or soap and water.



13. Step into 0.5% chlorine foot bath. Step out of the foot bath and remove rubber boots without touching them.

14. Perform hand hygiene with ABHR or soap and water.

Sharps safety



**Do not
recap the
Needle**



- Limit use of needles/sharps
- Never recap needles
- Never direct used needle towards any part of the body
- Do not remove used needles from syringes or manipulate them by hand
- Never re-use syringes or needles
- Dispose after use - Use puncture-proof containers
- Place containers at point-of-use, securely sealed with lid, upright
- Do not shift containers from one room to other
- Replace containers when $\frac{3}{4}$ full

Patient-care equipment

- Dedicated medical equipment (preferably disposable, when possible) should be used for the provision of patient care
- All non-dedicated, non-disposable medical equipment used for patient care should be cleaned and disinfected according to manufacturer's instructions



Environmental infection control

- Environmental surfaces/objects contaminated with blood or body fluids - cleaned and disinfected using standard hospital detergents/disinfectants
Ex: **Freshly prepared 1% Sodium Hypochlorite or 5% Lysol**
- Wear gloves, gown, mask and closed impermeable shoes (e.g. boots)
- Cleaning heavily soiled surfaces/Linen (e.g. soiled with vomit or blood) increases the risk of splashes - facial protection should be worn in addition to gloves, gown and closed, impermeable shoes.



Environmental infection control

- DO NOT Spray (i.e. fog) occupied or unoccupied clinical areas with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit.

- DO NOT Spray on individuals



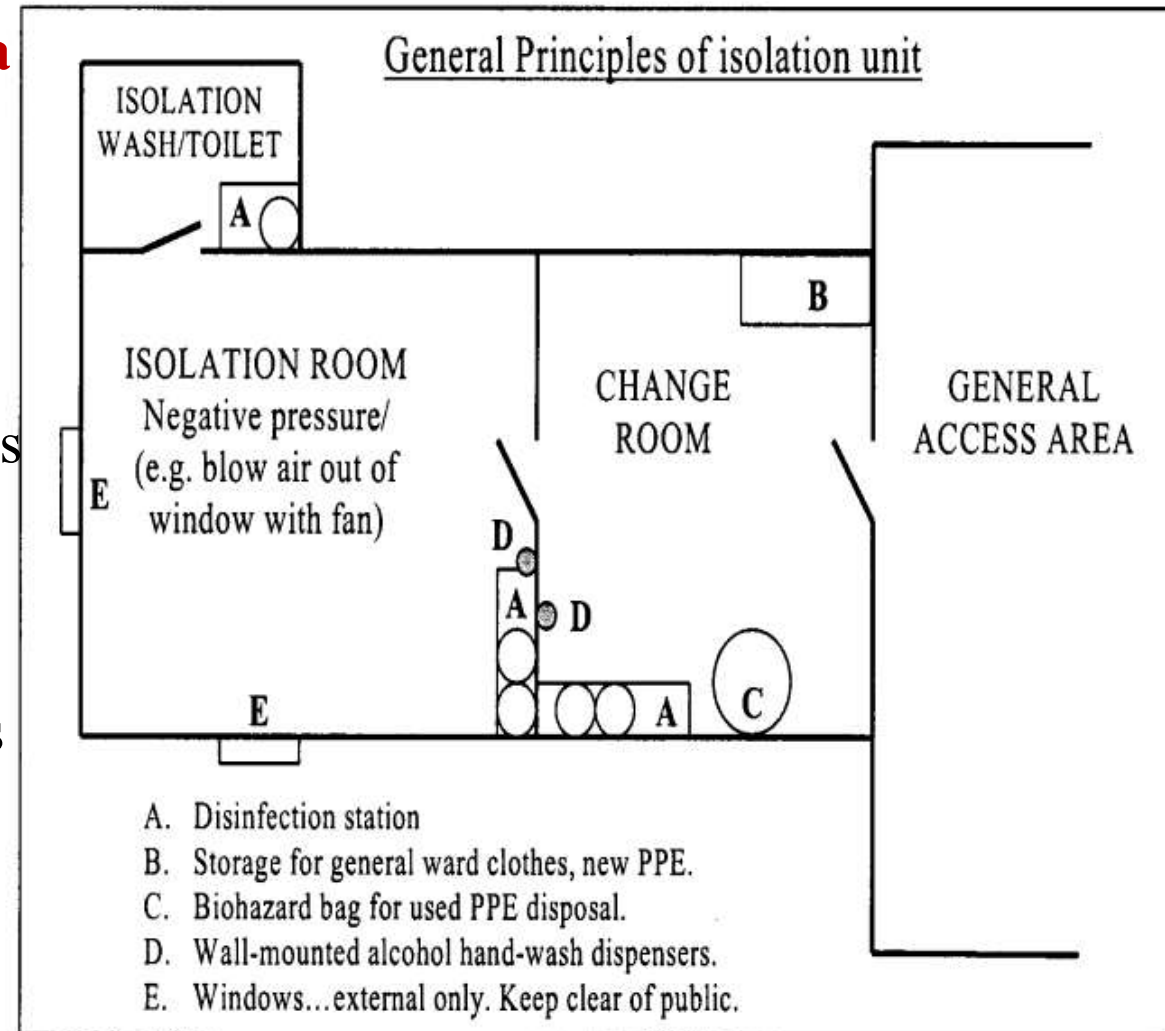
Handling of Soiled Linen

- Should be placed in clearly-labelled, leak-proof
- Container surfaces should be disinfected (using a disinfectant) after removal from the site
- Linen should be transported directly to the laundry with water and detergent
- For low-temperature laundering, **wash linen with then soak in 1% chlorine for approximately 30 minutes** and then dried according to routine standards and procedures
- When handling soiled linen from Ebola disease patients, use gloves, gown, closed impermeable shoes and facial protection.
- If safe cleaning and disinfection of heavily soiled linen is not possible or reliable - burn the linen to avoid any unnecessary risks to individuals handling these items

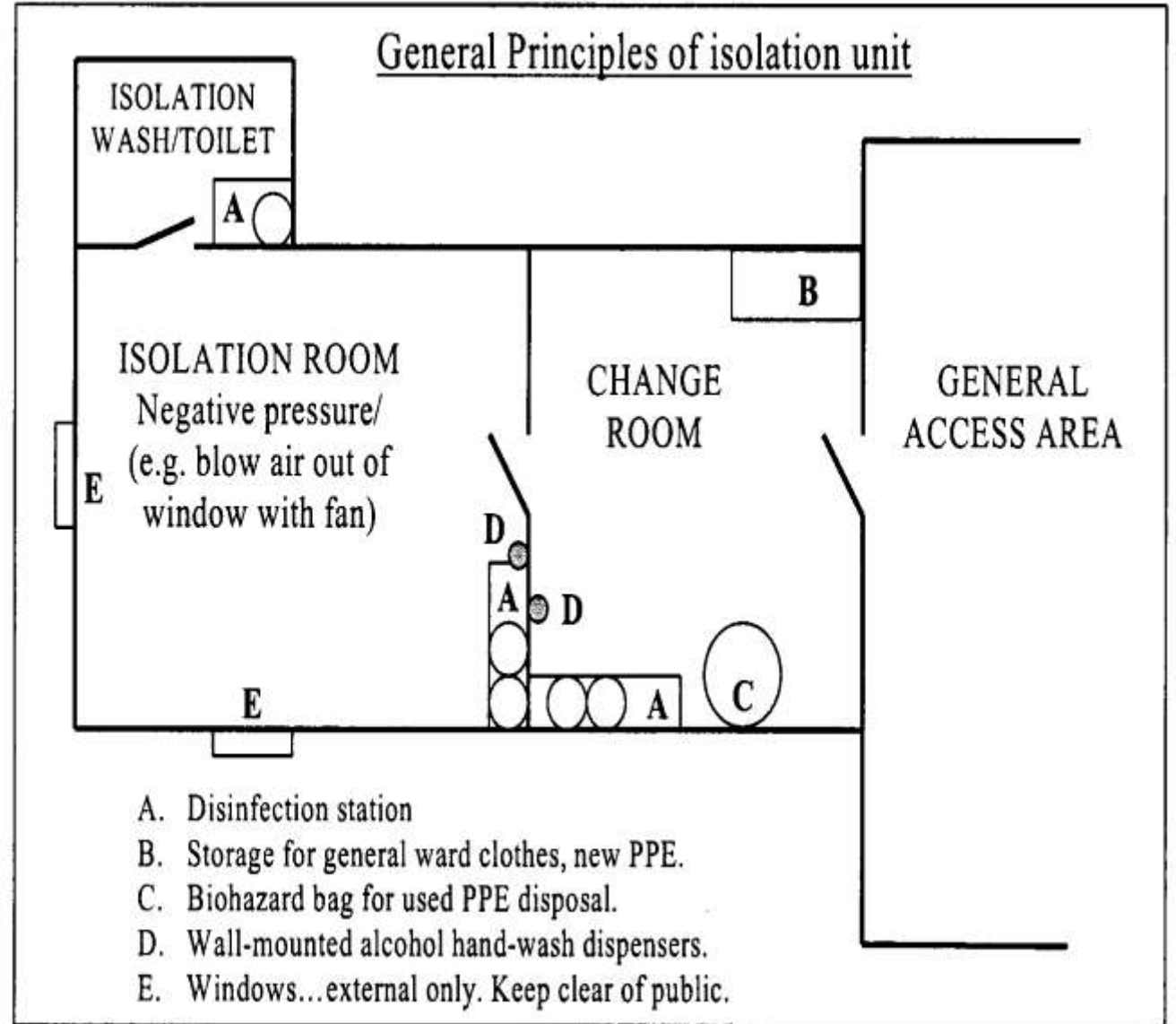


Direct patient care - Patient placement

- Place the patient in **single room (containing a private bathroom)** with the **door closed**
- Absolutely **Restrict all non-essential staff** from patient care areas.
- Maintain a log of persons entering the patient's room
- Allow access to only those necessary for the patient's well-being and care, such as a child's parent, if absolutely necessary
- Use of **PPE** is essential for the health care worker/caregiver



- Contact precautions in addition to standard precautions
- Do not touch eyes, nose, mouth with hands
- Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care.



All persons entering the patient room should be well trained and equipped for donning and doffing of PPE and must wear at least:

- Gloves
- Gown (fluid resistant or impermeable) to cover clothing and exposed skin
- Eye protection (goggles) to prevent splashes on eye.
- Facemask to prevent splashes on nose and mouth.
- Face shield, if used, will protect eye, nose and mouth.
- Closed impermeable shoe

Additional PPE might be required in certain situations (e.g., copious amounts of blood, other body fluids, vomit, or faeces present in the environment), including but not limited to:

- Double gloving
- Disposable shoe covers
- Leg coverings



Aerosol Generating Procedures on patients

- To be avoided as far as possible.
- Visitors /relatives should not be present.
- Limit the number of health care providers present during the procedure
- Conduct the procedures in an isolation room as far as possible.
- Room doors should be kept closed during the procedure, entry and exit should be minimized during and shortly after the procedure.
- HCP should wear complete PPE with N95 masks during the procedure.
- Disinfect the room after the procedure is over.

Laboratory Activities

- **Pre-identify and train** the lab personnel's who would perform the tests.
- Activities such as micro-pipetting and centrifugation can mechanically generate fine **aerosols** that might pose a risk of transmission of infection through inhalation
- **PPE to be used** - gown, gloves, particulate respirators (e.g. N95) and eye protection or face shields, or powered air purifying respirators (PAPR) when aliquoting, performing centrifugation or undertaking any other procedure that may generate aerosols

- Place specimens in clearly-labeled- Name, Hosp ID, Date of collection and bold labelling of **“Suspect Ebola”** on all vials in non-glass, **leak-proof containers** and deliver directly to designated specimen handling areas.
- **Disinfect external surfaces of specimen containers thoroughly** (using an effective disinfectant) prior to transport. Ex: Sodium hypochlorite at 1% or 5% Lysol
- Equipment (cell counters, analyzers etc.) should also be disinfected appropriately as per manufactures instructions



Waste Management

- Waste should be **segregated**
- WASTE DISPOSAL:
 - Sharps: Puncture-proof containers
 - Solid waste: Leak-proof bags
 - **Incineration OR burial in pit**
 - Pit depth: 2m, fill to 1-1.5m
 - Cover waste with 10-15cm soil
- Placenta and anatomical samples should be buried in a separate pit or incinerated

- Area for final treatment and disposal of waste - **controlled access** – no animals/untrained personnel/children
- **Waste** (faeces/urine/vomit/liquid waste from washing) - dispose in **sanitary sewer or pit latrine**. No further treatment is necessary
- **PPE:**
 - Wear gloves, mask, gown and closed impermeable shoes (e.g. boots) when handling solid infectious waste.
 - Wear gloves, gown, mask, closed shoes and goggles/facial protection, when handling liquid infectious waste (e.g. any secretion or excretion with visible blood even if it originated from a normally sterile body cavity). Avoid splashing when disposing of liquid infectious waste.

Handling of dead body

- Only **trained personnel** should handle remains during an outbreak.
- The handling of human remains should be kept to a minimum.
- Remains should **NOT** be sprayed, washed or embalmed.
- Remains should be wrapped in sealed, leak-proof body bag and should be **cremated/buried promptly**. Body bag:
 - Impermeable, vinyl, minimum thickness 400 microns
 - Able to hold 100-125 kilos
 - Equipped with at least four handles to allow safe hand carry
 - Leak-proof and able to fully contain blood-borne pathogens

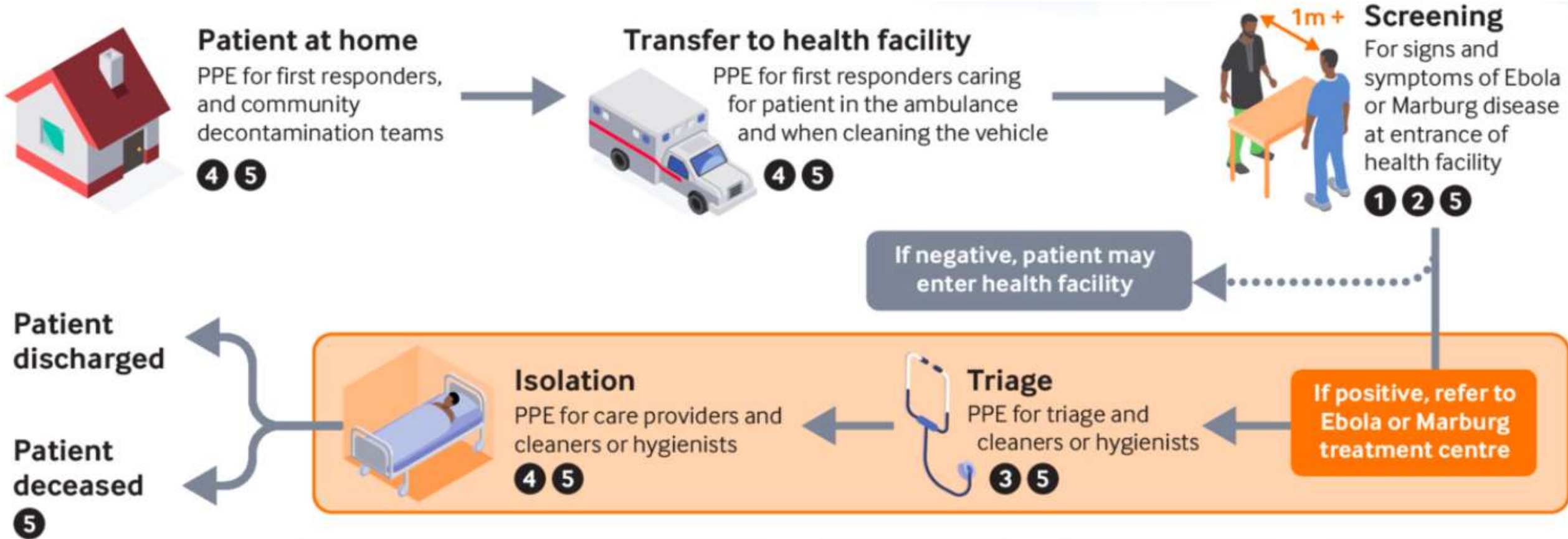
- **PPE while handling of dead body -**







- **Personnel performing autopsies** - particulate respirator (e.g., FFP2, or EN certified equivalent, or US NIOSH-certified N95) or a PAPR.
- **Cleaners/hygienists and mortuary/burial workers** should wear the same PPE recommended for other health and care workers, with the exception that 1) the outer pair of **gloves** should be **heavy-duty** (utility) gloves, 2) **aprons** should be **heavy-duty**, and 3) their footwear should be **waterproof boots**.
- Personal Protective equipment is not required for individuals driving or riding a vehicle to collect human remains.

Non Patient care activities

- Contact tracing and case finding interviews should be conducted **outdoors** whenever possible and **a distance of more than one meter** should be maintained between interviewer and interviewee.
- Protective equipment is not required when interviewing asymptomatic individuals

SUMMARY



	Body	Face	Hands	Feet
1 Screening Minimum 1 metre distance, use "no-touch technique"	 Scrubs			 Closed-toe shoes Doesn't have to be waterproof rubber boots in this setting but could be based on availability
2 Screening Minimum 1 metre distance cannot be maintained	 Scrubs + fluid-resistant gown	 Medical mask Mask should be fluid resistant and non-collapsible	 One pair of gloves Nitrile preferred	
3 Triage Likely patient contact	 Scrubs + fluid-resistant coverall	 If no coverall available use:  Gown + head and neck covering	 Two pairs of gloves Nitrile preferred	 Triage more likely to wear rubber boots
4 Patient care Direct or indirect contact with patients	 Scrubs + fluid-resistant coverall + disposable or reusable apron		 Eye protection Face shield or goggles	 Usually waterproof rubber boots
5 Environmental services and burial teams Cleaners, hygienists, and waste handlers (health facilities and community settings). Safe and dignified burial teams	 Scrubs + fluid-resistant coverall + heavy duty apron	  Use respirator for aerosol generating procedures	 Two pairs of gloves Nitrile preferred inside, with a heavy duty outer glove	 Waterproof rubber boots

Managing Exposure to Infection

- IMMEDIATE ACTIONS after exposure:
 - Wash affected skin thoroughly with soap and water
 - Irrigate mucous membranes (eyes) with copious water/eyewash solution
- Medical evaluation and monitoring:
 - Twice-daily fever monitoring for **21 days** after exposure
 - Consult infectious disease expert if fever develops within 21 days of exposure
- Infected healthcare worker must be **isolated** and treated as EVD patient
- **Contact tracing** and follow-up of family, friends, co-workers and other patients, who may have been exposed through close contact with the infected HCW

Government of India
Ministry of Health and Family Welfare

Dated 22.05.2026

Isolation Facility Preparedness Checklist for Managing Suspect/Confirmed Ebola Disease

Date of Assessment: _____


Facility Name: _____

District/State: _____

Assessed by: _____

A. Isolation Facility Preparedness

Checklist Item	Status	Remarks
Single isolation room identified		
Private bathroom attached to isolation room		
Negative pressure ventilation can be maintained in isolation room		
Isolation room doors can remain closed		
Access restricted to essential personnel only		
Visitor policy defined and displayed		
Entry/exit logbook available		
Signage for restricted entry available		

 **B. Personal Protective Equipment (PPE)**



Checklist Item	Status	Remarks
Gloves available		
Impermeable/fluid-resistant gowns available (Tyvek suit)		
Medical masks/N95 masks available		
Goggles available		
Face shields available		
Closed impermeable footwear/boots available		
Shoe covers available		
<u>PPE donning area designated</u>		
<u>PPE doffing area designated</u>		
<u>PPE disposal bins available</u>		
Staff trained in donning/doffing		



C. Hand Hygiene

Checklist Item	Status	Remarks
Alcohol-based hand rub available		
Functional <u>handwashing</u> stations available		
Soap and water continuously available		
Hand hygiene posters displayed		

D. Patient Care Equipment

Checklist Item	Status	Remarks
Dedicated patient care equipment available		
If dedicated patient care equipment not available, provision for their cleaning/disinfection available		
Cleaning/disinfection SOP available		

E. Laboratory Preparedness

Checklist Item	Status	Remarks
Linkages established with NIV, Pune and <u>IDSP</u> for referral of samples to NIV, Pune or <u>ICMR</u> designated laboratory		
Staff trained for handling <u>EVD</u> specimens		
Leak-proof specimen containers available		
<u>Biohazard</u> labels available		
Disinfectants available		
N95/PAPR available for aerosol-generating work		
SOP for sample collection, packaging and transport available		
Staff trained in collection, packaging and transportation		

F. Environmental Cleaning and Disinfection

Checklist Item	Status	Remarks
Sodium hypochlorite (1%) / Chlorine solution (0.5-1%) / <u>Lyzol 5%</u> available		
Environmental cleaning staff trained		
<u>PPE</u> for cleaning staff available		
Staff trained in donning and doffing of <u>PPE</u>		

G. Waste Management

Checklist Item	Status	Remarks
Biomedical waste segregation system available		
Leak-proof waste bags available		
Covered waste bins available		
Puncture-proof sharps containers available		
Waste disposal site/incinerator identified		
Controlled access to waste disposal area		
Waste handlers trained and equipped		

H. Training and Capacity Building

Checklist Item	Status	Remarks
Clinical staff trained		
Nursing staff trained		
Laboratory staff trained		
Housekeeping staff trained		
Waste handlers trained		
Mock drills conducted		
Training records maintained		

References

- Guidelines for hospital infection control while managing the suspect/ case of Ebola Disease. MoHFW. 2026
- WHO – Infection Prevention and Control Guideline for Ebola and Marburg Disease (August 2023)
- WHO – Ebola Disease Fact Sheet
- PPE Guidance for Healthcare Workers - CDC

Personal Protective Equipment (PPE KIT)



THANK YOU