



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive



Irish guidelines on Personal Protective Equipment (PPE) to be used in suspected or confirmed Ebola virus disease (EVD) scenarios

Version 2.0

13/04/2015

Table of contents

Glossary	3
Introduction & key facts	4
Preventing transmission of Ebola virus	5
Selection of personal protective equipment	7
Recommended levels of personal protective equipment	8
PPE in the community or primary care setting.....	8
PPE in the acute hospital setting.....	9
Staff training in the use of personal protective equipment	10
Level 1 PPE.....	12
Level 2 PPE.....	12
PPE key points	14
PPE zones	15
Trained observer (PPE buddy)	17
Trained Observer PPE.....	17
References	19
Appendices	20
Appendix 1 Technical specifications for each PPE item.....	20
Appendix 2 Description of powered air purifying respirator (PAPR).....	28
Appendix 3 Donning and doffing level 1 PPE.....	30
Appendix 4 Donning and doffing level 2 PPE: Option A (gown).....	32
Appendix 5 Donning and doffing level 2 PPE: Option B (coverall).....	38
Appendix 6 PPE training.....	44
Appendix 7 PPE breach protocol.....	46
Appendix 8 EVD SAC PPE subgroup membership.....	47
List of Tables	
Table 1. Levels of PPE and clinical scenarios.....	8
Table 2. Level 1 PPE.....	12
Table 3. Level 2 PPE: Option A (Fluid resistant long-sleeved gown).....	13
Table 4. Level 2 PPE: Option B (Coverall).....	13
Table 5. Level 2 PPE: Option C (PAPR and its accompanying suit).....	13
List of Figures	
Figure 1. Key principles of EVD preparedness for the acute hospital setting.....	6

Glossary

ABHR	Alcohol-based hand rub
ACDP	Advisory Committee on Dangerous Pathogens
AGP	Aerosol generating procedures
APF	Assigned protection factor
BBV	Blood borne virus
CDC	US Centers for Disease Control and Prevention
ECDC	European Centre for Disease Prevention & Control
EMI	Emergency management of injuries
EVD	Ebola virus disease
FFP	Filtering face piece
HCW	Healthcare worker
IPCN	Infection prevention and control nurse
NIU	National Isolation Unit
NVRL	National Virus Reference Laboratory
PAPR	Powered air purifying respirator
PCR	Polymerase chain reaction
PPD	Personal protective distance
PPE	Personal protective equipment
RPD	Respiratory protection device
RPE	Respiratory protection equipment
SAC	Scientific Advisory Committee
WHO	World Health Organization

Introduction & key facts

- Ebola virus disease (EVD) is a rare and potentially fatal zoonotic infection, caused by the Ebola virus
- The virus is spread via direct contact with blood or body fluids (saliva, vomit, faeces, urine, semen) of a person with symptomatic infection, followed by the entry of infected blood or body fluids through unprotected broken skin or mucous membranes (eyes, mouth or nose)
- There is currently no evidence to support airborne transmission of Ebola virus. Because splashes or droplets and aerosol generation can arise in certain clinical scenarios (e.g., coughing and vomiting) and aerosol generating procedures (AGP) may occur as part of patient care (e.g., intubation), as a precautionary measure, a fluid resistant filtering face protection 3 (FFP3) respirator is recommended as part of level 2 personal protective equipment (PPE) for scenarios of suspected or confirmed EVD
- If an exposed person becomes infected with Ebola virus, it may take up to 21 days for symptoms of infection to develop. Most develop symptoms between eight and 11 days after exposure
- Transmission from an asymptomatic patient (i.e., during the incubation period of EVD) has not been documented. An infected person becomes more infectious as EVD progresses, because the volume of the infecting virus increases and the infection results in increased production of infectious body fluids
- The lowest transmission risk is in the care of minimally symptomatic patients (febrile) and the highest risk is in the care of highly symptomatic patients with secretions and excretions (e.g., diarrhoea, vomiting or bleeding), also known as fluid producers
- Consistent application of standard precautions by every healthcare worker (HCW) every time remains the most effective way to prevent transmission of Ebola virus, as well as other communicable diseases
- HCWs are at risk of acquiring EVD in scenarios where there is unprotected direct contact of broken skin or mucous membranes with infectious secretions and excretions. Therefore, the use of PPE is recommended where direct contact is anticipated. The level of PPE to be worn will depend on the outcome of the risk assessment. Where direct contact can be avoided, maintaining a minimum personal protective distance (PPD) of one metre (three feet) between the HCW and the patient is recommended. The PPD should be further extended if the patient is a fluid producer
- Ebola virus is easily inactivated by chemical disinfectants, including alcohol and chlorine and by heat (1 hour at 58 – 60°C or 30 minutes at 75°C)

Preventing transmission of Ebola virus

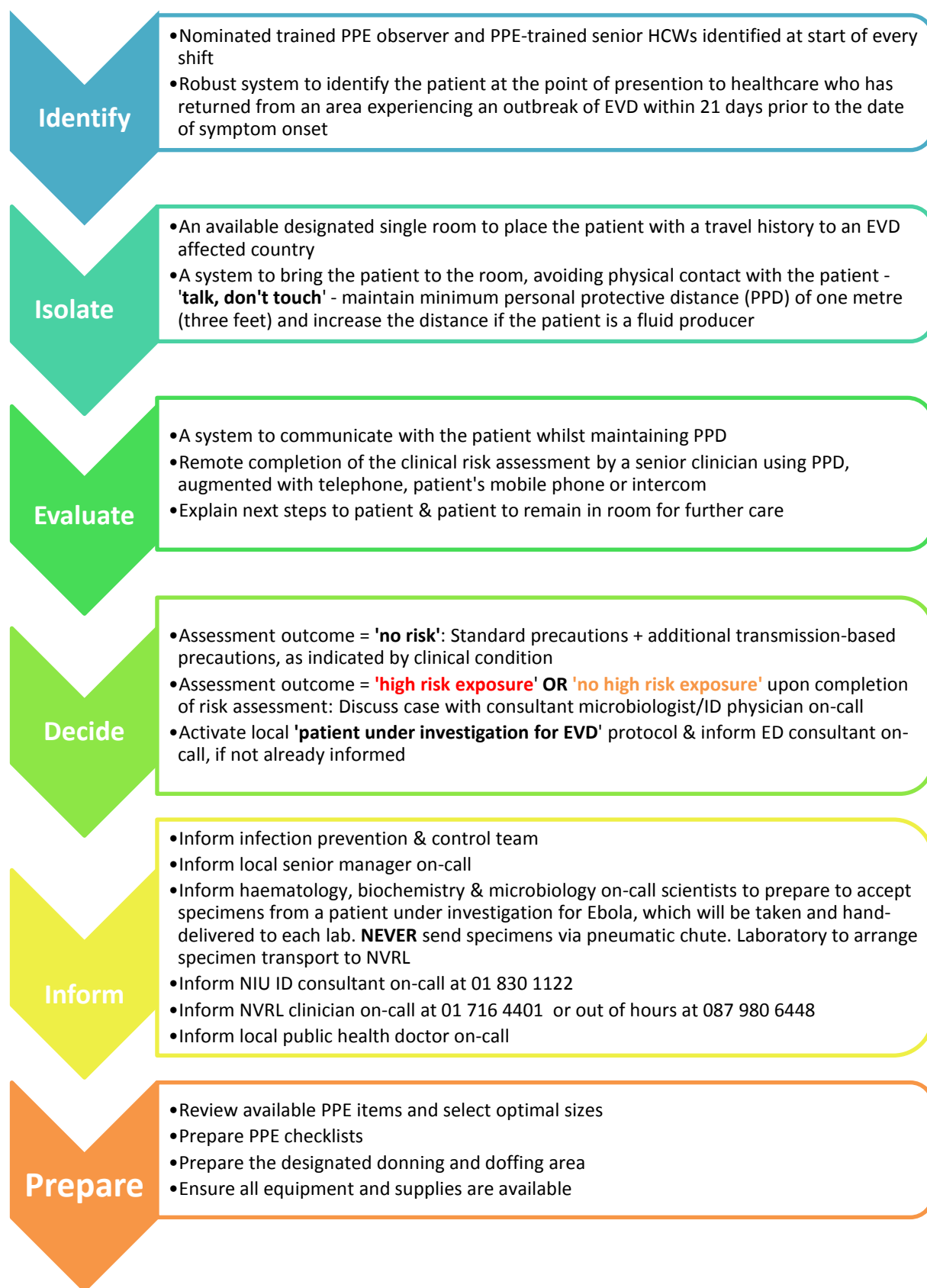
In the context of the widespread and ongoing outbreak of EVD in west Africa, it is important that all Irish healthcare settings have an EVD preparedness plan, supported by regular local HCW training and simulated local practice exercises to test the plan.

PPE is just one element in a series of preventative measures which need to be implemented as part of a local EVD preparedness plan. The efficacy of PPE is likely to be compromised if careful attention is not paid to all of the other preparedness elements. Some of the key principles in local EVD preparedness in the acute hospital setting are outlined in *Figure 1*.

For all settings (primary, pre-hospital care and acute hospitals), the early identification of a patient who has departed an Ebola-affected country within 21 days prior to symptom onset and who presents with fever or history of fever should lead to immediate action, including prompt patient placement in a designated area, with tissues and disposable emesis bags readily available to the patient. Verbal communication with the patient is essential, so that the patient understands the rationale for and steps involved in the assessment process. A patient information leaflet (in English and French) should be also available.

In the initial stages of the risk assessment, a key protective measure is avoidance of direct physical contact with the patient, with the HCW adopting a **'talk, don't touch'** approach and maintaining a **personal protective distance (PPD)** from the patient of a minimum of one metre (three feet). The PPD should be further extended if the patient is a fluid producer. The PPD approach is complemented by a system to communicate remotely with the patient; via telephone, the patient's own mobile phone or an intercom, as a means to facilitate completion of the initial clinical risk assessment. An informed decision can then be made regarding the appropriate level of PPE to be donned for completion of the physical assessment, investigation and ongoing patient care.

Figure 1. Key principles of Ebola virus disease (EVD) preparedness for the acute hospital setting



Selection of personal protective equipment

The PPE recommendations in this guideline for Ireland take into account legislative requirements, recent experiences and publications, including those from the US Centers for Disease Control and Prevention (CDC), the World Health Organisation (WHO), the European Centre for Disease Prevention & Control (ECDC) and the Advisory Committee on Dangerous Pathogens (ACDP) [1-6]. These guidelines will be kept under review, as new evidence becomes available. The PPE items recommended in this guideline have been selected based on recommended technical specifications, where such specifications are available. As part of the guideline development process, the PPE subgroup also reviewed individual PPE items currently available on the Irish market. As newer PPE items become available, they can be evaluated. The PPE subgroup recommends that different PPE options are available to HCWs, taking into account the following considerations:

- Compliance with technical specifications and legislative requirements (mandatory)
- Available sizes
- Available lengths (where applicable) and designs
- The wearer's bodily habitus
- Breathability of materials
- Comfort and flexibility
- Length of time to be spent with the patient
- Anticipated level of direct patient contact
- Availability on the market

Regardless of the PPE item selected, the PPE subgroup recommends that the wearer must receive documented training in the safe use of each item. At the time of writing this guideline, the PPE subgroup are aware of design and procurement issues for certain PPE items, both within Ireland and other European countries.

The PPE subgroup agrees with guidance issued by CDC and WHO, that PPE options for body coverage of either long-sleeved gowns or coveralls provide equivalent protection if worn, donned and doffed correctly.

Appendix 1 provides technical specifications of each recommended PPE item.

Recommended levels of personal protective equipment

It is expected that every HCW will observe standard precautions, including compliance with the WHO ‘five moments for hand hygiene’ in the care of every patient every time, regardless of perceived infection risk.

In order to determine the appropriate PPE to be worn, in scenarios where direct physical contact with the patient is required, the HCW must first undertake a clinical risk assessment, to determine the patient’s risk of EVD and current symptoms. Wherever possible, a personal protective distance (PPD) of a minimum of one metre (three feet) should be maintained between the HCW and the patient to enable the clinical risk assessment to be completed remotely.

Two levels of PPE are recommended (level 1 and level 2) in scenarios where EVD is included in the patient’s differential diagnosis and direct physical contact with the patient is required (**Table 1**).

Table 1. Levels of PPE and clinical scenarios

PPE	Clinical scenarios
Level 1	Direct physical contact with the patient with suspected EVD, who has minimal symptoms (i.e., fever, without symptoms of fluid production, such as vomiting, diarrhoea or bleeding)
Level 2	<p>First clinical assessment, investigation and care of the patient in any of the following scenarios:</p> <ul style="list-style-type: none"> (a) An accurate or a controlled risk assessment cannot take place (e.g., an unconscious or critically ill patient, where credible suspicion of EVD has been raised) (b) Uncontrolled patient secretions or excretions: diarrhoea, vomiting or bleeding (i.e., patient is a fluid producer) (c) Patient with communication difficulties <p>If access to level 2 PPE is not available (e.g., community or primary care setting), the HCW must first consider his or her personal safety, maintain a PPD and contact the ambulance service, communicating the need to activate the referral pathway to hospital for a patient with suspected EVD</p> <p>Ongoing care of the patient who awaits results of Ebola virus polymerase chain reaction (PCR) test at the National Virus Reference Laboratory (NVRL) in context of above scenarios (a), (b) or (c)</p> <p>Ongoing care of the patient with a first negative PCR result for Ebola virus, but for whom an alternative diagnosis has not yet been reached in context of above scenarios (a), (b) or (c)</p> <p>Ongoing care of the patient with confirmed EVD</p> <p>Contact with the body of a person who has died from suspected or confirmed EVD</p> <p><u>Clinical judgement should always be used by a senior HCW when deciding upon the appropriate level of PPE for any clinical scenario</u></p>

PPE in the community or primary care setting

In the community or primary care setting, once EVD is suspected, the patient should be led to a designated single room, maintaining a personal protective distance (PPD) of a minimum of one metre (three feet), with the distance increased if the patient is a fluid producer.

Direct physical contact with the patient should be avoided and clinical risk assessment conducted remotely, using a phone or patient's mobile phone, where feasible. Temperature monitoring is not essential, but could be performed directly by the patient. Laboratory tests are not indicated outside of the acute hospital setting.

If physical contact with the patient is required prior to transfer to the Emergency Department and the patient does not have symptoms of fluid production (e.g., no vomiting, diarrhoea or bleeding), then level 1 PPE should be donned prior to any physical contact. However, if the patient has symptoms of fluid production (e.g., vomiting, diarrhoea or bleeding), level 2 PPE is indicated. As level 2 PPE is not available in community or primary care settings, the HCW must first consider his or her personal safety, maintain a PPD and contact the ambulance service, communicating the need to activate the referral pathway to hospital for a patient with suspected EVD.

PPE in the acute hospital setting

Upon presentation of the patient to the acute hospital, once the suspicion of EVD has been raised, the patient should be placed in a designated single room. Wherever possible, completion of the clinical risk assessment should be conducted remotely by a senior HCW (maintaining PPD or communicating with the patient via phone, mobile phone or intercom). Next, an informed decision can be made on the level of PPE that is required for physical assessment, investigation and ongoing patient care.

All HCWs should be familiar with donning and doffing procedures for level 1 PPE. Ideally, every HCW would be formally trained in the use of level 2 PPE. However, the logistics involved in providing training, including refresher training, for every HCW in use of level 2 PPE are impractical. Therefore, training and refresher training on level 2 PPE should primarily focus on senior clinical and support staff working in areas where direct physical contact with a patient, patient specimens or contaminated physical environment may arise in scenarios of suspected or confirmed EVD:

- Ambulance service
- Emergency department
- Designated clinical area for accommodation of patient with suspected or confirmed EVD
- Hospital laboratory
- NVRL
- Infectious diseases clinic
- Critical care unit
- National Isolation Unit (NIU)

Where a clinical risk assessment cannot be performed remotely, if there are difficulties in communicating with the patient (e.g. language barrier or diminished level of consciousness), or the patient is a fluid producer (e.g., vomiting, diarrhoea or bleeding), the HCW should use clinical judgement, adopting the precautionary principle, initially selecting a higher level of PPE, pending availability of further information.

The number of HCWs wearing PPE who are required for patient care should be determined by the clinical needs of the patient.

Staff training in the use of personal protective equipment

As level 2 PPE will be unfamiliar to the majority of HCWs, it is critically important that every HCW who may be likely to come into contact with a patient or specimens from a patient with suspected or confirmed EVD receives practical training on selecting the optimal types and sizes of each item of their own level 2 PPE kit, along with instructions on the sequence of how to put on (don) and to take off (doff) each item. Formal records of HCW training on level 2 PPE must be maintained locally. Only HCWs who have been trained and are comfortable in donning and doffing level 2 PPE should be permitted to have involvement in the investigation and care of a patient with suspected or confirmed EVD. Local records of PPE sizes selected by HCWs at training should be retained to monitor local PPE stock requirements and optimise stock management. Consideration should also be given to providing each trained HCW with a wallet-sized card on which to record their preferred size for each item of PPE.

As the sequence of level 2 PPE donning and doffing is quite complex, it is critically important that these procedures are directly observed and guided by a trained observer using a checklist, which is completed and retained locally. It is important that the HCW also has the opportunity to practice the trained observer role as part of level 2 PPE training and that every HCW understands that safe donning and doffing of PPE cannot occur without supervision and direction. **The trained observer takes charge over and takes time on every donning and doffing procedure.**

HCWs must be provided with the opportunity to refresh their PPE training periodically (a six week interval between initial training and first refresher training is recommended) and to participate in simulated exercises to test the local EVD preparedness plan. Training records must be current and accessible.

It may not be possible for some HCWs to be involved in the investigation or care of a patient with suspected or confirmed EVD [e.g., pregnancy, immunocompromising illness or if available PPE items

are not compatible with a person's bodily habitus (e.g., facial hair impedes a correct respirator fit)]. Such issues should be identified prior to undertaking PPE training. The HCW should be referred to the occupational health department for assessment, before PPE training takes place and the HCW is deemed ready to be involved in the investigation or care of a patient with suspected or confirmed EVD.

There is currently no evidence to support airborne transmission of Ebola virus. Because splashes or droplets and aerosol generation can arise in certain clinical scenarios (e.g., coughing and vomiting) and aerosol generating procedures (AGP) may occur as part of patient care (e.g., intubation), as a precautionary measure, a fluid-resistant filtering face protection 3 (FFP3) respirator is recommended as part of level 2 PPE. [1-5].

In certain scenarios (lengthy durations of anticipated direct patient contact, wearer's facial contours or facial hair interferes with proper respirator fit), the use of a powered air purifying respirator (PAPR) and its accompanying suit could be considered, with the PAPR to provide no less filtration than a FFP3 respirator. Where a PAPR is used, there must also be documented training on donning, doffing and observing of donning and doffing, along with a local protocol on cleaning and disinfection of any reusable PAPR components, disposal of single use PAPR components and a PAPR maintenance schedule, all in keeping with the manufacturer's instructions. A description of a PAPR is provided in **Appendix 2**. Instructions for donning and doffing a PAPR and its accompanying suit are not provided in this guideline and are entirely dependent on the product selected and manufacturer's instructions.

The local PPE training programme should include HCW training on the safe donning, use and doffing of respiratory PPE. This would include a programme for fit-testing, undertaking a seal check each time a respirator is worn and avoiding self-contamination during doffing.

The PPE subgroup of the EVD Scientific Advisory Committee (SAC) acknowledges that implementing local EVD preparedness, in particular training of HCW in level 2 PPE is both time and resource-intensive. However, where HCW acquisition of EVD has occurred both in outbreak and non-outbreak settings, a lack of preparedness and training have been cited as potential contributory factors.

The PPE donning and doffing sequences that follow are based on scenarios where direct contact with a patient or the patient's environment is anticipated in a clinical setting. The sequences may need minor adaptation for use in scenarios where patient specimens are being tested in the hospital laboratory setting.

Level 1 PPE

Level 1 PPE is the minimum PPE kit recommended for initial physical contact with a patient who has departed an Ebola-affected country within 21 days prior to symptom onset, who presents with fever or history of fever and who does not have diarrhoea, vomiting or bleeding (i.e., not a fluid producer). The items in the level 1 PPE kit are listed in **Table 2** and a recommended sequence for donning and doffing level 1 PPE is provided in **Appendix 3**.

Table 2. Level 1 PPE

Item number	Item
1	Fluid resistant long-sleeved gown
2	Fluid resistant surgical face mask
3	Goggles OR face shield
4	Gloves†

†Gloves with extended cuffs (intermediate length or long) may be preferred if regular length gloves do not fit securely over the gown cuff

Level 2 PPE

Level 2 PPE is recommended to minimise the risk of exposure of the HCW's skin or mucous membranes to potentially infectious secretions and excretions, which may be encountered during physical assessment, investigation of specimens and ongoing clinical care of the patient with suspected or confirmed EVD.

Within level 2 PPE, there are three options, with each considered equally effective:

- **Option A** – Fluid resistant long-sleeved gown
- **Option B** – Fluid resistant coverall
- **Option C** – Powered air purifying respirator (PAPR) and its accompanying suit

The items in the level 2 PPE kit are listed in **Tables 3 (Option A), 4 (Option B) and 5 (Option C)**. A suggested sequence for donning and doffing level 2 PPE (Option A) is provided in **Appendix 4** and for level 2 PPE (Option B) in **Appendix 5**. A suggested EVD level 2 PPE training course structure is provided in **Appendix 6**.

Table 3. Level 2 PPE: Option A (Fluid resistant long-sleeved gown)

Level 2 PPE: Option A (Fluid resistant long-sleeved gown)
Double gloves: intermediate length inner gloves and longer outer gloves
Fluid resistant long-sleeved gown
Plastic apron
FFP3 respirator
Face shield
Goggles (optional if face shield provides sufficient eye coverage)
Hood
Knee high rubber boots

Table 4. Level 2 PPE: Option B (Coverall)

Level 2 PPE: Option B (Coverall)
Double gloves: intermediate length inner gloves and longer outer gloves
Fluid resistant coverall with integrated hood
Plastic apron
FFP3 respirator)
Face shield
Goggles (optional if face shield provides sufficient eye coverage)
Hood
Knee high rubber boots

Table 5. Level 2 PPE: Option C (PAPR and its accompanying suit)

Level 2 PPE: Option C: Powered air purifying respirator (PAPR) and its accompanying suit
Double gloves: intermediate length inner glove and longer outer glove
PAPR suit
PAPR apparatus
Plastic apron
Knee high rubber boots

A description of a PAPR is provided in **Appendix 2**. Instructions for donning and doffing a PAPR and its accompanying suit are not provided in this guideline and are entirely dependent on the product selected and manufacturer's instructions. Additional PPE items might be required in the PAPR PPE kit.

PPE key points

- The use of both a face shield and goggles is recommended in this guideline. However, if the face shield design provides sufficient coverage of the HCW's eyes and meets the recommended specification (**Appendix 1**), goggles can be safely omitted from the PPE kit, unless the HCW's preference is to wear both
- The use of a plastic apron is recommended in this guideline. However, it could be considered an optional item, to be added based on risk assessment, with apron use preferred in scenarios where the patient is a fluid producer
- The PPE items recommended in this guideline should be single-use (i.e., disposed of after each use)
- Provided a PPE item is not legally designated as single-use only*, decontamination could be considered in a scenario where ongoing care of the patient with EVD is required (e.g., NIU). For example, knee high rubber boots could be potentially reused. In that scenario, incorporation of fluid-resistant disposable boot covers into the local donning and doffing checklist, along with a local decontamination policy for the knee high rubber boots would be required. Addition of boot covers over boots to the PPE kit will add to the complexity of the donning and doffing procedure



*Single use only symbol

- A considerable volume of waste will be generated during patient care. Waste generated in the care of a patient with suspected or confirmed EVD is managed as Category A waste and a local EVD waste management policy is required [7]
- As the sequence of level 2 PPE donning and doffing is quite complex, it is critically important that these procedures are directly observed and guided by a trained observer using a checklist. The HCW must understand that safe donning and doffing of PPE cannot occur without supervision and direction. The trained observer takes charge over and takes time on every donning and doffing procedure

PPE zones

Donning and doffing procedures must take place in separate designated areas/zones. It is useful to demarcate each zone using tape and to use consistent traffic light terminology when referring to each: red zone (patient area), amber zone (doffing area), green zone (donning area).

PPE storage and donning area (Green Zone)

- A designated area near the patient room where decontaminated equipment and new PPE are stored and where PPE is donned
- Potentially contaminated equipment, used PPE or waste from the patient area (red zone) must not be stored in the green zone. If waste is transported through this area, it must be contained in an appropriate waste container
- Placement of a mirror in the donning area should be considered, so the HCW can use the mirror to verify the integrity of their PPE and help to identify potential breaches in PPE
- PPE must be comfortable and secure before leaving the donning area (green zone), as it cannot be modified once the HCW enters the patient area (red zone)
- Signage highlighting key steps in the donning sequence should be displayed

Patient area (Red Zone)

- Single patient room with the door kept closed
- PPE must be worn by any HCW entering the red zone
- Items removed from the red zone should be considered potentially contaminated

PPE doffing area (Amber Zone)

- A designated area near the patient room where doffing of PPE takes place and discarded PPE is placed in appropriate waste containers
- If space does not permit a separate donning and doffing area, a clearly designated area beside the door inside the patient room could be used for some of the doffing steps, as long as the following criteria are met:
 - The doffing steps can be seen and verified by the trained observer, (e.g., through a window)
 - The designated doffing area inside the patient room, is not used for any other purpose
 - The HCW has access to a stock of clean gloves and alcohol-based hand rub (ABHR) while in the patient room, which are not within the patient's reach

- The doffing area must have:
 - Surfaces that are easy to clean and disinfect
 - Adequate space for doffing, including space for a seat (which can be easily cleaned), to allow the HCW to sit down to remove the knee high rubber boots
 - Adequate supplies of disinfectant (e.g., hypochlorite solution 1000 ppm) and/or wipes for disinfection of PPE
 - Adequate supplies of ABHR for performing hand hygiene, as indicated after doffing steps
 - Touch-free automatic ABHR dispensers
 - Leak-proof designated category A waste containers for discarding used PPE, as specified in Guidance Note H1402. Packaging and Transport of waste from suspect and confirmed cases of the Ebola Virus [7]
- Signage highlighting key steps in the doffing sequence should be displayed, with reminders for HCW to perform hand hygiene using ABHR between specified doffing steps and to avoid touching the face
- Placement of a mirror in the doffing area should be considered, so the HCW can use the mirror to verify the integrity of their PPE and help to identify potential breaches in PPE

Trained observer (PPE buddy)

- As the sequence of level 2 PPE donning and doffing is quite complex, it is critically important that these procedures are directly observed and guided by a trained observer using checklists (**Appendices 4 & 5**)
- Safe doffing of PPE is critical. Used PPE is potentially contaminated with Ebola virus
- The HCW must understand that safe donning and doffing of PPE cannot occur without supervision and direction. The trained observer takes charge over and takes time on every donning and doffing procedure
- Every HCW who is trained on level 2 PPE must get the opportunity to undertake the role of trained observer, in addition to practicing both donning and doffing during the training session
- The trained observer:
 - Checks the HCW's PPE is correctly fitted, including seal check of FFP3 respirator
 - Ensures the HCW has performed hand hygiene at the correct moments, using a correct technique
 - Checks that used PPE is disposed of, as per the local EVD waste policy
 - Activates the PPE breach protocol if any exposures occur (**Appendix 7**)
 - Must be assertive

Trained Observer PPE

The recommended PPE for the trained observer will vary depending on the trained observer's location and the anticipated tasks to be undertaken by the trained observer:

PPE donning

- The trained observer is not required to wear PPE during PPE donning, which takes place in the green zone

PPE doffing

- During PPE doffing, if the HCW will not require physical assistance with doffing and the trained observer can supervise doffing while remaining in the green zone, the trained observer is not required to wear additional PPE
- During PPE doffing, if the HCW will require physical assistance with doffing, the trained observer should be wearing PPE, which is appropriate to the level of anticipated contact with the

HCW who is doffing. The level of PPE required by the trained observer should be decided locally and incorporated into the local PPE training module

- If the trained observer will be moving into the red zone at any stage, the trained observer must be wearing the appropriate level of PPE indicated by clinical risk assessment before entering the red zone



If the trained observer has been wearing PPE, that PPE must be doffed safely and disposed of, followed by hand hygiene with ABHR before the trained observer resumes supervision of a new donning or doffing sequence.



References


1. Centers for Disease Control and Prevention (CDC). 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). October 20, 2014. Available at: <http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html>. Accessed on 17 November 2014
2. World Health Organization. Personal Protective Equipment in the Context of Filovirus Disease Outbreak Response. Rapid advice guideline. October 2014. Available at: http://apps.who.int/iris/bitstream/10665/137410/1/WHO_EVD_Guidance_PPE_14.1_eng.pdf?ua=1&ua=1 Accessed on 17 November 2014
3. World Health Organization. Personal Protective Equipment in the Context of Filovirus Disease Outbreak Response. Technical specifications for PPE equipment to be used by health workers providing clinical care for patients. 31 October 2014. Available at: http://apps.who.int/iris/bitstream/10665/137411/1/WHO_EVD_Guidance_SpecPPE_14.1_eng.pdf?ua=1&ua=1 Accessed on 17 November 2014
4. European Centre for Disease Prevention and Control (ECDC). Critical aspects of the safe use of personal protective equipment. Stockholm: ECDC; 2014. Available at: <http://www.ecdc.europa.eu/en/publications/Publications/safe-use-of-ppe.pdf> Accessed on 17 November 2014
5. Advisory Committee on Dangerous Pathogens (ACDP). Management of Hazard Group 4 viral haemorrhagic fevers and similar human infectious diseases of high consequence. November 2014. Available at: <https://www.gov.uk/government/publications/viral-haemorrhagic-fever-algorithm-and-guidance-on-management-of-patients> Accessed on 26 November 2014
6. Health and Safety Authority. Guidelines to the Safety, Health and Welfare at Work (Biological Agents) Regulations 2013. Accessed on 28 November 2014. Available at: http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Guidelines_to_the_Safety_Health_and_Welfare_at_Work_Biological_Agents_Regulations_2013.html
7. Guidance Note H1402. Packaging and Transport of waste from suspect and confirmed cases of the Ebola Virus. Available at: <http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Assessingapossiblecase/File,14932,en.pdf> Accessed on 24 November 2014
8. Health and Safety Authority. A Guide to Respiratory Protective Equipment 2010. Accessed on 28 November 2014. http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Respiratory_Protective_Equipment_.html


Appendices



Appendix 1 Technical specifications for each PPE item


PPE item	Technical description	Relevant standards	
Inner gloves Level 1 & level 2 PPE	Nitrile Non-sterile Single use Latex free Disposable Extended cuff Beaded cuff Ambidextrous Powder free Intermediate length (approximately 12 inches) Different sizes – Small, medium, large, extra-large Darker colour to differentiate from outer gloves in level 2 PPE Textured fingertips	EU standard directive 93/42//EEC Class 1, EN455 EU standard directive 89/686/EEC Category 111, EN 374 ANSI/ISEA 105-2011 ASTM D6319-10 Or equivalent	
Outer gloves Level 2 PPE	Nitrile Non-sterile Single use Latex free Disposable Extended cuff Beaded cuff Ambidextrous Powder free Intermediate length (approximately 16 inches) Different sizes – Small, medium, large, extra-large Lighter colour to differentiate from inner gloves in level 2 PPE Textured fingertips	EU standard directive 93/42//EEC Class 1, EN455 EU standard directive 89/686/EEC Category 111, EN 374 ANSI/ISEA 105-2011 ASTM D6319-10 Or equivalent	


PPE item	Technical description	Relevant standards	
<p>Long-sleeved gown which is suitable for level 1 PPE only</p>	<p>Disposable Single use Latex free Fluid resistant Provides full impervious cover Cuffs (preferably waterproof) Different sizes available Different lengths available – chosen length should reach to wearer’s mid calf Light colours preferable to better detect possible contamination Fasteners/ties at neck and waist Preferably secured with Velcro at neck for easy doffing</p>	<p>Quality compliant with this standard: Tested for resistance to fluid penetration</p> <p>EN 13795 high performance level or AAMI level 3 performance (minimum level required) or Equivalent</p>	
<p>Long-sleeved gown which is suitable for both level 1 & level 2 PPE</p>	<p>Disposable Single use Latex free Fluid resistant Provides full impervious cover (360 degrees) Cuffs (preferably waterproof) Different sizes available Different lengths available – chosen length should reach to wearer’s mid calf and cover top of knee high rubber boots Light colours preferable to detect possible contamination Fasteners/ties at neck and waist Preferably secured with Velcro at neck for easy doffing</p>	<p>Quality compliant with this standard: Tested for resistance to blood-borne pathogen penetration</p> <p>AAMI PB70 Level 4 performance or Equivalent</p>	



PPE item	Technical description	Relevant standards	
Hood Level 2 PPE	Disposable Single use Latex free Soft and breathable Covers neck and shoulders reaching upper part of gown/coverall Facial opening constructed without elastic (ideally) Different sizes preferable Preferably fluid resistant Preferably sealed/protected seams		

PPE item	Technical description	Relevant standards	
<p>Coverall</p> <p>Level 2 PPE</p>	<p>Disposable</p> <p>Single use</p> <p>Latex free</p> <p>Fluid resistant</p> <p>Sealed/protected seams</p> <p>Zipper covered by adhesive flaps</p> <p>Large ring pull zipper preferable for easy doffing</p> <p>Thumb/finger loops to anchor sleeves in place</p> <p>Different sizes available</p> <p>Light colours preferable to detect possible contamination</p> <p>Elasticated wrists</p> <p>Non-elasticated ankles preferable for easy doffing over rubber boots</p>	<p>Quality compliant with one of the following options, depending on resistance of materials:</p> <p>Option 1: tested for resistance to blood and body fluid penetration: meets or exceeds ISO 16603 class 3 exposure pressure</p> <p>OR</p> <p>Option 2: tested for resistance to blood borne pathogen penetration: meets or exceeds ISO 16604 class 2 exposure pressure</p> <p>OR</p> <p>Option 3: Compliant with EN 14126 highest performance test (EN Class)</p> <ul style="list-style-type: none"> ▪ ISO 16603 - Resistance to penetration by blood/fluids under pressure ▪ ISO16604 - Resistance to penetration by blood borne pathogens ▪ ISO22610 - Resistance to wet bacterial penetration (mechanical contact) ▪ ISO/DIS 22611 - Resistance to biologically contaminated aerosols ▪ ISO 22612 - Resistance to dry microbial penetration <p>OR</p> <p>Option 4: Compliant with ASTM Standards: ASTM F1670 and ASTM F1671</p>	

PPE item	Technical description	Relevant standards	
<p>Surgical mask</p> <p>Level 1 PPE</p>	<p>Disposable Single use Fluid resistant 160 mm Hg Latex free</p> <p>Good breathability Easy to differentiate between internal and external surface</p> <p>BFE (%) age at 3.0 microns (>98%) PFE (%) age at 0.1 microns (>98%) Delta P (Pa) at least 38.5</p>	<p>Quality compliant with standards:</p> <ul style="list-style-type: none"> ▪ EN 14683 Type 11R performance ▪ ASTM F2100 level 2 or level 3 ▪ Or equivalent 	
<p>FFP3 respirator mask</p> <p>Level 2 PPE</p>	<p>Shape that will not collapse easily Latex free Adjustable straps to facilitate good fit High filtration efficiency- filter performance ≥99% Total inward leakage (max) <2% Fluid resistant Good breathability Non-irritating Non-valved or shrouded expiration valve, where both mask and valve are fluid resistant (i.e., valve is shrouded/covered by fluid resistant material)</p>	<p>Quality compliant with:</p> <ul style="list-style-type: none"> ▪ EN 149:2001 + A1:2009 (refers to filter efficiency) ▪ EN 14683:2005 Classification 11R FFP3 	

PPE item	Technical description	Relevant standards	
<p>Goggles</p> <p>Level 1 & level 2 PPE</p>	<p>Disposable Single use Latex free</p> <p>Good seal with the skin of the face Adjustable straps to facilitate good fit Flexible frame to easily fit all face contours without too much pressure Covers the eyes and surrounding areas and accommodates for prescription glasses Indirect venting to reduce fogging No or covered ventilation openings preferred Fog and scratch resistant</p> <p>Anti-mist spray may be applied prior to donning the goggles</p> <p>Goggles are not required if the face shield provides complete coverage of sides and length of the face</p>	<p>Quality compliant with standards:</p> <ul style="list-style-type: none"> • EU standard directive 86/686/EEC, EN 166/2002 	

PPE item	Technical description	Relevant standards	
<p>Face shield</p> <p>Level 1 & level 2 PPE</p>	<p>Disposable Single use Latex free</p> <p>Made of clear plastic Provides good visibility to wearer and patient Minimises glare Fog resistant Adjustable straps/harness to facilitate good fit</p> <p>For level 2 PPE, complete coverage of sides and length of the face preferable and if this can be achieved, then goggles are not required</p>	<p>Quality compliant with standards:</p> <ul style="list-style-type: none"> ▪ EU standard directive 86/686/EEC, EN166/2002 ▪ ANSI/ISEA Z87.1-2010 Or equivalent ▪ Face shield visor with chin guard to conform to EN166.1.B.3.9 	

PPE item	Technical description	
<p>Apron</p> <p>Level 2 PPE</p>	<p>Disposable</p> <p>Single use</p> <p>Latex free</p> <p>Fluid resistant</p> <p>Made of polyester with PVC coating, or other waterproof material</p> <p>Straight with bib</p> <p>Minimum basic weight: 250g/m² or 60 microns +/- 10%</p> <p>Covering size: approximately 70-90cm width x 120-150cm height, or standard adult size</p> <p>Neck strap allows for tear off with waist ties</p>	
<p>Rubber boots</p> <p>Level 2 PPE</p>	<p>Generally single use for EVD level 2 PPE</p> <p>Latex free (preferable)</p> <p>Fluid resistant</p> <p>Knee high, in order to be higher than the bottom edge of the gown</p> <p>Different sizes available</p> <p>Nonslip, have a PVC sole that is completely sealed</p> <p>Light colour preferable to detect possible contamination</p> <p>Heel lip for ease of doffing</p>	

Appendix 2 Description of powered air purifying respirator (PAPR)

What is a PAPR?

The equipment is battery operated, consists of a half or full face piece, breathing tube, battery operated blower and particulate filters (HEPA only)
A PAPR uses a blower to pass contaminated air through a HEPA filter, which removes the contaminant and supplies purified air to a face piece
A PAPR is not a true positive-pressure device because it can be over-breathed when inhaling
A face shield may also be used in conjunction with a half-mask PAPR for protection against body fluids
A PAPR should be worn for high-risk aerosol-generating procedures

Choosing a PAPR

A PAPR may be selected for use if:

- The FFP3 respirator mask does not fit
- Employee has facial hair or facial contours that would interfere with mask-to-face seal
- The FFP3 respirator mask is unavailable
- High-risk aerosol-generating procedure being undertaken
- PAPRs can be used by persons who are [medically certified](#), but who cannot wear FFP3 respirator mask

Choosing the correct filter type is a critical aspect in the RPE (Respiratory Protection Equipment) selection process. Use of the incorrect filter such as a particulate filter for protection against vapours would result in no protection being given and the equipment will be completely ineffective [8].

Filters

There are three main filter types:

1. Particle filter (P sign and filtration efficiency number 1, 2 or 3) subdivided into three classes:
 - a. P1=low efficiency filters
 - b. P2=medium efficiency filters
 - c. P3=high efficiency filters
2. Gas/vapour filter
3. Combined filters (for particles, gases & vapours)

Assigned protection factor

Each RPD (Respiratory Protection Device) has a protection factor (PF) assigned to it, which is the ratio of the airborne concentration of the substance outside the device to that inside the device. PF's have a wide range, from low protection factors to high (e.g., from 4 to 2000).

APF-Assigned Protection Factor, which best reflects the workplace conditions, is the value to use when selecting RPE. Some APFs for specific types and classes of device are published in IS EN 529:2005 (Annex C). For example, an APF of 4 gives a lower level of protection than an APF of 20.

CE marked Particulate Filter Type	APF (likely to be obtained in practice)
P1	4
P2	10
P3	20

European Standard

Full face masks are frequently components of other RPDs, such as power assisted respirators or self contained/airline supplied breathing apparatus. These systems are generally approved as a complete set against the relevant standard- e.g. EN12942, EN137, and EN139.

EN143 - Particulate filters

Particulate filters which are effective against all dusts and fibres. Most are also effective against metal (e.g., welding) fume, liquid mists, bacteria and virus, although this should always be checked with the supplier of any individual filter. This standard describes only those filters to be fitted to EN140 half face pieces and EN136 full face pieces.

There are three classes of particulate filter: P1 (low efficiency), P2 (medium efficiency) and P3 (high efficiency). It is very important that the correct filter class is chosen for any given application.

Use of PAPRs

Employees must be instructed how to put on, position, adjust, and remove respirators.

Cleaning and disinfection

- Recommendations on cleaning and disinfection differ between individual manufacturers.
- PAPRs should be cleaned according to manufacturer's recommendations

Inspection, maintenance and repairs

- Follow manufacturer's recommendations on inspection, maintenance, including battery recharging and repairs

Appendix 3 Donning and doffing level 1 PPE

Item number	Item
1	Fluid resistant long-sleeved gown
2	Fluid resistant surgical face mask
3	Goggles OR face shield
4	Gloves†

†Gloves with extended cuffs (intermediate length) may be preferred if regular length gloves do not fit securely over the gown cuff

Donning level 1 PPE

First steps

- Gather the items required for level 1 PPE
- Check PPE is the correct size
- Remove wrist and hand jewellery
- Ensure you are “bare below the elbow”

STEP NUMBER	LEVEL 1 DONNING STEPS	COMMENT	TICK BOX
1	Perform hand hygiene and allow hands to dry	Soap and water if hands physically dirty ABHR if hands are physically clean	
2	Put on fluid resistant long-sleeved gown	Secure waist and neck ties	
3	Put on surgical mask	Secure upper ties with a bow knot at middle of head Fit flexible upper band to the bridge of the nose Fit snug to face and below chin Secure lower ties with a bow knot behind neck	
4	Put on goggles or face shield	Adjust elastic strap to fit securely If goggles fog up, the surgical mask is not fitted correctly, adjust mask seal and retry	
5	Put on gloves	Grasp gown cuff while donning each glove and ensure the gloves extend to cover the gown cuff†	
6	Check PPE is secure and comfortable before approaching a patient Do not adjust PPE during patient care activity		

†Gloves with extended cuffs (intermediate length) may be preferred if regular length gloves do not fit securely over the gown cuff

Doffing level 1 PPE

STEP NUMBER	LEVEL 1 DOFFING STEPS	COMMENTS	TICK BOX
1	Perform hand hygiene on gloved hands and allow to dry	Use ABHR Ask a colleague to dispense ABHR directly onto your outstretched palms OR use an automated dispenser <u>If you self-dispensed ABHR, remember you will now need to dispose of the container in the waste bin before removing your gown and gloves</u>	
2	THE GOWN OR GLOVES COULD BE CONTAMINATED WITH EBOLA VIRUS	Break gown ties at waist With gloved hands, grasp front of the gown at shoulder level and pull gown forward gently, breaking gown neck ties Ideally, remove the gown and the gloves in the same manoeuvre. The gown should be removed pulling slowly from inside out, until the wrists are reached Each glove is removed slowly, with the discarded glove left inside the gown bundle The ungloved hands should only touch the inside of the gown bundle Discard the bundle containing gown and gloves into waste container If the gown comes off first without the inner gloves leaving them on the hands, discard the gown bundle and proceed to remove each glove slowly inside out and discard gloves into waste container	
3	Perform hand hygiene on bare hands and allow to dry	Use ABHR Ask colleague to dispense ABHR onto your outstretched palms OR use an automated dispenser If you're self-dispensing ABHR, a new container should be used for this step and onwards	
4	THE GOGGLES OR FACE SHIELD COULD BE CONTAMINATED WITH EBOLA VIRUS Slowly remove goggles or face shield	Do not touch the front of the goggles or face shield Tilt the head forward, grasp the elastic strap at the back of the head, close the eyes and gently lift the strap from behind and forward away from the face Discard the goggles or face shield into waste container	
5	Perform hand hygiene on bare hands and allow to dry	Use ABHR	
6	THE MASK COULD BE CONTAMINATED WITH EBOLA VIRUS Slowly remove the mask	Do not touch the front of the mask Break the lower ties first Next, break the upper ties, close the eyes and gently lift the mask from behind and forward away from the face Discard the mask into waste container	
7	Perform hand hygiene on bare hands and allow to dry	Use ABHR	

Don a new pair of gloves. Seal the healthcare risk waste container. Quarantine the container. The next steps in waste disposal will be determined by laboratory test results and in consultation with the local Department of Public Health.

Appendix 4 Donning and doffing level 2 PPE: Option A (gown)

Level 2 PPE: Option A (Fluid resistant long-sleeved gown)

Double gloves: intermediate length inner gloves and longer outer gloves

Fluid resistant long-sleeved gown

Plastic apron

FFP3 respirator

Face shield

Goggles (optional if face shield provides sufficient eye coverage)

Hood

Knee high rubber boots

The following provides a suggested sequence for donning and doffing level 2 PPE using the fluid resistant long-sleeved gown. A local donning and doffing sequence can be developed based on local PPE items and suited to local infrastructure and zone layout. The rationale for each step in the local sequence must be clear and the sequence followed consistently.

Donning level 2 PPE – Green zone

First steps

- Use the toilet
- Hydrate
- Remove all jewellery, including watches
- No personal items in clothing – mobile phones, pagers, pens, notebooks
- Change into scrubs:
 - Option 1: Surgical scrubs. Will either dispose of these after each use or develop a local protocol to ensure safe laundering of each item after use
 - Option 2: Disposable scrubs – single use only
- Put on waterproof or washable footwear
- Hair secured back. Fringe tucked under hair band or theatre cap may be worn to secure hair
- Any minor skin breaks covered by waterproof dressing
- Eyewear comfortable and glasses clean
- Gather the items on the PPE list in the preferred sizes and review the donning sequence with trained observer
- Access to a mirror is recommended

STEP NUMBER	LEVEL 2 DONNING STEPS	COMMENTS	TICK BOX
1	Consumed adequate fluids and been to bathroom		
2	All jewellery, pens, phones removed		
3	Long hair secured back		
4	Remove footwear and put on knee high rubber boots		
5	Perform hand hygiene on bare hands and allow to dry	<ul style="list-style-type: none"> ▪ Soap and water if hands physically dirty ▪ ABHR if hands are physically clean 	
6	Put on first pair of inner gloves, which should be of intermediate length	Check size and dexterity are suitable	
7	Put on fluid resistant long-sleeved gown	<ul style="list-style-type: none"> ▪ Secure waist and neck ties ▪ Trained observer can assist with neck ties and confirms that the HCW's back is completely covered ▪ Ensure cuffs of inner gloves are tucked inside underneath the gown sleeve 	
8	Put on FFP3 respirator, as per manufacturer's instructions	Put on FFP3 respirator and then perform seal check, as per manufacturer's instructions	
9	Put on hood	<ul style="list-style-type: none"> ▪ Ensure hood covers ears, neck and shoulders and adjust to ensure minimal skin exposure and best fit ▪ Trained observer may assist 	
10	Put on plastic apron	Consider sticking an adhesive label with HCW's name on front of apron for ease of HCW identification	
11	Put on goggles	<ul style="list-style-type: none"> ▪ Adjust elastic strap to fit securely ▪ If goggles fog up, the respirator mask is not fitted correctly, adjust mask seal and retry ▪ Check visibility 	
12	Put on the face shield	<ul style="list-style-type: none"> ▪ Adjust elastic strap to fit securely ▪ Check visibility 	
13	Put on the second pair of outer gloves, which should be of longer length to inner gloves	<ul style="list-style-type: none"> ▪ Outer gloves are pulled over gown cuff extending up over the gown sleeves ▪ Take care that inner gloves and cuff do not become displaced as outer gloves are donned 	
14	Check PPE is secure and comfortable – extend arms, bend at waist, turn and walk up and down & check PPE skin cover is optimal – use the mirror to self-check and trained observer to confirm		
15	REMINDE THE HCW PRIOR TO ENTERING THE PATIENT ROOM (RED ZONE) <ul style="list-style-type: none"> ▪ Don't adjust or remove your PPE in the patient room (red zone) ▪ Don't touch your face whilst wearing PPE ▪ Use ABHR on your gloved hands during patient care whilst in the patient room (red zone) 		

Doffing level 2 PPE

- Before leaving the patient's room (red zone) and entering the PPE removal area (amber zone), the HCW wearing level 2 PPE should:
 - Inspect the PPE for signs of visible contamination/soiling
 - If heavy soiling, first use absorbent wipes, **then** disinfect with disinfectant wipe or sponge solution (e.g., hypochlorite/chlorine-based disinfectant 1000 ppm)
 - Perform hand hygiene on outer gloved hands using ABHR and allow to dry
 - Verify that a trained observer is ready to supervise doffing of PPE before exiting the patient room (red zone)
- Next, move to PPE doffing area (amber zone)
- There must be sufficient supply of ABHR via an automated dispenser and non-sterile gloves in the doffing area (amber zone)
- Hand hygiene on gloved hands is recommended throughout the doffing sequence. Alternatively, gloves may be changed between each doffing step. If gloves are being changed, hand hygiene must be performed on bare hands prior to donning a new pair of gloves. Glove changes might be a preferred option in clinical scenarios where the patient is a fluid producer
- A designated waste container of sufficient size to accommodate the PPE waste generated should be available inside the amber zone, within arm's reach of the boundary with the green zone
- A chair which is easy to clean and disinfect should be provided inside the amber zone, just at the boundary of the amber and green zones. The chair should be positioned so the HCW can sit down to remove the rubber boots, easing each boot off slowly using the other boot and then swivel on the chair to step into the green zone in sock feet
- Access to a mirror is recommended

STEP NUMBER	LEVEL 2 DOFFING STEPS	COMMENTS	TICK BOX
1	<p>REMIND HCW UPON EXIT FROM PATIENT ROOM (RED ZONE)</p> <ul style="list-style-type: none"> ▪ Not to touch the face whilst wearing PPE ▪ Keep hands in front of the body ▪ Wait for further instruction between steps 		
2	Perform hand hygiene on outer gloved hands and allow to dry	ABHR	
3	<p>THE APRON COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the plastic apron</p>	<ul style="list-style-type: none"> ▪ Gently pull forward on the front of the apron, breaking neck strap and waist ties ▪ Roll apron away from the body inside out and discard apron into waste container 	
4	Perform hand hygiene on outer gloved hands and allow to dry	ABHR	
5	<p>THE OUTER GLOVES COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the outer gloves</p>	<ul style="list-style-type: none"> ▪ Take care not to contaminate the inner gloves ▪ Remove one outer glove at a time, peeling slowly from inside out ▪ Hold first hand's outer glove in palm of second hand. once it is removed and then peel off second hand's outer glove slowly from inside out ▪ Discard outer gloves into waste container 	
6	Carefully inspect the inner gloves for holes or tears	<p>If defect in inner glove – remove inner glove, perform hand hygiene with ABHR and put on a new pair of gloves</p> <p>If no defect in inner glove – perform hand hygiene with ABHR on inner gloved hands and allow to dry</p>	
7	<p>THE FACE SHIELD COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the face shield</p>	<ul style="list-style-type: none"> ▪ Do not touch the front of the face shield ▪ Tilt the head forward, grasp the elastic strap at the back of the head and gently lift the strap from behind and forward away from the face ▪ Discard the face shield into waste container 	
8	Perform hand hygiene on gloved hands and allow to dry	ABHR	
9	<p>THE GOGGLES COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the goggles</p>	<ul style="list-style-type: none"> ▪ Do not touch the front of the goggles ▪ Tilt the head forward, grasp the elastic strap at the back of the head, close the eyes and gently lift the strap from behind and forward away from the face ▪ Open the eyes and discard the goggles into waste container 	

STEP NUMBER	LEVEL 2 DOFFING STEPS	COMMENTS	TICK BOX
10	Perform hand hygiene on gloved hands and allow to dry	ABHR	
11	<p>THE HOOD COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the hood</p>	<ul style="list-style-type: none"> ▪ Do not touch the front of the hood ▪ Tilt the head forward and gently grasp the top of the hood, close the eyes and pull the hood up and away from the head ▪ Open the eyes and discard the hood into waste container 	
12	Perform hand hygiene on gloved hands and allow to dry	ABHR	
13	<p>THE GOWN COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the gown</p> <p>Inspect the scrubs for any signs of visible contamination</p>	<ul style="list-style-type: none"> ▪ Avoid touching the front of the gown ▪ Break gown ties at waist ▪ With gloved hands, grasp front of the gown at shoulder level and pull gown forward gently, breaking gown neck ties <p>OR</p> <p>trained observer can assist with neck ties and pushing the rear edge of the gown forward from inside (must wear an appropriate level of PPE to assist)</p> <ul style="list-style-type: none"> ▪ The gown should be removed pulling slowly from inside out, until the wrists are reached ▪ Discard the gown into waste container 	
14	<p>THE INNER GLOVES COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the inner gloves</p>	<ul style="list-style-type: none"> ▪ Remove one glove at a time peeling slowly from inside out ▪ Hold first hand's glove in palm of second hand, once it is removed and then peel off second hand's glove slowly from inside out ▪ Discard the gloves into waste container 	
15	Perform hand hygiene on bare hands and allow to dry	ABHR	
16	Put on a new pair of gloves		
17	<p>THE FFP3 MASK COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the FFP3 mask</p>	<ul style="list-style-type: none"> ▪ Avoid touching front of mask ▪ Tilt head forward, grasp bottom elastic strap and pull up until top strap is reached, then grasp both straps, close the eyes and pull mask away from face ▪ Open the eyes and discard FFP3 mask into waste container 	

STEP NUMBER	LEVEL 2 DOFFING STEPS	COMMENTS	TICK BOX
18	Perform hand hygiene on gloved hands and allow to dry	ABHR	
19	While standing up or while sitting on the chair, slowly take off the rubber boots and step into the green zone	<ul style="list-style-type: none"> ▪ Try to ease off each boot slowly using the boot of the other foot and try to avoid touching the boots if possible ▪ Discard rubber boots into the waste container inside the boundary of the amber zone 	
20	Slowly remove the gloves	<ul style="list-style-type: none"> ▪ Remove one glove at a time peeling slowly from inside out ▪ Hold first hand's glove in palm of second hand, once it is removed and then peel off second hand's glove slowly from inside out ▪ Discard the gloves into waste container inside the boundary of the amber zone 	
21	Perform hand hygiene on bare hands and allow to dry	ABHR	
22	Trained observer signs off that the PPE doffing checklist has been completed and files the completed checklist for local records		
23	If there has been a PPE breach, refer to Appendix 7		
24	<p>HCW may exit the green zone wearing scrubs and his/her own footwear</p> <p>The scrubs should be managed according to local policy – disposed of after use or placed in a designated laundry bag for decontamination</p>		

The next HCW to enter the amber zone wearing newly-donned PPE is responsible for cleaning and decontamination of the chair in the amber zone and for sealing the healthcare risk waste container, decontaminating its external surface, handing the sealed, labelled and decontaminated container out for immediate transport to the designated waste quarantine area. Then the HCW in PPE can enter the red zone to deliver ongoing patient care. The next steps in waste disposal will be determined by the laboratory test results and in consultation with the local Department of Public Health.

Appendix 5 Donning and doffing level 2 PPE: Option B (coverall)

Level 2 PPE: Option B (Coverall)

Double gloves: intermediate length inner gloves and longer outer gloves

Fluid resistant coverall with integrated hood

Plastic apron

FFP3 respirator

Face shield

Goggles (optional if face shield provides sufficient eye coverage)

Hood

Knee high rubber boots

The following provides a suggested sequence for donning and doffing level 2 PPE using the fluid resistant coverall with integrated hood. A local donning and doffing sequence can be developed based on local PPE items and suited to local infrastructure and zone layout. The rationale for each step in the local sequence must be clear and the sequence followed consistently.

Donning level 2 PPE – Green zone

First steps

- Use the toilet
- Hydrate
- Remove all jewellery, including watches
- No personal items in clothing – mobile phones, pagers, pens, notebooks
- Change into scrubs:
 - Option 1: Surgical scrubs. Will either dispose of these after each use or develop a local protocol to ensure safe laundering of each item after use
 - Option 2: Disposable scrubs – single use only
- Put on waterproof or washable footwear
- Hair secured back. Fringe tucked under hair band or theatre cap may be worn to secure hair
- Any minor skin breaks covered by waterproof dressing
- Eyewear comfortable and glasses clean
- Gather the items on the PPE list in the preferred sizes and review the donning sequence with trained observer
- Access to a mirror is recommended

STEP NUMBER	LEVEL 2 DORNING STEPS	COMMENTS	TICK BOX
1	Consumed adequate fluids and been to bathroom		
2	All jewellery, pens, phones removed		
3	Long hair secured back		
4	Remove footwear and put on knee high rubber boots		
5	Perform hand hygiene on bare hands and allow to dry	<ul style="list-style-type: none"> ▪ Soap and water if hands physically dirty ▪ ABHR if hands are physically clean 	
6	Put on first pair of inner gloves, which should be of intermediate length	Check size and dexterity are suitable	
7	Put on fluid-resistant coverall with integrated hood but leave the hood off the head for the moment	<ul style="list-style-type: none"> ▪ Secure zip and cover zip with adhesive flap firmly fixed to coverall ▪ Trained observer can assist and confirms that the HCW is completely covered ▪ Ensure cuffs of inner gloves reach underneath the cuffs of the coverall and the thumb/finger loop of the coverall is secured over the inner glove 	
8	Put on FFP3 respirator, as per manufacturer's instructions	Put on FFP3 respirator and then perform seal check, as per manufacturer's instructions	
9	Now put up the hood of the coverall	<ul style="list-style-type: none"> ▪ Ensure all hair is tucked underneath the hood of the coverall ▪ Trained observer can assist 	
10	Next put on the separate outer hood	<ul style="list-style-type: none"> ▪ Ensure hood covers ears, neck and shoulders and adjust to ensure minimal skin exposure and best fit ▪ Trained observer may assist 	
11	Put on plastic apron	Consider sticking an adhesive label with HCW's name on front of apron for ease of HCW identification	
12	Put on goggles	<ul style="list-style-type: none"> ▪ Adjust elastic strap to fit securely ▪ If goggles fog up, the respirator mask is not fitted correctly, adjust mask seal and retry ▪ Check visibility 	
13	Put on the face shield	<ul style="list-style-type: none"> ▪ Adjust elastic strap to fit securely ▪ Check visibility 	
14	Put on the second pair of outer gloves, which should be of longer length than inner gloves	<ul style="list-style-type: none"> ▪ Outer gloves are pulled over coverall cuff extending up over the coverall sleeves ▪ Take care that inner gloves and coverall cuff do not become displaced as outer gloves are donned 	
15	Check PPE is secure and comfortable – extend arms, bend at waist, turn and walk up and down & check PPE skin cover is optimal – use the mirror to self-check and trained observer to confirm		

STEP NUMBER	LEVEL 2 DONNING STEPS	COMMENTS	TICK BOX
16	<p>REMINDE THE HCW PRIOR TO ENTERING THE PATIENT ROOM (RED ZONE)</p> <ul style="list-style-type: none"> ▪ Don't adjust or remove your PPE in the patient room (red zone) ▪ Don't touch your face whilst wearing PPE ▪ Use ABHR on your gloved hands during patient care whilst in the patient room (red zone) 		

Doffing level 2 PPE

- Before leaving the patient's room (red zone) and entering the PPE removal area (amber zone), the HCW wearing level 2 PPE should:
 - Inspect the PPE for signs of visible contamination/soiling
 - If heavy soiling, first use absorbent wipes, **then** disinfect with disinfectant wipe or sponge solution (e.g., hypochlorite/chlorine-based disinfectant 1000 ppm)
 - Perform hand hygiene on outer gloved hands using ABHR and allow to dry
 - Verify that a trained observer is ready to supervise doffing of PPE before exiting the patient room (red zone)
- Next, move to PPE doffing area (amber zone)
- There must be sufficient supply of ABHR via an automated dispenser and non-sterile gloves in the doffing area (amber zone)
- Hand hygiene on gloved hands is recommended throughout the doffing sequence. Alternatively, gloves may be changed between each doffing step. If gloves are being changed, hand hygiene must be performed on bare hands prior to donning a new pair of gloves. Glove changes might be a preferred option in clinical scenarios where the patient is a fluid producer
- A designated waste container of sufficient size to accommodate the PPE waste generated should be available inside the amber zone, within arm's reach of the boundary with the green zone
- A chair which is easy to clean and disinfect should be provided inside the amber zone, just at the boundary of the amber and green zones. The chair should be positioned so the HCW can sit down to remove the rubber boots, easing each boot off slowly using the other boot and then swivel on the chair to step into the green zone in sock feet
- Access to a mirror is recommended

STEP NUMBER	LEVEL 2 DOFFING STEPS	COMMENTS	TICK BOX
1	<p>REMIND HCW UPON EXIT FROM PATIENT ROOM (RED ZONE)</p> <ul style="list-style-type: none"> ▪ Not to touch the face whilst wearing PPE ▪ Keep hands in front of the body ▪ Wait for further instruction between steps 		
2	Perform hand hygiene on outer gloved hands. Allow to dry	ABHR	
3	<p>THE APRON COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the plastic apron</p>	<ul style="list-style-type: none"> ▪ Gently pull forward on the front of the apron, first breaking neck strap, followed by waist ties ▪ Roll apron away from the body inside out and discard apron into waste container 	
4	Perform hand hygiene on outer gloved hands. Allow to dry	ABHR	
5	<p>THE OUTER GLOVES COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the outer gloves</p>	<ul style="list-style-type: none"> ▪ Take care not to contaminate the inner gloves ▪ Remove one outer glove at a time, peeling slowly from inside out ▪ Hold first hand's outer glove in palm of second hand, once it is removed and then peel off second hand's outer glove slowly from inside out ▪ Discard outer gloves into waste container 	
6	<p>Carefully inspect the inner gloves for holes or tears</p> <p>Perform hand hygiene on inner gloved hands and allow to dry</p>	<p>If no defect in inner glove – perform hand hygiene with ABHR on inner gloved hands and allow to dry</p> <p>If defect in inner glove identified, perform hand hygiene with ABHR and put on a new pair of long outer gloves over the defective inner gloves</p>	
7	<p>THE FACE SHIELD COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the face shield</p>	<ul style="list-style-type: none"> ▪ Do not touch the front of the face shield ▪ Tilt the head forward, grasp the elastic strap at the back of the head and gently lift the strap from behind and forward away from the face ▪ Discard the face shield into waste container 	
8	Perform hand hygiene on gloved hands. Allow to dry	ABHR	
9	<p>THE GOGGLES COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the goggles</p>	<ul style="list-style-type: none"> ▪ Do not touch the front of the goggles ▪ Tilt the head forward, grasp the elastic strap at the back of the head, close the eyes and gently lift the strap from behind and forward away from the face ▪ Open the eyes and discard the goggles into waste container 	

STEP NUMBER	LEVEL 2 DOFFING STEPS	COMMENTS	TICK BOX
10	Perform hand hygiene on gloved hands. Allow to dry	ABHR	
11	<p>THE OUTER HOOD COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the outer hood</p>	<ul style="list-style-type: none"> ▪ Do not touch the front of the hood ▪ Tilt the head forward, close the eyes and gently grasp the top of the hood at the crown of the head ▪ Pull the hood up and away from the head ▪ Open the eyes and discard the hood into waste container 	
12	Perform hand hygiene on gloved hands. Allow to dry	ABHR	
13	<p>THE COVERALL COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Tilt head back and release the adhesive flap which covers the zip Unzip the coverall Reaching from the crown of the head, pull back the hood of the coverall Slowly remove the coverall to the level of the top of the boots Take care not to flex the neck forward in a way that the FFP3 mask could touch the scrubs</p> <p>In the event there had been a breach of inner gloves, necessitating donning a new pair of long outer gloves (Step 6), the outer gloves should now be removed in the same manoeuvre as the coverall, leaving just the inner gloves</p> <p>Inspect the scrubs for any signs of visible contamination</p>	<ul style="list-style-type: none"> ▪ Avoid touching the front of the coverall ▪ With gloved hands, grasp the inside of the coverall at shoulder level and push the coverall from inside to out off the shoulders gently OR trained observer can assist with removal of the coverall peeling off from inside out down the torso (must wear an appropriate level of PPE to assist) ▪ The coverall should be removed from inside to out rolling slowly downwards from inside out, until the top of the boots are reached 	
14	<p>THE INNER GLOVES COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the inner gloves</p>	<ul style="list-style-type: none"> ▪ Remove one glove at a time peeling slowly from inside out ▪ Hold first hand's glove in palm of second hand, once it is removed and then peel off second hand's glove slowly from inside out ▪ Discard the gloves into waste container 	
15	Perform hand hygiene on bare hands. Allow to dry	ABHR	
16	Put on a new pair of gloves		
17	<p>THE FFP3 MASK COULD BE CONTAMINATED WITH EBOLA VIRUS</p> <p>Slowly remove the FFP3 mask</p>	<ul style="list-style-type: none"> ▪ Avoid touching the front of the FFP3 mask ▪ Tilt head forward, grasp bottom elastic strap and pull up until top strap is reached, then grasp both straps, close the eyes and pull mask away from face ▪ Open the eyes and discard FFP3 mask into waste container 	

STEP NUMBER	LEVEL 2 DOFFING STEPS	COMMENTS	TICK BOX
18	Perform hand hygiene on gloved hands and allow to dry	ABHR	
19	While sitting on the chair, slowly take off the rubber boots with the coverall in one manoeuvre and swivel or step into the green zone	<ul style="list-style-type: none"> ▪ Try to ease off each boot slowly using the boot of the other foot and try to avoid touching the boots if possible ▪ Discard rubber boots and coverall into the waste container inside the boundary of the amber zone 	
20	Perform hand hygiene on gloved hands and allow to dry	ABHR	
21	Slowly remove the gloves	<ul style="list-style-type: none"> ▪ Remove one glove at a time peeling slowly from inside out ▪ Hold first hand's glove in palm of second hand once, it is removed and then peel off second hand's glove slowly from inside out ▪ Discard the gloves into waste container inside the boundary of the amber zone 	
22	Perform hand hygiene on bare hands and allow to dry	ABHR	
23	Trained observer signs off that the PPE doffing checklist has been completed and files the completed checklist for local records		
24	If there has been a PPE breach, refer to Appendix 7		
25	<p>HCW may exit the green zone wearing scrubs and his/her own footwear</p> <p>The scrubs should be managed according to local policy – disposed of after use or placed in a designated laundry bag for decontamination</p>		

The next HCW to enter the amber zone wearing newly-donned PPE is responsible for cleaning and decontamination of the chair in the amber zone and for sealing the healthcare risk waste container, decontaminating its external surface, handing the sealed, labelled and decontaminated container out for immediate transport to the designated waste quarantine area. Then the HCW in PPE can enter the red zone to deliver ongoing patient care. The next steps in waste disposal will be determined by the laboratory test results and in consultation with the local Department of Public Health.

Appendix 6 PPE training

With thanks to colleagues in Cork University Hospital and Beaumont Hospital for sharing content of local EVD PPE training programmes.

Target audience

Training and refresher training on level 2 PPE should primarily focus on senior clinical and support staff working in areas where direct physical contact with a patient, patient specimens or contaminated physical environment may arise in scenarios of suspected or confirmed EVD:

- Ambulance service
- Emergency department
- Designated clinical area for accommodation of patient with suspected or confirmed EVD
- Hospital laboratory
- NVRL
- Infectious diseases clinic
- Critical care unit
- National Isolation Unit (NIU)

The level 2 PPE training session typically takes a minimum duration of three to four hours to complete.

A refresher course is advised at an interval of six weeks after the initial training session and typically takes one hour to complete.

The EVD PPE video is designed to complement the EVD PPE training course. It is NOT meant to replace practical training and each HCW MUST get an opportunity to practice PPE donning, doffing and supervision.

The recommended PPE trainer to PPE student ratio for practical sessions is 1:2 or 1: 4 and depends on HCW skills and knowledge.

Formal records of HCW training on level 2 PPE must be maintained locally. Only HCWs who have been trained and are comfortable in donning and doffing level 2 PPE should be permitted to have involvement in the investigation and care of a patient with suspected or confirmed EVD. Local records of PPE sizes selected by HCW at training should be retained to monitor local PPE stock requirements and optimise stock management. Consideration should also be given to providing each trained HCW with a wallet-sized card on which to record their preferred size for each item of PPE.

Learning objectives

Students will be able to:

- Understand what Ebola virus is and how it is spread
- Understand that PPE is just one element of the preventive actions required
- Understand the principles of PPE use
- Identify key risk behaviours
- Understand that the trained observer is in charge of donning and doffing and the importance of listening and following instructions slowly and exactly
- Practice donning and doffing individual items of PPE according to the local checklist
 - For the FFP3 mask, manufacturer's instructions must be followed and a seal check must form part of donning procedure
- Practice being a trained observer of a donning and doffing procedure

Course outline

- Ebola virus, how it spreads, factors influencing nosocomial transmission, current epidemiological situation
- Local EVD preparedness plan to manage suspected case and importance of communication with patient and with colleagues
- Principles of PPE
- Legislation governing PPE
- Prevention of sharps injuries
- Safe packaging and transport of laboratory specimens and importance of communication with laboratory staff
- Management of waste
- Environmental decontamination (cleaning, disinfection, spillages)
- Practice donning and doffing and trained observer role for a donning and doffing procedure

At the end of the training programme the student should be able to:

- Have knowledge of the local EVD preparedness plan
- Select their own PPE kit items in the most suitable size
- Safely don and remove PPE under instruction
- Act as a trained observer for donning and doffing
- State (where applicable) what size of PPE best fits

Appendix 7 PPE breach protocol

In the event that a percutaneous injury (needlestick or sharps injury, blood or body fluid splash or bite injury) occurs during the care of a patient with suspected or confirmed EVD, the HCW should exit the patient room (red zone) and alert the trained observer.

The steps for emergency management of injuries (EMI) should be followed immediately <http://www.hpsc.ie/A-Z/EMIToolkit/> and the possibility of transmission of any blood borne virus (BBV), including EVD be considered.

If a PPE breach is identified (tear or hole in PPE or inadvertent touching of mucous membranes) without injury the HCW should exit the patient room (red zone) and alert the trained observer.

The trained observer must also inform the following of the injury or PPE breach:

- Occupational health department
- Infection prevention and control team
- Public health department

In addition to the emergency and subsequent management of the percutaneous injury, the HCW will require assessment and follow-up in accordance with the '**Guidance for Contact Tracing of EVD Cases**' available at www.hpsc.ie

Appendix 8 EVD SAC PPE subgroup membership

- Dr Karen Burns, Consultant Microbiologist, HPSC & Beaumont Hospital (Chair)
- Dr Robert Cunney, National Clinical Lead HCAI & AMR Clinical Programme & Consultant Microbiologist, HPSC & Children's University Hospital, Temple St
- Dr Gabriel Fitzpatrick, Specialist Registrar, Public Health Medicine, HPSC
- Ms Helen Murphy, Infection Prevention & Control Nurse Manager, HPSC
- Ms Margaret Fitzgerald (PhD), Senior Surveillance Scientist, HPSC
- Ms Sheila Donlon, Assistant Director of Nursing, Infection Prevention & Control, Beaumont Hospital
- Dr Blanaid Hayes, Consultant Occupational Health Physician, Beaumont Hospital
- Ms Stephanie O'Gara, Health & Safety Advisor, Beaumont Hospital
- Dr Rob Plant, Consultant in Intensive Care Medicine, Cork University Hospital
- Mr Mark Doyle, Consultant in Emergency Medicine, University Hospital Waterford
- Dr Kevin Carson, Consultant in Paediatric Intensive Care Medicine, Children's University Hospital, Temple Street
- Dr Ceppie Merry, Consultant Infectious Diseases Physician, St James's Hospital
- Professor Martin Cormican, Consultant Microbiologist, Galway University Hospital and Professor of Bacteriology, NUI Galway
- Dr Jack Lambert, Consultant Infectious Diseases Physician, National Isolation Unit, Mater Misericordiae University Hospital
- Ms Breda Corrigan, Assistant Director of Nursing, Infection Prevention & Control, Mater Misericordiae University Hospital