World Health Organization

INTERIM GUIDANCE

Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, with Focus on Ebola

December 2014

WHO/HIS/SDS/2014.4Rev.1.

Contents

Acknowledgements

WHO staff and consultants associated with this update of the WHO 2008 *"Interim Infection Control Recommendations for Care of Patients with Suspected or Confirmed Filovirus (Ebola, Marburg) Haemorrhagic Fever"* are:

Benedetta Allegranzi (WHO Service Delivery and Safety, Health Systems and Innovation, Geneva, Switzerland)

Jean Christophe Aze (WHO Global Capacities, Alert and Response, Health Security and Environment, Geneva, Switzerland)

Sergey Eremin (WHO Pandemic and Epidemic Diseases, Health Security and Environment, Geneva, Switzerland)

Pierre Formenty (WHO Pandemic and Epidemic Diseases, Health Security and Environment, Geneva, Switzerland)

Edward Kelley (WHO Service Delivery and Safety, Health Systems and Innovation, Geneva, Switzerland)

Claire Kilpatrick (WHO Consultant, WHO Service Delivery and Safety, Health Systems and Innovation, Geneva, Switzerland)

Margaret Montgomery (WHO Water, Sanitation, Hygiene and Health, Family, Women's and Children's Health, Geneva, Switzerland)

Jean-Bosco Ndihokubwayo (WHO Africa Regional Office, Health Systems and Services, Brazzaville, Republic of the Congo)

Carmem Lucia Pessoa Da Silva (WHO Pandemic and Epidemic Diseases, Health Security and Environment, Geneva, Switzerland)

Cathy Roth (WHO Assistant Director General Office, Health Security and Environment, Geneva, Switzerland)

José Rovira Vilaplan (WHO Global Capacities, Alert and Response, Health Security and Environment, Geneva, Switzerland)

Nahoko Shindo (WHO Pandemic and Epidemic Diseases, Health Security and Environment, Geneva, Switzerland)

Julie Storr (WHO Consultant, WHO Service Delivery and Safety, Health Systems and Innovation, Geneva, Switzerland)

Constanza Vallenas (WHO Pandemic and Epidemic Diseases, Health Security and Environment, Geneva, Switzerland)

WHO wishes to acknowledge the review of this document by the following external international experts:

Ndoye Babacar (PRONALIN, Ministère de la santé et la prévention du Sénégal, Dakar, Senegal)

Mary J. Choi (Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, United States of America)

Marie-Noëlle Chraïti (WHO Collaborating Centre on Patient Safety, University of Geneva Hospitals, Geneva, Switzerland)

Bryan E. Christensen (Domestic Healthcare Infection Control Team, 2014 CDC Ebola Response, Centers for Disease Control and Prevention, Atlanta, United States of America)

Nizam Damani (Craigavon Area Hospital, Craigavon, United Kingdom)

Mauricio Ferri (Department of Community Health Sciences - University of Calgary, Canada)

Robert Fowler (Department of Medicine and Interdepartmental Division of Critical Care Medicine, University of Toronto, Toronto, Canada)

Frederique Jacquerioz (Health Office for Latin America, Department of Tropical Medicine, Tulane University School of Public Health and Tropical Medicine, Lima, Peru)

Shevin T Jacob (Division of Allergy and Infectious Diseases, University of Washington, Seattle, United States of America)

Jeff Hageman (Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, United States of America)

Joost Hopman (Radboud University Medical Center, Nijmegen, The Netherlands)

Alex Kallen (Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, United States of America)

David Kuhar (Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, United States of America)

Shaheen Mehtar (Tygerberg Hospital & Stellenbosch University, Tygerberg, Cape Town, South Africa)

Folasade Ogunsola (College of Medicine, University of Lagos, Lagos, Nigeria)

Didier Pittet (WHO Collaborating Centre on Patient Safety, University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland)

Key messages for infection prevention and control to be applied in health-care settings

- Strengthen and carefully apply standard precautions when providing care to ALL patients regardless of the signs and symptoms they present with.
- Isolate suspected or confirmed hemorrhagic fever (HF) cases in single isolation rooms or cohort them in specific confined areas while rigorously keeping suspected and confirmed cases separate. Assure restricted access and dedicated equipment to these areas.
- Exclusively assign clinical and non-clinical personnel to HF patient care areas.
- Prior to entering the patient isolation rooms/areas, ensure that all visitors and health workers rigorously use personal protective equipment (PPE) and perform hand hygiene as indicated in this document. PPE should include double gloves, gown or coverall and apron, face mask, eye protection (goggles or face shield) head cover, and boots.
- Ensure safety of injections and phlebotomy procedures and management of sharps.
- Ensure regular and rigorous environmental cleaning, decontamination of surfaces and equipment, management of soiled linen and of waste as indicated in this document.
- Ensure safe processing of laboratory samples from suspected or confirmed patients with HF.
- Ensure that the infection prevention and control measures indicated in this document are followed while handling dead bodies or human remains of suspected or confirmed patients with HF for post-mortem examination and burial preparation.
- Promptly evaluate, care for, and if necessary, isolate health workers or any person exposed to blood or body fluids from suspected or confirmed patients with HF.

Introduction

This document provides a summary of infection prevention and control (IPC) measures for those providing direct and non-direct care to patients with suspected or confirmed cases of Filovirus haemorrhagic fever (HF), including Ebola or Marburg haemorrhagic fevers, in health-care facilities (HCFs). It also includes some instructions and directions for those managing the implementation of IPC activities. These IPC measures should be applied not only by health-care professionals but by anyone in direct contact with patients (e.g., visitors, family members, volunteers), as well as by those not in contact with patients but potentially exposed to the virus through contact with the environment (e.g., cleaners, laundry, housekeepers, security).

This document represents an update of the WHO 2008 *"Interim Infection Control Recommendations for Care of Patients with Suspected or Confirmed Filovirus (Ebola, Marburg) Haemorrhagic Fever".* This update is based upon review of WHO and other international reference documents being used and published during the current Ebola outbreak (see references) and consensus from international experts.

Ebola virus disease is a severe illness caused by Ebola Filovirus (http://www.who.int/csr/disease/ebola/en/). It is highly infectious, rapidly fatal, with a high mortality rate, ***but it can be prevented***. It is spread through ***direct contact*** with body fluids (blood, stool, vomit, saliva, urine, sperm, etc.) of an infected person and by contact with contaminated surfaces or equipment, including linen soiled by body fluids from an infected person. The Ebola virus can be eliminated from the environment with heat, alcohol-based products, and sodium hypochlorite (bleach) or calcium hypochlorite (bleaching powder) at appropriate concentrations. It is also susceptible to a wide range of commonly used disinfectants, including aldehydes, halogens, peroxides, phenolics, and quaternary ammonium compounds.

If carefully implemented, IPC measures will reduce or stop the spread of the virus and protect health workers and others. It is advised that in the affected area(s), a subcommittee for clinical case management be established;[1] as part of this committee, a coordinator(s) should be named to oversee adherence to the IPC measures in each HCF and acts as a focal person to coordinate activities and advise. If available, this person should be the professional in charge of IPC in the HCF.

Case identification and detection, contact tracing and patient clinical assessment and management are not the object of this Guidance document and instructions for these activities can be found elsewhere.[1, 2] However, regarding IPC measures to be implemented during interviews for contact tracing and case finding in the community, the following principles should be kept in mind: 1) shaking hands should be avoided; 2) a distance of more than one metre (about 3 feet) should be maintained between interviewer and interviewee; 3) PPE is not required if this distance is assured and when interviewing asymptomatic individuals (e.g., neither fever, nor diarrhoea, bleeding or vomiting) and provided there will be no contact with the environment, potentially contaminated with a possible/probable case; and 4) it is advisable to provide workers undertaking contact tracing and case finding in the community with alcohol-based handrub solutions and instructions to appropriately perform hand hygiene.

1. General patient care in any health-care facility

Strengthen and carefully apply ***standard precautions***[2-4] (Annex 1) when providing care to ALL patients regardless of the signs and symptoms they present with. This is especially important because the initial manifestations of HF may be non-specific. Hand hygiene is the most important measure. Gloves should be worn for any contact with blood or body fluid. Medical mask and goggles or face shield should be used if there is any potential for splashes of blood or body fluids to the face, and cleaning of contaminated surfaces is paramount.

During HF outbreaks, each health-care facility in high-transmission affected areas should have a dedicated and well equipped triage area at the entrance, to identify any potential HF case seeking care in the facility. This area should be staffed with professionals (e.g. doctor or nurse) trained on basic IPC principles and specific precautions for HF and on the use of a standard algorithm to identify HF cases. Staff in the triage area should wear a scrub suit, a gown, examination gloves and a face shield. The area should be large enough to keep the patient at a 1-metre distance at least and should be equipped with an easily accessible hand hygiene facility (either alcohol-based handrub dispensers or a sink or a bucket with faucet containing water, liquid soap and single-use towels), thermometer, bin with lid and infectious waste plastic bags, a sharps' container (if rapid diagnostic test for malaria or any other similar practice is meant to be performed here). The hand hygiene technique posters and the standard triage algorithm to identify HF cases should be clearly displayed in this area. Triage staff should follow a 'no touch' process when interviewing the patient. A distance of at least one metre (3 feet) should be kept from the patient at all times, whenever possible.

2. Direct patient care (for suspected or confirmed patients with haemorrhagic fever)

Patient placement, staff allocation and visitors

- Put suspected or confirmed cases in single ***isolation rooms*** with an adjoining dedicated toilet or latrine, showers, sink equipped with running water, soap and single-use towels, alcohol-based handrub dispensers, stocks of personal protective equipment (PPE), stocks of medicines, good ventilation, screened windows, doors closed and restricted access,[5] if isolation rooms are unavailable, ***cohort*** these patients in specific confined areas while rigorously ***keeping suspected and confirmed cases separate*** and ensure the items listed here for isolation rooms are readily available. Make sure that there is at least 1 metre (3 feet) distance between patient beds.
- Ensure that clinical and non-clinical personnel are assigned exclusively to HF patient care areas and that members of staff do not move freely between the HF isolation areas and other clinical areas during the outbreak.
- Restrict all non-essential staff from HF patient care areas.
- Stopping visitor access to the patient is preferred, but if this is not possible, limit their number to include only those necessary for the patient's well-being and care, such as a child's parent.
- Do not allow other visitors to enter the isolation rooms/areas and ensure that any visitors wishing to observe the patient do so from an adequate distance (approximately 3 metres or 9 feet).
- Before allowing visitors to HF patients to enter the HCF, screen them for signs and symptoms of HF.

Hand hygiene, personal protective equipment and other precautions

- Ensure that all visitors use PPE and perform hand hygiene as indicated below and are provided with related instructions (Annexes 2, 3, 4) [2, 5, 6, 7, 8] prior to entry into the isolation room/area.
- Ensure that all health workers (including aides and cleaners) wear PPE (Annexes 2, 3, 4) before entering the isolation rooms/areas and having contacts with the patients and/or the environment.
- Personal clothing should not be worn for working in the patient areas. Scrub or medical suits should be worn.

- ***Carefully apply the following precautions***[3-9] to avoid any possible unprotected direct contact with blood and body fluids when providing care to any patient with HF, including suspected cases:

  1. Perform ***hand hygiene***:
     - before donning gloves and wearing PPE on entry to the isolation room/area,
     - before any clean/aseptic procedures being performed on a patient,
     - after any exposure risk or actual exposure with the patient's blood and body fluids,
     - after touching (even potentially) contaminated surfaces/items/equipment in the patient's surroundings, and
     - after removal of PPE, upon leaving the care area.

     Hand hygiene should be performed within the isolation rooms/areas every time it is needed according to the above indications during care to a patient, along with change of gloves. When caring for patients in the same room, it is essential to complete the care to each patient before moving to the next one, and to perform glove disinfection and change outer gloves and perform hand hygiene between each patient. WHO suggests the following 2-step procedure to facilitate changing gloves safely while providing clinical care for patients with filovirus disease: 1) disinfect the outer gloves before removing them safely and 2) keep the inner gloves on and disinfect them before putting on a fresh outer pair.[5] Neglecting to perform hand hygiene during and after PPE removal (Annex 2) will reduce or negate any benefits of the protective equipment.

     To perform hand hygiene, either use an ***alcohol-based handrub or soap and running water*** applying the correct technique recommended by WHO (Annex 3).[6] Always perform hand hygiene with soap and running water when hands are visibly soiled. Alcohol-based handrubs should be made available at every point of care (at the entrance and within the isolation rooms/areas) and are the standard of care. However, if alcohol-based handrubs are unavailable, perform hand hygiene with soap and running water every time necessary according to the above indications. In settings where bleach/chlorine solutions are currently used for hand hygiene, WHO recommends implementing a strategy to change to alcohol-based handrub or soap and water. Bleach/chlorine solutions currently in use for hand hygiene and glove disinfection can be used in the interim period in emergency situations until alcohol-based handrubs or soap and water become available.[6] Alcohol-based handrubs can be produced locally at the national or HCF level by following the WHO recommendations and instructions (Annex 5).[10]

  2. Before entering the isolation rooms/areas, put on the following full set of ***PPE*** [5, 11] in dedicated changing zone and according to the sequence indicated in Annex 2:
     - ***Double gloves*** (non-sterile examination gloves) which should be correctly sized; nitrile gloves are preferred (Annex 3). The outer glove should preferably have a long cuff, reaching well above the wrist, ideally to the mid-forearm.[5,8] Consider changing gloves if heavily soiled with blood or any other body fluids while providing care to the same patient (perform careful hand hygiene immediately after removal). Always change gloves and perform hand hygiene immediately after removal, when moving from one patient to another, when caring for patients in the same room.
     - A disposable ***gown*** or ***coverall*** made of fabric that is tested for resistance to penetration by blood or body fluids or to blood-borne pathogens to cover clothing and exposed skin.
     - A disposable, waterproof ***apron*** worn over the gown or coverall. If disposable aprons are not available, heavy duty, reusable waterproof aprons can be used if appropriate cleaning and disinfection between patients is performed.
     - A fluid-resistant medical/surgical ***mask*** with a structured design that does not collapse against the mouth (e.g. duckbill, cup shape).
     - ***Eye protection*** (either goggles or face shield) in order to have the mucous membranes of their eyes, mouth and nose completely covered by PPE and prevent virus exposure.
     - Waterproof ***boots*** (e.g. rubber/ gum boots) should be worn by all health workers. If boots are not available, health workers must wear closed shoes (slip-ons without shoelaces and fully covering the dorsum of the foot and ankles) and overshoes these must be removed while still wearing gloves and with caution to avoid hand contamination.
     - Avoid aerosol-generating procedures if possible. Wear a fluid-resistant particulate ***respirator*** (FFP2 or EN certified equivalent or US NIOSH-certified N95), if any procedures that stimulate coughing or promote the generation of aerosols (e.g., aerosolized or nebulized medication

administration, diagnostic sputum induction, bronchoscopy, airway suctioning, endotracheal intubation, positive pressure ventilation via face mask) are to be performed.[9]

- PPE should be put on under the supervision of a trained colleague (buddy) in a dedicated, well equipped area. Equipment includes a mirror, hand hygiene facilities, including buckets with faucets containing chlorine solution for glove disinfection and also water buckets with faucets or sinks with running water, liquid soap, and single-use towels, bowls containing chlorine solution for the decontamination of boots, bins lined with infectious waste bags and a lid, containers for the collection of reusable equipment to be decontaminated.

3. Before exiting the isolation area, ***carefully remove and dispose of PPE*** into waste containers, following standardized procedures (Annex 2).[2]

   When removing PPE, be careful to avoid any contact between the soiled items (e.g. gloves, gowns) and any area of the face (i.e. eyes, nose or mouth) or non-intact skin.

   PPE removal must take place under the supervision of a trained colleague (buddy) in a dedicated, well equipped area. Necessary equipment includes a mirror, hand hygiene facilities including buckets with faucets containing chlorine solution for glove disinfection as well as water buckets with faucets or sinks with running water, liquid soap, and single use towels, bowls containing chlorine solution for boots decontamination, bins with infectious waste bags and lid, containers for collection of reusable equipment to be decontaminated.

4. ***Do not recycle any single-use disposable PPE***, but do ***carefully clean and decontaminate the reusable equipment*** (as described below). If goggles and face shields are reused, it is essential that they are appropriately cleaned and decontaminated. These items should be cleaned with water (± detergent) to remove any organic matter and then immersed fully in a 0.5% chlorine solution [a solution containing 5000 ppm (parts per million) available free chlorine] for a minimum of 10 minutes for full decontamination. After decontamination, they should be thoroughly rinsed with water (to remove irritating hypochlorite residues and salt deposits) before re-use.

   If health workers continue wearing the gum boots during their shift, these should be cleaned and decontaminated after coming out of the isolation area and before leaving the area dedicated to PPE removal. Boots should be cleaned by stepping into a bowl of water and should then be decontaminated by standing in a bowl of 0.5% chlorine solution for at least one minute. At least once a day, boots should be disinfected by soaking in a 0.5% chlorine solution for 30 minutes. The wipes used for the initial cleaning should be treated as infectious waste; the disinfectant can be safely poured down a sink or drain.[12]

5. Rigorously use ***dedicated equipment*** (e.g. stethoscopes) for each patient. However, if this is not possible, decontaminate the items between each patient contact. For instance, if the stethoscope has to be used on different patients, it is essential that the full stethoscope (i.e. staff hand contact as well as patient contact surfaces) be thoroughly cleaned first with water and soap using appropriate PPE to remove organic matter and then wiped with alcohol.[12] All waste generated during this decontamination process should be treated as infectious waste (see below).

   Items and equipment should not be moved between isolation rooms/areas and other areas of the HCF, unless they are appropriately discarded and disposed. For instance, the patient charts and records should be kept outside the isolation rooms/areas to avoid their contamination.

Injection safety and management of sharps

- Each patient should have ***exclusively dedicated injection and parenteral medication equipment*** which should be disposed of at the point of care. Syringes, needles or similar equipment should never be reused.[13]
- Limit the use of needles and other sharp objects as much as possible.
- Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care.[14]
- If the use of sharp objects cannot be avoided, ensure the following precautions are observed:[13]
  - Never replace the cap on a used needle.
  - Never direct the point of a used needle towards any part of the body.
  - Do not remove used needles from disposable syringes by hand, and do not bend, break or otherwise manipulate used needles by hand.

- Dispose of syringes, needles, scalpel blades and other sharp objects in appropriate, puncture-resistant containers.

- Ensure that puncture-resistant containers for sharps objects are placed as close as possible to the immediate area where the objects are being used ('point of use') to limit the distance between use and disposal, and ensure the containers remain upright at all times. If the sharps container is far, never carry sharps in your hand but place them all in a kidney dish or similar to carry to the sharps container.
- Ensure that the puncture-resistant containers are securely sealed with a lid and replaced when 3/4 full.
- Ensure the containers are placed in an area that is not easily accessible by visitors, particularly children (e.g. containers should not be placed on floors, or on the lower shelves of trolleys in areas where children might gain access).

3. Environmental cleaning and management of linen

Personal protective equipment

- ***Wear a full set of PPE*** (see section 2), and ***heavy duty/rubber gloves***, when cleaning the environment and handling infectious waste.

Cleaning process

- Environmental surfaces or objects contaminated with blood, other body fluids, secretions or excretions should be cleaned and disinfected as soon as possible using standard hospital detergents / disinfectants (e.g. a 0.5% chlorine solution or a solution containing 5,000 ppm available free chlorine)[15]. ***Application of disinfectants should be preceded by cleaning*** to prevent inactivation of disinfectants by organic matter.
- If locally prepared, prepare cleaning and disinfectant solutions every day. Change cleaning solutions and refresh equipment frequently while being used during the day, as they will quickly become contaminated (follow your hospital protocols if available). For preparing chlorine-based solutions, see instructions in Annex 6.
- Clean floors and horizontal work surfaces at least once a day with clean water and detergent. Cleaning with a moistened cloth helps to avoid contaminating the air and other surfaces with air-borne particles. Allow surfaces to dry naturally before using them again.
- Dry sweeping with a broom should never be done. Rags holding dust should not be shaken out and surfaces should not be cleaned with dry rags.
- Cleaning should always be carried out from "clean" areas to "dirty" areas, in order to avoid contaminant transfer.
- WHO discourages spraying occupied or unoccupied clinical areas with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit. If spraying is not preceded by cleaning, the disinfectant may not work in the presence of organic matter and blood/body fluids.

  When spraying is used, it should be preceded by cleaning with water and detergent to mechanically remove the contaminants and organic matter. After spraying disinfectant, ensure that it is properly distributed on the surfaces. Furthermore, excessive use of spraying creates a wet environment, which is not only inconvenient but may be dangerous as it is slippery and takes longer to dry, especially in a humid environment.

  In the context of HF outbreaks, spraying may be accepted outdoors and in some community settings (e.g. decontamination of EVD victims' households by a burial team) as the only feasible option. It may be considered also when disinfecting sand or gravel floors. In conclusion, considering its limitations, spraying should be used with caution, and the spraying of people wearing PPE or street clothes and for the routine disinfection of rooms is not recommended. If spraying chlorine solutions is utilized, staff should still maintain maximum attention while manipulating organic material, touching contaminated surfaces, and removing PPE, because these may still be contaminated by the Ebola virus even after being sprayed.

Management of linen

- Linen that has been used on patients can be heavily contaminated with body fluids (e.g. blood, vomit) and splashes may result during handling. When handling soiled linen from patients, staff should use the ***full set of PPE*** (see section 2), and ***heavy duty/rubber gloves and apron***.
- Soiled linen should be placed in clearly-labelled, leak-proof bags or buckets at the site of use and the container surfaces should be disinfected (using an effective disinfectant) before removal from the isolation room/area. If there is any solid excrement such as faeces or vomit, scrape off carefully using a flat firm object and flush it down the toilet or in the sluice before linen is placed in its container. If the linen is transported out of the patient room/area for this procedure it should be put in a separate container – it should never be carried against the body.
- Heavily soiled, contaminated linen should preferably be incinerated or processed by autoclaving, especially if safe cleaning and disinfection are not possible or reliable. Any unnecessary manipulation should be avoided and linen should be disposed of safely.
- Linen meant to be washed and decontaminated, should be transported directly to the laundry area in its container and laundered promptly.
- For low-temperature laundering, wash linen with detergent and water, rinse and then soak in 0.05% chlorine solution (a solution containing 500 ppm available free chlorine) for approximately 15 minutes. Linen should then be dried according to routine standards and procedures.
- Washing contaminated linen by hand should be discouraged. However, if washing machines are not available or power is not ensured, take the soiled linen out of the container and empty it into a large drum container of water and soap. Soak the linen in this drum and make sure it is totally covered with water. Use a stick to stir; then throw out the water and refill the drum with chlorine 0,05% (a solution containing 500 ppm available free chlorine) and soak for 15 minutes. Remove the linen and then rinse in clean water. Remove excess water and spread out to dry. Avoid splashing as much as possible.

4. Waste management

Waste management plan

- A detailed waste management plan should be developed during the design of HF treatment facilities. This plan should detail written procedures for healthcare waste management, the number of staff required and their roles and responsibilities. The plan should also map the safe movement of waste from points of generation, internal transport routes, storage, treatment facility, and final disposal areas.[16]

Personal protective equipment

- ***Wear a full set of PPE*** (see section 2), and ***heavy duty/rubber gloves***, when handling infectious waste (e.g. solid waste or any secretion or excretion with visible blood). Goggles provide greater protection than visors from splashes that may come from below when pouring liquid waste from a bucket. Avoid splashing when disposing of liquid infectious waste.

Waste management procedures

- Waste should be segregated at the point of generation to enable appropriate and safe handling. Ideally, waste should not be stored more than 24 hours before being destroyed.
- Sharp objects (e.g. needles, syringes, glass articles) and tubing that has been in contact with blood or body fluids should be placed inside puncture resistant waste containers (as described above). These should be located as close as practical to the patient care area where the items are used, similarly in laboratories.
- All solid, non-sharp, infectious waste should be collected using leak-proof waste bags in covered bins.
- Infectious solid waste should not be transported by hand due to the risk of accident or injury from infectious material or incorrectly disposed sharps. Use of a covered trolley or a wheeled bin with a lid will reduce the potential for exposure. In facilities where use of such items is difficult due to a lack of

concrete or level flooring, a wheelbarrow may be used. If none are available, a labelled and lidded collection bin can be used. After each use, all surfaces of the trollies or bins should be disinfected with chlorine 0.5 % (a solution containing 5000 ppm available free chlorine).

- An incinerator may be used for short periods during an outbreak to destroy solid waste. However, it is essential to ensure that total incineration has taken place. Although they may serve the immediate need for destroying infectious waste and eliminating viral contamination risks, low level incinerators (or burning in open barrels) are not recommended as waste may not be fully burned, and exposure to fumes from these incinerators has been linked to immediate and chronic health risks, as well as detrimental environmental impacts. Caution is also required when handling flammable material and when wearing gloves due to the risk of burn injuries if gloves are ignited. Medium-level and advanced incineration, such as two chamber incinerators, are preferable because they reach higher temperatures for longer periods, thus ensuring complete burning and elimination of risks associated with waste, and they are more environmentally friendly as well. However, they require a reliable power supply and fuel (petrol/diesel/gas) for the operation of the burners, temperature monitoring and possibly also air pollution control devices.[16]
- A safer and more environmentally friendly alternative to incineration is autoclaving. WHO supports and recognizes the environmental health benefits of using autoclaves for destroying health-care waste and has been calling for the phasing out of incineration since 2004. However, autoclaving requires reliable water and electrical supplies. In the context of HF outbreaks in Africa, several additional specific factors should also be considered. These include the large amount of waste generated from PPE disposal and that on average, autoclaves only reduce the volume of waste by 50%. Therefore, shredding or compaction post-treatment would be necessary, which would require additional time from already overstretched staff. Finally, autoclaving may require additional space for burying, compared to incineration.[16]
- Waste should be placed in a designated pit of appropriate depth (e.g. 2 metres or about 7 feet) and filled to a depth of 1–1.5 m (or about 3–5 feet). After each waste load, the waste should be covered with a layer of soil 10–15 cm deep.
- Placenta and anatomical samples should be buried in a separate pit.
- Waste, such as faeces, urine and vomit, and liquid waste from washing, can be disposed of in the sanitary sewer or in pit latrines dedicated to HF patients. Standard precautions should be taken to prevent contamination of the environment by faeces and urine. Ebola is likely to inactivate significantly faster in the environment than enteric viruses with known waterborne transmission (e.g., norovirus, hepatitis A virus). Containing excreta for a period of time in a closed tank (at least a week) could allow for natural virus declines. Two tank systems with parallel tanks would help to facilitate this, as one tank could be used until full, then allowed to sit while the next tank is being filled.[16]

Summary table for implementation of IPC best practices duringdirect patient care and related activities

What?	How?	Who is responsible?
Create isolation rooms or areas	• Identify single rooms and prioritise these for patients with known or suspected Ebola virus. • Refer to guidance on setting up an isolation area.[2]	• Coordinator or infection prevention and control (IPC) staff to identify areas/rooms for patient placement. • Health workers to adhere to recommendations and report to the coordinator when a patient is not placed in an isolation room/area.
Restrict all non-essential staff from HF patient care rooms/areas	• Ensure that clinical and nonclinical personnel are assigned exclusively to patient care areas and that members of staff do not move freely between these areas and other clinical areas during the outbreak. • Cohort staff between areas with suspected and those with confirmed haemorrhagic fever (HF) patients. • Use signage to alert restrictions of staff. • Maintain a log of persons entering the room.	• Coordinator and/or IPC staff

What?	How?	Who is responsible?
Limit the number of visitors allowed access to the patient.	• Use signage and other communications to alert restrictions of visitors. Make simple messages understandable for the public but also be careful to avoid stigmatization. • Maintain a log of persons entering the room.	• Coordinator and/or IPC staff • Involve patient or community representatives, if available. • Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Ensure that all staff and visitors correctly use and remove recommended personal protective equipment (PPE).	• Ensure the equipment is always available at the entry of the isolation rooms/areas. • Provide staff and visitors with instructions on the use and correct removal of PPE through training and reminder posters.	• Coordinator and/or IPC staff • Involve patient or community representatives, if available. • Health workers to adhere to recommendations and report to the coordinator when they are not followed. • Another staff member should be assigned to supervise the sequence of putting on and removing PPE by his/her colleague.
Ensure that all staff and visitors perform hand hygiene according to the above recommendations. These hand hygiene actions should be performed when recommended even if PPE is worn.	• Provide staff and visitors with instructions on the importance of hand hygiene best practices through training and reminder posters. • Ensure continuous availability of alcohol-based handrub and soap, water and single-use towels at the isolation room/areas entry and at the point of care.	• Coordinator and/or IPC staff. • Involve patient or community representatives, if available. • Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Limit the use of needles and other sharp objects as much as possible. If this cannot be avoided see instructions in the text.	• Provide staff and carers with instructions on the essential use of needles and sharps through training and reminder posters. • Ensure the equipment is available to do this.	• Health workers to adhere to recommendations.
Dispose of needles and other sharp objects safely.	• Provide staff and carers with instructions on the safe disposal of sharps through training and reminder posters. • Ensure the equipment is available to do this.	• Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Create system of safe management of waste and linen.	• Provide staff and visitors/carers with instructions on the safe management and disposal of waste and linen through training and reminder posters. • Ensure the equipment is available to do this.	• Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care.	• Provide staff with training and visual instructions on the need for essential phlebotomy and laboratory testing.	• Health workers to adhere to recommendations.
Only take a patient out of their room/care area if they are free of virus, or for essential, life-saving tests.	• Provide staff with training and visual instructions on the appropriate times to take the patient from their care area and on precautions to take.	• Health workers to adhere to recommendations and report to the coordinator when they are not followed.
Undertake cleaning of the environment and patient care equipment safely following recommendations in the text.	• Provide staff and visitors/carers with instructions on cleaning through training and reminder posters. • Ensure the equipment is available to undertake recommended cleaning.	• Health workers to adhere to recommendations and report to the coordinator when they are not followed.

5. Non-patient care activities (for suspected or confirmed patients with haemorrhagic fever)

A. Diagnostic laboratory activities

- For procedures to safely collect blood or other samples from people suspected or confirmed to be infected, follow the instructions provided by WHO.[9]
- All laboratory sample processing must take place under a safety cabinet or at least a fume cabinet with exhaust ventilation. Do not carry out any procedure on the open bench.
- Activities such as micro-pipetting and centrifugation can mechanically generate fine aerosols that might pose a risk of transmission of infection through inhalation as well as the risk of direct exposure.
- Laboratory personnel handling potential HF clinical specimens should wear full set of PPE (see section 2), and particulate respirators (e.g., FFP2, or EN certified equivalent, or US NIOSH-certified N95), or powered air purifying respirators (PAPR) when aliquotting, performing centrifugation or undertaking any other procedure that may generate aerosols.
- When removing PPE, avoid any contact between the soiled items (e.g. gloves, gowns) and any area of the face (i.e. eyes, nose or mouth).
- Do not hang up the apron or gown for reuse. Discard immediately.
- Perform hand hygiene immediately after the removal of PPE used during specimen handling and after any contact with potentially contaminated surfaces even when PPE is worn.
- Place specimens in clearly-labelled, non-glass, leak-proof containers and deliver directly to designated specimen handling areas.
- Disinfect all external surfaces of specimen containers thoroughly (using an effective disinfectant) prior to transport.

B. Movement and burial of human remains

- The coordinator and/or the IPC staff should be consulted for any decision making on movement and burial of human remains.
- For this topic, see also the WHO *"Interim manual-Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation"*[1] and the WHO document *"Field situation: How to conduct safe and dignified burial of a patient who has died from suspected or confirmed Ebola virus disease"*.[17]
- The handling of human remains should be kept to a minimum. The following recommendations should be adhered to in principle, but may need some adaptation to take account of cultural and religious concerns:
  - ***Wear the full set of PPE*** (see section 2), and ***heavy duty/rubber gloves*** to handle the dead body of a suspected or confirmed case of HF. Place the body in a double bag, wipe over the surface of each body bag with a suitable disinfectant (e.g., 0.5% chlorine solution) and seal and label with the indication of highly-infectious material. Immediately move the body to the mortuary or the cemetery.
  - PPE should be put on at the site of collection of human remains, worn during the process of collection and placement in body bags, and should be removed immediately after. Hand hygiene should be performed immediately following the removal of PPE.
  - Remains should not be sprayed, washed or embalmed. Any practice of washing the remains in preparation for "clean burials" should be discouraged.
  - Only trained personnel should handle remains during the outbreak.
  - PPE is not required for individuals driving or riding a vehicle to collect human remains, provided that drivers or riders will not be handling a dead body of a suspected or confirmed case of HF.
  - After wrapping in sealed, leak-proof bags, human remains should be placed inside a coffin if possible, and buried promptly.

C. Post-mortem examinations

- The coordinator and/or the IPC staff should be consulted for any decision making on post-mortem examinations.
- Post-mortem examination of HF patient remains should be limited to essential evaluations only and should be performed by trained personnel.
- Personnel examining remains should ***wear full set of PPE*** (see section 2).
- In addition, personnel performing autopsies of known or suspected HF patients should wear a particulate respirator (e.g., FFP2, or EN certified equivalent, or US NIOSH-certified N95) or a PAPR.
- When removing PPE, avoid any contact between soiled gloves or equipment and the face (i.e. eyes, nose or mouth).
- Hand hygiene should be performed immediately following the removal of PPE.
- Place specimens in clearly-labelled, non-glass, leak-proof containers and deliver directly to designated specimen handling areas.
- All external surfaces of specimen containers should be thoroughly disinfected (using an effective disinfectant) prior to transport.
- Tissue or body fluids for disposal should be carefully placed in clearly marked, sealed containers for incineration.

D. Managing exposure to virus through body fluids including blood

- Persons including HCWs with percutaneous or muco-cutaneous exposure to blood, body fluids, secretions, or excretions from a patient with suspected or confirmed HF should ***immediately and safely*** stop any current tasks, leave the patient care area, and safely remove PPE. Remove PPE carefully according to the steps indicated in this document (Annex 2) because exposure during PPE removal can be just as dangerous for nosocomial transmission of HF. Immediately after leaving the patient care area, ***wash*** the affected skin surfaces or the percutaneous injury site with soap and water. Accordingly, irrigate mucous membranes (e.g. conjunctiva) with copious amounts of water or an eyewash solution, and not with chlorine solutions or other disinfectants.
- Immediately report the incident to the local coordinator. This is a time-sensitive task and should be performed as soon as the HCW leaves the patient care unit.
- Exposed persons should be ***medically evaluated*** including for other potential exposures (e.g., HIV, HCV) and ***receive follow-up care***, including fever monitoring, twice daily for 21 days after the incident. Immediate consultation with an expert in infectious diseases is recommended for any exposed person who develops fever within 21 days of exposure.
- People suspected of being infected should be cared for/isolated, and the same recommendations outlined in this document must be applied until a negative diagnosis is confirmed.
- Contact tracing and follow-up of family, friends, co-workers and other patients, who may have been exposed to Ebola virus through close contact with the infected health workers is essential.

References

1. Interim manual - Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation World Health Organization, Geneva, 2014; Available from: http://www.who.int/csr/disease/ebola/manual_EVD/en/
2. Clinical Management of Patients with Viral Haemorrhagic Fever: A pocket Guide for the Front-line Health Worker. World Health Organization, Geneva, 2014.
3. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. Centers for Disease Control and Prevention, Atlanta, GA, 2007; Available from: http://www.cdc.gov/HAI/prevent/prevent_pubs.html
4. Standard precautions in health care aide-memoire. World Health Organization, Geneva, 2007; Available from: http://www.who.int/csr/resources/publications/standardprecautions/en/.
5. Personal protective equipment in the context of Filovirus disease outbreak response. Rapid advice guideline. World Health Organization, Geneva, 2014. Available from: http://www.who.int/csr/resources/publications/ebola/ppe-guideline/en/
6. Guideline on hand hygiene in health care in the context of filovirus disease outbreak response. Rapid advice guideline. World Health Organization, Geneva, 2014. Available from: http://www.who.int/csr/resources/publications/ebola/hand-hygiene/en/
7. Hand Hygiene Posters. World Health Organization, Geneva, 2009. ; Available from: http://www.who.int/gpsc/5may/tools/workplace_reminders/en/
8. Glove Use Information Leaflet. World Health Organization, Geneva, 2009. Available from: http://www.who.int/gpsc/5may/tools/training_education/en/
9. Guidance on Personal Protective Equipment To Be Used by Healthcare Workers During Management of Patients with Ebola Virus Disease in U.S. Hospitals, Including Procedures for Putting On (Donning) and Removing (Doffing). Centers for Disease Control and Prevention, Atlanta, GA. Available from: http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html
10. Guide to Local Production: WHO-recommended Handrub Formulations. World Health Organization, Geneva, 2010. Available from: http://www.who.int/gpsc/5may/tools/system_change/en/
11. Personal protective equipment (PPE) in the context of filovirus disease outbreak response. Technical specifications for PPE equipment to be used by health workers providing clinical care for patients. World Health Organization, Geneva, 2014. Available from: http://www.who.int/csr/resources/publications/ebola/ppe-guideline/en/
12. Hoffman PN, Bradley C, Ayliffe GAJ, Health Protection Agency (Great Britain). Disinfection in healthcare. 3rd ed. Malden, Mass: Blackwell Pub. 2004.
13. WHO best practices for injections and related procedures toolkit. World Health Organization, Geneva, 2010. Available from: http://www.who.int/injection_safety/toolbox/9789241599252/en/
14. How to safely collect blood samples from people suspected to be infected with highly infectious blood-borne pathogens (e.g. Ebola) World Health Organization, Geneva, 2014. Available from: http://www.who.int/csr/resources/publications/ebola/blood-collect/en/
15. WHO best practices for injections and related procedures toolkit. World Health Organization, Geneva, 2010; Available from: http://www.who.int/injection_safety/toolbox/9789241599252/en/
16. Management of Hazard Group 4 viral haemorrhagic fevers and similar human infectious diseases of high consequence. Department of Health, United Kingdom, 2012; Available from: http://www.dh.gov.uk/publications.

Annex 1.

Standards Precautions in Heath Care: Key Elements at a Glance

1. Hand hygiene[1]

How to perform hand hygiene:

- Clean your hands by rubbing them with an alcohol-based formulation, as the preferred mean for routine hygienic hand antisepsis if hands are not visibly soiled. It is faster, more effective, and better tolerated by your hands than washing with soap and water.
- Wash your hands with soap and water when hands are visibly dirty or visibly soiled with blood or other body fluids or after using the toilet.

Summary technique:[1]

- Hand washing (40–60 sec): wet hands and apply soap; rub all surfaces; rinse hands and dry thoroughly with a single use towel; use towel to turn off faucet.
- Hand rubbing (20–30 sec): apply enough product to cover all areas of the hands; rub all surfaces until dry.

Summary indications:[1]

1. Before touching a patient: Clean your hands before touching a patient when approaching him/her*
2. Before clean / aseptic procedure: Clean your hands immediately before accessing a critical site with infectious risk for the patient (e.g. a mucous membrane, non-intact skin, an invasive medical device)*
3. After body fluid exposure risk: Clean your hands as soon as the task involving an exposure risk to body fluids has ended (and after glove removal)*
4. After touching a patient: Clean your hands when leaving the patient's side after having touched the patient*
5. After touching patient surroundings: Clean your hands after touching any object or furniture when living the patient surroundings, without having touched the patient*

2. Gloves

- Wear GLOVES when touching blood, body fluids, secretions, excretions, mucous membranes, non-intact skin.
- Change GLOVES between tasks and procedures on the same patient after contact with potentially infectious material.
- Remove THEM after use, before touching non-contaminated items and surfaces, and before going to another patient. Perform hand hygiene immediately after removal.

3. Facial protection (eyes, nose, and mouth)

- Wear (1) a surgical or procedure mask and eye protection (eye visor, goggles) or (2) a face shield to protect mucous membranes of the eyes, nose, and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.

4. Gown

- Wear a gown to protect skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.
- Remove soiled gown as soon as possible, and perform hand hygiene.

5. Prevention of needle stick and injuries from other sharp instruments[2]

Use care when:

- Handling needles, scalpels, and other sharp instruments or devices.

6. Respiratory hygiene and cough etiquette

Persons with respiratory symptoms should apply source control measures:

- Cover their nose and mouth when coughing/sneezing with tissue or mask, dispose of used tissues and masks, and perform hand hygiene after contact with respiratory secretions.

7. Environmental cleaning

- Use adequate procedures for the routine cleaning and disinfection of environmental and other frequently touched surfaces.

8. Linens

Handle, transport, and process used linen in a manner which:

- Prevents skin and mucous membrane exposures and contamination of clothing.
- Avoids transfer of pathogens to other patients and or the environment.

9. Waste disposal

- Ensure safe waste management.
- Treat waste contaminated with blood, body fluids, secretions and excretions as clinical waste, in accordance with local regulations.
- Human tissues and laboratory waste that is directly associated with specimen processing should also be treated as clinical waste.
- Discard single use items properly.

10. Patient care equipment

- Handle equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of pathogens to other patients or the environment.
- Clean, disinfect, and reprocess reusable equipment appropriately before use with another patient.
- Clean used instruments.
- Dispose of used needles and other sharp instruments.

Source: Modified from: Standard precautions in health care aide-memoire. World Health Organization, Geneva, 2007; Available at: http://www.who.int/csr/resources/publications/standardprecautions/en/.

[1] For more details, see: 1) WHO Guidelines on Hand Hygiene in Health Care, 2009, available at: http://www.who.int/gpsc/5may/tools/en/. 2) "Hand Hygiene: Why, How & When?", available at: http://www.who.int/gpsc/5may/tools/training_education/en/

[2] The SIGN Alliance at: http://www.who.int/injection_safety/sign/en/

***NOTE**: Hand hygiene must be performed in all indications described regardless of whether gloves are used or not.

Annex 2.
How to use PPE safely and effectively

Although PPE is the most visible control used to prevent transmission, it must be used in conjunction with administrative and engineering controls. PPE must be correctly selected according to risk assessment and used in a safe manner, and they must be available and accessible to health workers. WHO has recently provided detailed recommendations for selection and use of PPE for health workers providing clinical care for patients with EVD in the rapid advice guideline "Personal Protective Equipment in the Context of Filovirus Disease Outbreak Response".[1]

The fundamental principles guiding PPE selection in the context of an EVD outbreak are as follows:

- Balance should be reached between the best possible protection against EVD while allowing health workers to provide the best possible care to patients with maximum ease, dexterity, comfort and minimal heat-associated stress.
- It is most important to have PPE which protects the mucosae – mouth, nose and eyes – from contaminated droplets and fluids. While it is necessary to ensure that skin is not exposed to splashes or when in direct contact with patient or contaminated objects, protection of the mucosae remains a priority.
- Hands are known to transmit pathogens to other parts of the body or face and to other individuals. Therefore, both hand hygiene and gloves are essential, both to protect the health worker and to prevent transmission to others.
- Face cover, protective foot wear, gowns or coveralls, and head cover are also considered essential to prevent transmission of Ebola virus to health workers.

Detailed technical specifications for all PPE items are available in the recent WHO document[1] accompanying the PPE guideline.[2]

Before putting on PPE

Health workers should be trained on the use of PPE as part of their comprehensive IPC training. The training should address the protocols adopted by a specific facility and include practicing both donning and doffing procedures and performing care-related activities while wearing PPE. Their competency in using PPE should be assessed and tested and, ideally, properly documented.

Adequate resources (human, material and financial) must be made available. Management of the resources should 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 need to be in place for donning and doffing stepwise procedures, management of used and potentially contaminated PPE and associated medical devices, including safe discard and decontamination and re-use if recommended by the manufacturer.

Appropriate spaces should be designated so that PPE can be donned and doffed in separate areas. Use of trained observers to monitor for correct PPE donning and doffing is essential. While having the trained observers is a preferable option, using your "buddy"[3] as an observer is also recommended. Careful preparation in the low risk area (e.g. by preparing medications, adding electrolytes to intravenous solutions, handling necessary "sharps" such as needles and glass vials in low risk areas, etc.) for activity in the high-risk area preserves time with the patient, and increases general efficiency and safety.

When putting on PPE

PPE must be put on in the proper order in the donning area as the PPE cannot be modified while in the patient care area. An observer or a "buddy" should check the integrity of the PPE, making sure it is well adjusted, and write the name and role of the person (e.g. "Nurse Doe"), as well as the time of entry into the high-risk zone on the apron (if disposable) or on the front of the head cover. While using a mirror to check and adjust the PPE may be useful, it never replaces an actual "buddy".

Although the precise sequence of putting on PPE is less important than for the doffing (removing) procedure, it should mirror the reverse order of the removing sequence as closely as possible. It is important also to remember that protecting mucosae is essential, and so eye protection should be put on in a way that it can be taken off as late as possible during the PPE removal process.

Names and times of entry should be properly logged.

Two examples of recommended donning procedures are given below:

Steps recommended to put on PPE including gown

1. Remove all personal items (jewellery, watch, cell phones, pens, etc.).
2. Put on the scrub suit and rubber boots* in the changing room.
3. Move to the clean area at the entrance of the isolation unit.
4. By visual inspection, ensure that all sizes of the PPE set are correct and the quality is appropriate.
5. Undertake the procedure of putting on PPE under the guidance and supervision of a trained observer (colleague/buddy).
6. Perform hand hygiene.
7. Put on gloves (examination, nitrile gloves).
8. Put on disposable gown made of fabric that is tested for resistance to penetration by blood or body fluids OR to blood-borne pathogens.
9. Put on face mask.
10. Put on face shield OR goggles.
11. Put on head and neck covering: surgical bonnet covering neck and sides of the head (preferable with face shield) OR hood.
12. Put on disposable waterproof apron (if not available, use heavy duty, reusable waterproof apron).
13. Put on a second pair of (preferably long cuff) gloves over the cuff of the gown.

**If not available, use closed shoes (slip-ons without shoelaces and fully covering the dorsum of the foot and ankles) and shoe covers (nonslip and preferably impermeable).*

Steps recommended to put on PPE including coverall

1. Remove all personal items (jewellery, watch, cell phones, pens, etc.).
2. Put on scrub suit and rubber boots* in the changing room.
3. Move to the clean area at the entrance of the isolation unit.
4. By visual inspection, ensure that all sizes of the PPE set are correct and the quality is appropriate.
5. Undertake the procedure of putting on PPE under the guidance and supervision of a trained observer (colleague) or buddy.
6. Perform hand hygiene.
7. Put on gloves (examination, nitrile gloves).
8. Put on coverall.**
9. Put on face mask.
10. Put on face shield OR goggles.
11. Put on head and neck covering: surgical bonnet covering neck and sides of the head (preferable with face shield) OR hood.
12. Put on disposable waterproof apron (if not available, use heavy duty, reusable waterproof apron).
13. Put on second pair of (preferably long cuff) gloves over the cuff of the coverall.

If not available, use closed shoes (slip-ons without shoelaces and fully covering the dorsum of the foot and ankles) and shoe covers (nonslip and preferably impermeable).

*** Do not use adhesive tape to attach the gloves. If the inner gloves or the coverall sleeves are not long enough, make a thumb (or middle finger) hole in the coverall sleeve to ensure that your forearm is not exposed when making wide movements. Some coverall models have finger loops attached to sleeves.*

When wearing PPE

Each action in the high-risk area, like patient care everywhere, must result from a careful risk assessment. While safety of health workers is paramount, the safety of patients is no less important, and so all IPC precautions should be applied to prevent transmission to care providers, patients, and other people associated with the process of care.

Some practical precautions to take during patient care include no touching of the eye protection or mask and keeping hands away from the face, limiting the touching of surfaces and body fluids as much as possible, no leaning against walls, no kneeling down, no sitting, no running.

PPE should never be adjusted during patient care. If a partial or total breach in PPE occurs (e.g., gloves separate from sleeves exposing skin, a glove tears, a needlestick injury occurs, googles fog up, the mask becomes saturated and collapses onto the nose or mouth, an insect gets inside the goggles or beneath the face shield), the health worker must leave the patient care zone.

Everyone in the high risk area is responsible for contributing to safe and effective patient care. Regardless of rank, anyone should raise a concern and stop all movement and activity if necessary until the concern is voiced and addressed with a risk assessment.

“Buddies” should observe each other’s behaviour in the patient care area. If a breach in PPE occurs or the health worker feels unwell, he or she should leave the high-risk zone, together with the “buddy”.

When removing PPE

The removal of PPE after leaving the patient care area is a high-risk process. It should follow a stepwise procedure under supervision of a trained observer in a designated doffing area. PPE should be taken off slowly in the correct sequence to reduce the possibility of self-exposure to the Ebola virus.

Disposable PPE items should be disposed in an infectious waste disposal container, without pushing the equipment inside the can by hand. Pushing can be done if a stick is available for that purpose.

Two examples of recommended doffing procedures are shown below.

Steps recommended to remove PPE including gown

1. Always remove PPE under the guidance and supervision of a trained observer (colleague). Ensure that infectious waste containers are available in the doffing area for safe disposal of PPE. Separate containers should be made available for reusable items.
2. Perform hand hygiene on gloved hands.[4]
3. Remove apron leaning forward and taking care to avoid contaminating your hands. When removing the disposable apron, tear it off at the neck and roll it down without touching the front area. Then untie the back and roll the apron forward.
4. Perform hand hygiene on gloved hands.
5. Remove outer pair of gloves and dispose of them safely.
6. Perform hand hygiene on gloved hands.
7. Remove head and neck covering taking care to avoid contaminating your face, by starting from the bottom of the hood at the back and rolling from back to front and from inside to outside, and dispose of safely.
8. Perform hand hygiene on gloved hands.
9. Remove the gown by untying the knot first, then pulling from back to front rolling it from inside to outside and dispose of it safely.
10. Perform hand hygiene on gloved hands.
11. Remove eye protection by pulling the string from behind the head and dispose of safely.
12. Perform hand hygiene on gloved hands.
13. Remove the mask from behind the head, by first untying the bottom string above the head and leaving it hanging in front; and then the top string next, from behind the head, and dispose of safely.
14. Perform hand hygiene on gloved hands.
15. Remove rubber boots without touching them (or overshoes if wearing these). If the same boots are to be used outside of the high-risk zone, keep them on but clean and decontaminate appropriately before leaving the doffing area*.[5]
16. Perform hand hygiene on gloved hands.
17. Remove gloves carefully with appropriate technique and dispose of safely.
18. Perform hand hygiene.

Steps recommended to remove PPE including coverall

1. Always remove PPE under the guidance and supervision of a trained observer (colleague). Ensure that infectious waste containers are available in the doffing area for safe disposal of PPE. Separate containers should be made available for reusable items.
2. Perform hand hygiene on gloved hands.
3. Remove apron leaning forward and taking care to avoid contaminating your hands. When removing disposable[6] apron, tear it off at the neck and roll it down without touching the front area. Then untie the back and roll the apron forward.
4. Perform hand hygiene on gloved hands.
5. Remove head and neck covering (bonnet or hood) taking care to avoid contaminating your face, and dispose of safely.
6. Perform hand hygiene on gloved hands.
7. Remove coverall and outer pair of gloves: Ideally in front of a mirror, tilt head back to reach zipper, unzip completely without touching any skin or scrubs, and start removing coverall from top to bottom. After freeing shoulders, remove the outer gloves[7] while pulling the arms out of the sleeves. With inner gloves roll the coverall, from the waist down and from the inside of the coverall, down to the top of the boots. Use one boot to pull off coverall from other boot and vice versa, then step away from the coverall and dispose of it safely.
8. Perform hand hygiene on gloved hands.
9. Remove eye protection (face shield or goggles) by pulling the string from behind the head and dispose of safely.
10. Remove the mask from behind the head, the bottom string first and the top string next, and dispose of it safely.
11. Perform hand hygiene on gloved hands.
12. Remove rubber boots without touching them (or overshoes if wearing shoes). If the same boots are to be used outside of the high-risk zone, keep them on but clean and decontaminate appropriately before leaving the doffing area.[8]
13. Perform hand hygiene on gloved hands.
14. Remove gloves carefully with appropriate technique and dispose of them safely.
15. Perform hand hygiene.

Notes

[1] Personal protective equipment in the context of Filovirus disease outbreak response. Rapid advice guideline. World Health Organization, Geneva, 2014. Available from: http://www.who.int/csr/resources/publications/ebola/ppeguideline/en/.

[2] Personal protective equipment (PPE) in the context of filovirus disease outbreak response. Technical specifications for PPE equipment to be used by health workers providing clinical care for patients. World Health Organization, Geneva, 2014. Available from: http://www.who.int/csr/resources/publications/ebola/ppe-guideline/en/.

[3] The buddy system in this context is a procedure in which two health workers operate together as a single unit so that they are able to monitor and help each other and share the responsibility for his or her partner's safety.

[4] While working in the patient area, outer gloves should be changed between patients and prior to exiting (change after seeing the last patient).

[5] Appropriate decontamination of boots includes stepping into a footbath with 0.5% chlorine solution (and removing dirt with toilet brush if heavily soiled with mud and/or organic materials) and then wiping all sides with 0.5% chlorine solution. Boots should be disinfected by soaking in a 0.5% chlorine solution for 30 min, at least once a day, then rinsed and dried.

[6] When removing reusable apron over the head, take care to not disrupt face shield/goggles/mask

[7] This technique requires properly fitted gloves. When outer gloves are too tight or inner gloves are too loose and/or hands are sweaty, the outer gloves may need to be removed separately, after removing the apron.

[8] Appropriate decontamination of boots includes stepping into a footbath with 0.5% chlorine solution (and removing dirt with toilet brush if heavily soiled with mud and/or organic materials) and then wiping all sides with 0.5% chlorine solution. Boots should be disinfected by soaking in a 0.5% chlorine solution for 30 min, at least once a day, then rinsed and dried.

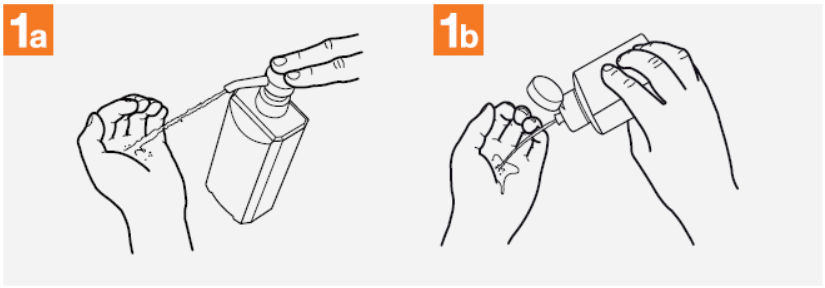
Annex 3.

How to perform hand hygiene by handrubbing or handwashing

How to Handrub?

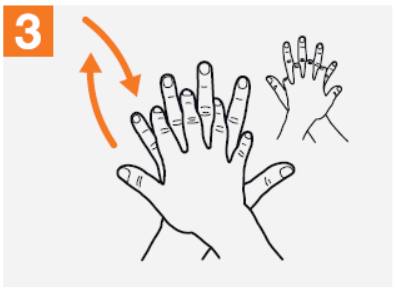
RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

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;



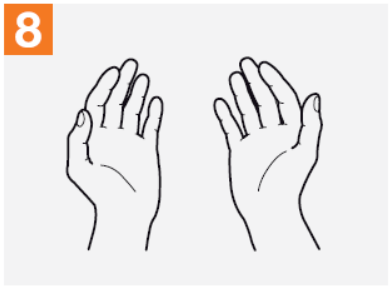
Right palm over left dorsum with interlaced fingers and vice versa;

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.

How to Handwash?

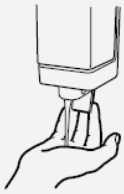
WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the entire procedure: 40-60 seconds

0

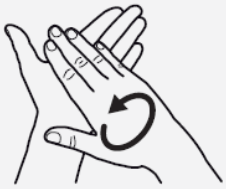
Wet hands with water;

1



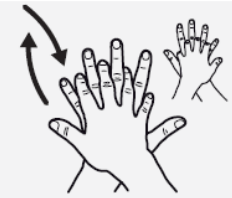
Apply enough soap to cover all hand surfaces;

2



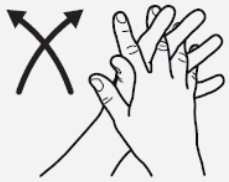
Rub hands palm to palm;

3



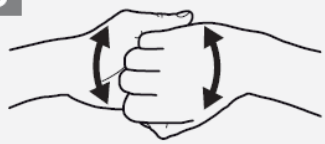
Right palm over left dorsum with interlaced fingers and vice versa;

4



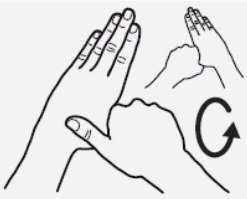
Palm to palm with fingers interlaced;

5



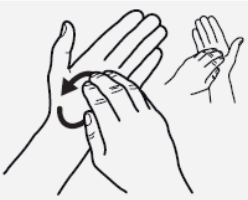
Backs of fingers to opposing palms with fingers interlocked;

6



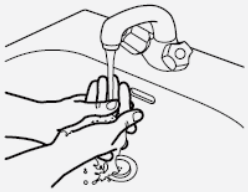
Rotational rubbing of left thumb clasped in right palm and vice versa;

7



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

8

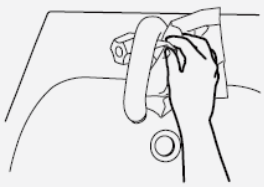


Rinse hands with water;

9

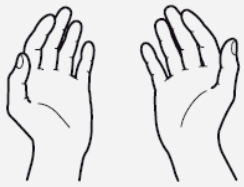
Dry hands thoroughly with a single use towel;

10



Use towel to turn off faucet;

11

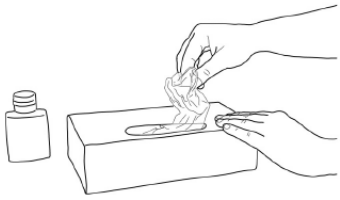


Your hands are now safe.

Annex 4.
Technique for donning and removing non-sterile examination gloves

When the hand hygiene indication occurs before a contact requiring glove use, perform hand hygiene by rubbing with an alcohol-based handrub or by washing with soap and water

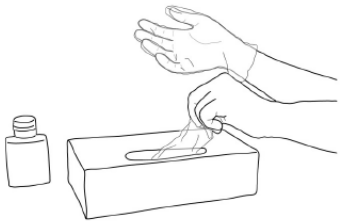
I. HOW TO DON GLOVES:



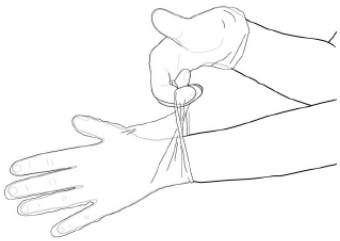
1. Take out a glove from its original box

2. Touch only a restricted surface of the glove corresponding to the wrist (at the top edge of the cuff)

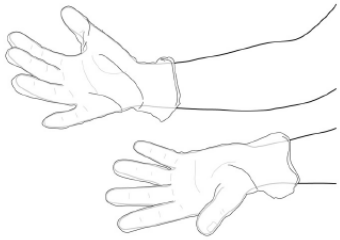
3. Don the first glove



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

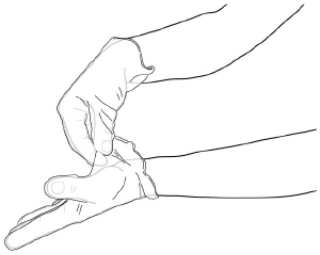


5. To avoid touching the skin of the forearm with the gloved hand, turn the external surface of the glove to be donned on the folded fingers of the gloved hand, thus permitting to glove the second hand

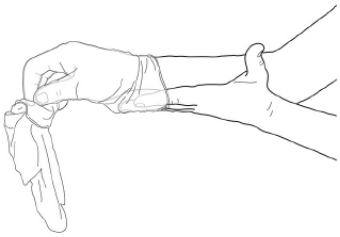


6. Once gloved, hands should not touch anything else that is not defined by indications and conditions for glove use

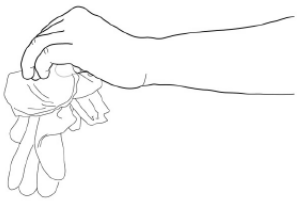
II. HOW TO REMOVE GLOVES:



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

4. Then, perform hand hygiene by rubbing with an alcohol-based handrub or by washing with soap and water

Source: Glove Use Information Leaflet. World Health Organization, Geneva, 2009. Available from: http://www.who.int/gpsc/5may/tools/training_educational/en/

Annex 5.

Guide to Local Production: WHO-recommended Handrub Formulations

GUIDE TO LOCAL PRODUCTION

This is intended to guide a local producer in the actual preparation of the formulation.

Materials required (small volume production)

REAGENTS FOR FORMULATION 1:

- Ethanol 96%
- Hydrogen peroxide 3%
- Glycerol 98%
- Sterile distilled or boiled cold water

REAGENTS FOR FORMULATION 2:

- Isopropyl alcohol 99.8%
- Hydrogen peroxide 3%
- Glycerol 98%
- Sterile distilled or boiled cold water

- 10-litre glass or plastic bottles with screw-threaded stoppers (1), or
- 50-litre plastic tanks (preferably in polypropylene or high density polyethylene, translucent so as to see the liquid level) (2), or
- Stainless steel tanks with a capacity of 80–100 litres (for mixing without overflowing) (3, 4)
- Wooden, plastic or metal paddles for mixing (5)
- Measuring cylinders and measuring jugs (6)
- Plastic or metal funnel
- 100 ml and 500 ml plastic bottles with leak-proof tops (7)
- An alcoholometer: the temperature scale is at the bottom and the ethanol concentration (percentage v/v and w/w) at the top (8)

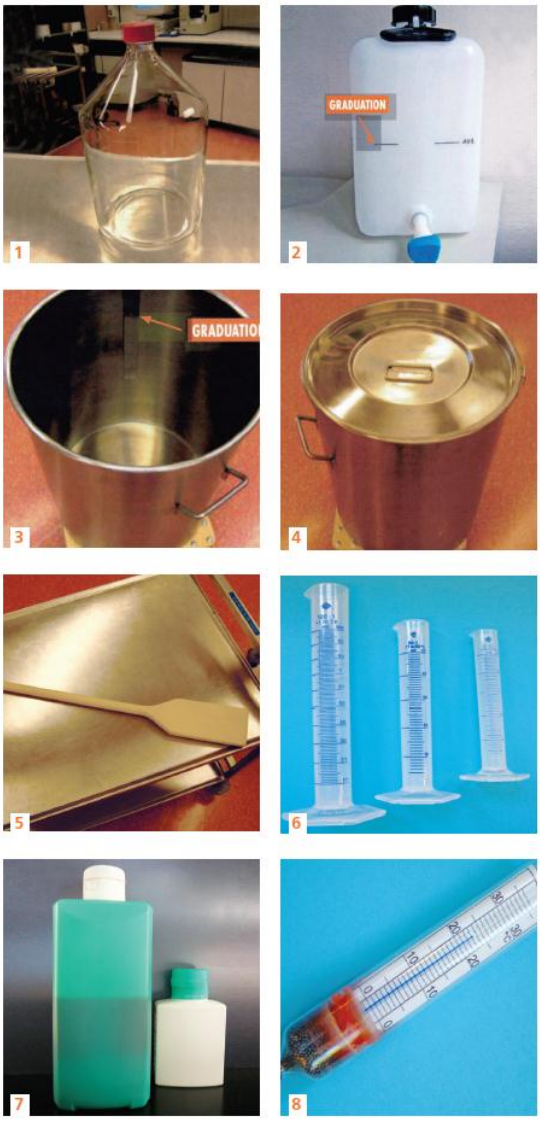
NOTE

- Glycerol: used as humectant, but other emollients may be used for skin care, provided that they are cheap, widely available and miscible in water and alcohol and do not add to toxicity, or promote allergy.
- Hydrogen peroxide: used to inactivate contaminating bacterial spores in the solution and is not an active substance for hand antisepsis.
- Any further additive to both formulations should be clearly labelled and be non-toxic in case of accidental ingestion.
- A colorant may be added to allow differentiation from other fluids, but should not add to toxicity, promote allergy, or interfere with antimicrobial properties. The addition of perfumes or dyes is not recommended due to risk of allergic reactions.

General information

Labelling should be in accordance with national guidelines and should include the following:

- Name of institution, date of production and batch number
- WHO-recommended handrub solution
- For external use only
- Avoid contact with eyes
- Keep out of the reach of children
- Use: Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry
- Composition: ethanol or isopropanol, glycerol and hydrogen peroxide
- Flammable: keep away from flame and heat



Production and storage facilities:

- Production and storage facilities should ideally be air conditioned or cool rooms. ***No naked flames or smoking should be permitted in these areas.***
- WHO-recommended handrub formulations should not be produced in quantities exceeding 50-litres locally or in central pharmacies lacking specialised air conditioning and ventilation.
- Since undiluted ethanol is highly flammable and may ignite at temperatures as low as 10°C, production facilities should directly dilute it to the above-mentioned concentration. The flashpoints of ethanol 80% (v/v) and of isopropyl alcohol 75% (v/v) are 17.5°C and 19°C, respectively.
- National safety guidelines and local legal requirements must be adhered to the storage of ingredients and the final product.

METHOD: 10-LITRE PREPARATIONS

These can be prepared in 10-litre glass or plastic bottles with screw-threaded stoppers.

Recommended amounts of products:

FORMULATION 1:
- Ethanol 96%: **8333 ml**
- Hydrogen peroxide 3%: **417 ml**
- Glycerol 98%: **145 ml**

FORMULATION 2:
- Isopropyl alcohol 99.8%: **7515 ml**
- Hydrogen peroxide 3%: **417 ml**
- Glycerol 98%: **145 ml**

Final products:

FORMULATION 1:
Final concentrations:
- Ethanol 80% (v/v)
- Glycerol 1.45% (v/v)
- Hydrogen peroxide 0.125% (v/v)

FORMULATION 2:
Final concentrations:
- Isopropyl alcohol 75% (v
- Glycerol 1.45% (v/v)
- Hydrogen peroxide 0.125% (v/v)

Step by step preparation:

1. The alcohol for the formula to be used is poured into the large bottle or tank up to the graduated mark.

2. Hydrogen peroxide is added using the measuring cylinder.

. Glycerol is added using a measuring cylinder. As glycerol is very viscous and sticks to the wall of the measuring cylinder, it should be rinsed with some sterile distilled or cold boiled water and then emptied into the bottle/tank.

4. The bottle/tank is then topped up to the 10-litre mark with sterile distilled or cold boiled water.

5. The lid or the screw cap is placed on the tank/bottle as soon as possible after preparation, in order to prevent evaporation.

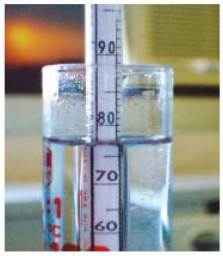
6. The solution is mixed by shaking gently where appropriate or by using a paddle.

7. Immediately divide up the solution into its final containers (e.g. 500 or 100 ml plastic bottles), and place the bottles in quarantine for 72 hours before use. This allows time for any spores present in the alcohol or the new/re-used bottles to be destroyed.

Quality control

1. Pre-production analysis should be made every time an analysis certificate is not available to guarantee the titration of alcohol (i.e. local production). Verify the alcohol concentration with the alcoholmeter and make the necessary adjustments in volume in the preparation formulation to obtain the final recommended concentration.

2. Post-production analysis is mandatory if either ethanol or an isopropanol solution is used. Use the alcoholmeter to control the alcohol concentration of the final use solution. The accepted limits should be fixed to ± 5% of the target concentration (75%–85% for ethanol).



3. The alcoholmeter shown in this information pamphlet is for use with ethanol; if used to control an isopropanol solution, a 75% solution will show 77% (± 1%) on the scale at 25°C.

Source: Guide to Local Production: WHO-recommended Handrub Formulations, http://www.who.int/gpsc/5may/tools/system_change/en/

Annex 6.

How to make chlorine solutions for environmental disinfection

Example I - Using Liquid Bleach

Chlorine in liquid bleach comes in different concentrations. Any concentration can be used to make a dilute chlorine solution by applying the following formula:

$$\left[\frac{\%\ \text{chlorine in liquid bleach}}{\%\ \text{chlorine desired}}\right] - 1 = \text{Total parts of water for each part bleach}\dagger$$

Example: To make a 0.5% chlorine solution from 3.5%‡ bleach:

$$\left[\frac{3.5\%}{0.5\%}\right] - 1 = 7 - 1 = 6 \text{ parts water for each part bleach}$$

Therefore, you must add 1 part 3.5% bleach to 6 parts water to make a 0.5% chlorine solution.

† "Parts" can be used for any unit of measure (e.g. ounce, litre or gallon) or any container used for measuring, such as a pitcher.

‡ In countries where French products are available, the amount of active chlorine is usually expressed in degrees chlorum. One degree chlorum is equivalent to 0.3% active chlorine.

Example II - Using Bleach Powder

If using bleach powder,† calculate the amount of bleach to be mixed with each litre of water by using the following formula:

$$\left[\frac{\%\ \text{chlorine desired}}{\%\ \text{chlorine in bleach powder}}\right] \times 1\,000 = \text{Grams of bleach powder for each litre of water}$$

Example: To make a 0.5% chlorine solution from calcium hypochlorite (bleach) powder containing 35% active chlorine:

$$\left[\frac{0.5\%}{35\%}\right] \times 1\,000 = 0.0143 \times 1\,000 = 14.3$$

Therefore, you must dissolve 14.3 grams of calcium hypochlorite (bleach) powder in each litre of water used to make a 0.5% chlorine solution.

† When bleach powder is used; the resulting chlorine solution is likely to be cloudy (milky).

Example III - Formula for Making a Dilute Solution from a Concentrated Solution

$$\text{Total Parts (TP) } (H_2O) = \left[\frac{\%\ \text{Concentrate}}{\%\ \text{Dilute}}\right] - 1$$

Example: To make a dilute solution (0.1%) from 5% concentrated solution.

$$\text{Calculate TP } (H_2O) = \left[\frac{5.0\%}{0.1\%}\right] - 1 = 50 - 1 = 49$$

Take 1 part concentrated solution and add to 49 parts boiled (filtered if necessary) water.

Source:

AVSC International (1999). Infection Prevention Curriculum. Teacher's Manual. New York, p.267.