



TECHNICAL DOCUMENT

Use of personal protective equipment for safe first assessment of Persons Under Investigation of Ebola virus disease in the EU/EEA

A tutorial for healthcare professionals

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This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Cornelius Bartels.

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Abbreviations

EVD	Ebola virus disease
HCW	Healthcare worker
IDHC	Infectious diseases of high consequence
PPE	Personal protective equipment
PUI	Person under investigation
VHF	Viral haemorrhagic fever

1 Short background

On 2 December 2014 ECDC launched the second version of the tutorial 'Safe use of personal protective equipment in the treatment of infectious diseases of high consequence'. The tutorial provided practical information on the proper use of personal protective equipment (PPE) at the point of care, including technical and procurement aspects. This new tutorial complements the previous one to guide healthcare staff in non-specialised settings in the use of PPE for first assessment of persons with potential risk of EVD infection or being under investigation (PUI) for Ebola virus disease.

Definition of infectious diseases of high consequence

Infectious diseases of high consequence (IDHC) are serious threats to human health. Patients with such diseases typically develop severe symptoms, require a high level of care, and the case-fatality rates can be high. Often, there is no specific vaccine, prophylaxis or treatment available. Several IDHC are transmissible from person to person and therefore require transmission precautions in healthcare workers (HCW). Depending on the transmission mode (e.g. by droplets or airborne) and their infectivity, they can generate large-scale epidemics (e.g. Ebola in West Africa 2014 or SARS in 2003) or even pandemics (e.g. the Spanish influenza pandemic in 1918).

With respect to the concept of 'airborne transmission' additional differentiation is needed:

- The term 'airborne transmission' is used to describe a primary transmission mode of certain pathogens, such as influenza or measles viruses.
- It may also be used to describe transmission of pathogens transmitted by droplets that become airborne under certain conditions. This occurs in cases of so-called 'secondary aerosolisation': High velocity liquid flows create an aerosol of small droplets in the environmental air in the vicinity of the liquid flow. These accelerated flows can have natural origin, e.g. during vomiting or arterial haemorrhages, but can also be generated during invasive medical interventions, such as bronchoscopy or tracheal suction. The latter mechanism is summarised under the term 'aerosol generating procedures – AGPs'.

Definition of person under investigation (PUI)

The term PUI is taken from the Ebola virus disease case definition for reporting in the EU, and is used to define a person that has potentially been infected by Ebola virus and needs further investigation to confirm or rule out the diagnosis.

A person

- meeting the clinical and the epidemiological criteria¹;
- OR
- with high-risk exposure and any of the listed symptoms², including fever of any grade.

¹ Clinical criteria:

- Any person currently presenting or having presented before death: Fever $\geq 38.6^{\circ}\text{C}$, AND any of the following: severe headache, vomiting, diarrhoea, abdominal pain, unexplained haemorrhagic manifestations in various forms, multi-organ failure OR
- a person who died suddenly and inexplicably

Epidemiological criteria:

In the 21 days before onset of symptoms: a) having been in an area with community transmission OR b) having had contact with a probable or confirmed EVD case

² Severe headache, vomiting, diarrhoea, abdominal pain, multi-organ failure, unexplained haemorrhagic manifestations

2 Scope and target

The scope of the tutorial is to improve the protection of staff dealing with Ebola Virus Disease (EVD) in non-specialised centres. This tutorial will focus on the use of various PPE components appropriate in the first assessment of possible EVD cases, particularly in healthcare facilities with a European standard of care but not designated for treatment of EVD patients.

The main target audience are healthcare professionals working in non-specialised settings in the EU/EEA, in particular those responsible for first assessment in non-specialised healthcare settings.

First assessment starts as soon as a healthcare worker thinks that he/she might be dealing with a potential EVD patient and as a consequence undertakes a clinical or risk factor assessment (triage) in order to identify the risk of transmission. This needs to be performed under safety measures explained in this tutorial, including the use of appropriate PPE and distancing measures.

3 Methodology

A team of ECDC experts jointly developed this document by combining their expertise in Biorisk management, training, clinical medicine, infection control and preparedness.

Additional sources included documents on the use of PPE for the care of Ebola patients, released by international organisations and European public health institutes.

Symbols used in the tutorial

To quickly signal what is good practice – and what is not – we use the following symbols:

- **[+ / +]** Experts' choice. Recommended by experts with substantial experience of the process.
- **[+ / -]** Consider the limitations before using this option. Further evidence needed.
- **[- / -]** According to experts, this practice should be avoided.

4 First assessment in the EU/EAA

First encounters between HCW and a person with potential risk of EVD infection or who is under investigation (PUI)³ for Ebola virus disease (EVD) can occur in various settings, ranging from airports, public transport, waiting areas in doctor's offices or hospitals, ambulances, emergency rooms or in the hospital ward where a patient shows IDHC symptoms while being treated for another kind of disease.

First assessment is performed in two steps, 1) first encounter (triage) and 2) PUI care and full history taking. Staff protection measures are applied according to the level of risk of EVD transmission for both steps.

The algorithm in the next table provides a guide to the initial assessment and management of persons with potential risk of EVD infection (Number 1) and on Persons Under Investigation (PUI) for EVD (Number 2). This table relates the status of the person undergoing the first assessment steps to the type of the staff protection appropriate. It does not cover the management of the EVD patient nor the topic of staff protection for treatment and care in specialised centres.

³ ECDC. Ebola virus disease case definition for reporting in EU. Available from: http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fever/EVDcasedefinition/Pages/default.aspx

Table 1. Status of the person and first assessment steps based on the algorithm

Algorithm for initial assessment and management of patients for Ebola virus disease	Status of the person	First assessment	Staff protection
	<p>1. Person with potential risk of EVD infection</p>	<p>a. First encounter and history check (triage):</p>	<p>Distancing measures</p>
	<p>2. Person Under Investigation (PUI) for EVD</p>	<p>b. PUI care and full history taking</p>	<p>PPE for 'first assessment' and distancing measures</p>

** Likelihood of exposure to bodily fluids and/or secretions (e.g. haemorrhage, vomiting, diarrhoea)*

First encounter and history check (triage) – distancing measures

The initial encounter of the HCW with the person with potential risk of EVD infection during the first assessment is often called 'triage'.

Distance support measures start with the first encounter: HCW maintaining a minimum distance of 1.5 metres (e.g. avoiding handshaking) already creates an effective protective layer against EVD for patients not exhibiting fluid symptoms. As a next step, a basic set of key questions provides orientation regarding the level of risk that the HCW is dealing with regarding an EVD patient (to define whether the person is a PUI or not).

PUI care and full history taking – PPE for 'first assessment' and distancing measures

As soon as it is recognised that someone is a PUI for EVD, staff immediately need to assess the transmission risk and take appropriate measures for patient care and precautions to avoid secondary infections. Healthcare workers should put on PPE for the first assessment and minimise contact when isolating the patient, providing care or taking a full clinical history.

A balanced approach including awareness, distancing measures and the use of appropriate PPE effectively reduces the infection risk.

Awareness

- Pre-emptive education of HCW (EVD symptoms and transmission).
- Targeted history taking (travel, malaria and other relevant tropical diseases, vaccination status).
- Locator card for potentially exposed persons inside the healthcare facility.
- Established notification procedure for alerting the competent public health authority.

Distancing measures

- Not having any direct contact but also keeping a minimum distance of 1.5 metres from the patient.
- The number of staff coming near to the patient should be reduced to the essential minimum.
- The patient needs to be moved to a separated and secured area which ideally has a closable barrier between it and other patient areas (isolation room).
- Any additional moving of the patient inside the healthcare structure must be avoided.

PPE for first assessment components

- Double gloves, hair cover, impermeable gown, surgical Type IIR face mask or FFP2 respirator and face shield or goggles.

During the first assessment of a person with potential risk of EVD infection or a PUI it is critical to avoid unnecessary direct contact with the patient, avoiding any kind of contact with the patient's bodily fluids. Distance support measures combined with PPE for first assessment provides a good level of staff protection in a limited contact setting.

Distancing measures

Distance support measures: As long the patient has the ability to self-care, direct contact between HCW and patient should be avoided, such as through the use of an 'exchange zone' for food and waste which is never accessed simultaneously by the patient and the HCW. The minimum distance of 1.5 metres from the patient is to be kept whenever possible.

Distance support measures can no longer be used when patient conditions deteriorate and more active support in nursing and treatment is required. The risk assessment needs to be updated continuously in order to allow timely escalation to PPE for 'nursing and treatment' within a three zone barrier nursing setting.

Disinfection and waste management when managing an EVD case in a non-specialist setting requires specialised PPE for IDHC. PPE for first assessment presented in this document is not sufficient to proceed with full disinfection of the isolation area after the patient is transferred to a specialised centre. Close the designated area and wait for a specialised waste management and cleaning team.

5 Selection of appropriate PPE components


Defining the level of risk and hence the appropriate level of protection is the key to allocating the correct PPE to staff to ensure their safety whilst enabling them to effectively perform their duties.

The selection of specific PPE components and their combination with each other needs to be based on a systematic risk assessment as a part of an occupational safety and health management system. This risk assessment needs to take into consideration the following entities:

- **hazard** posed by the characteristics of the causative pathogen of an IDHC
- specific **vulnerabilities** in staff exposed to the hazard
- analysis of **workplace** setting in which exposure to the hazard occurs
- analysis and description of planned **activities** carried out by staff at a defined workplace.

This table provides examples for criteria and characteristics to be considered in a risk assessment for occupational safety and health when dealing with IDHC.

Table 2. Risk assessment for level of PPE adaption

Exposure	Hazard	Impact
Workplace <ul style="list-style-type: none"> • Rescue services • Doctors offices • Hospitals (ER, ICU) • Treatment centres 	Pathogen quality <ul style="list-style-type: none"> • known/unknown • Transmissibility • Level of contagion • Pathogenicity • Severity of disease • Level of fatality • Out of reservoir survival • Persistence • Susceptibility or resistance to drugs 	Vulnerability <ul style="list-style-type: none"> • Susceptibility • Treatment options • Prophylaxis options • Vaccine options • Ease of detection • Diagnostic capability and availability • Decontamination and mitigation options • Scale of incident
		
Activity <ul style="list-style-type: none"> • First assessment • Distance support measures • Contact nursing • Intensive care • Invasive monitoring & treatment (intensive care processes) 		

5.1 PPE for 'first assessment' versus PPE for 'nursing and treatment'

Generally, there are two levels of protection which depend on the selected PPE components:

PPE for 'first assessment': type of PPE suitable for EVD for first assessment of persons with potential risk of infection or being Under Investigation (PUI): Surgical mask (droplets) or respirators (secondary aerosolisation or air-borne transmission), gown, hair cover, goggles or face shield, double gloving.

Note: Respiratory protection already needs to be in place for first assessment of airborne transmitted IDHC.

PPE for 'nursing and treatment': Appropriate type of PPE⁴ for direct contact activities in probable or confirmed cases of IDHC⁴.

⁴ European Centre for Disease Prevention and Control. Safe use of personal protective equipment in the treatment of infectious diseases of high consequence. Stockholm: ECDC; 2014.

Table 3. Type of PPE in infectious diseases of high consequence

PPE for IDHC 'first assessment': Surgical mask (droplets) or respirators (secondary aerosolisation or air-borne transmission), gown, hair cover, goggles or face shield, double gloving.*	PPE for IDHC 'nursing and treatment'
	
Low transmission risk	High transmission risk

* Whether to use surgical masks or respirators for EVD protection depends on the level of exposure and on the risk of secondary aerosolisation. A risk- and hazard-assessment for the different settings and activities is essential before any decisions are made on which level of protection is needed.

Surgical face masks mainly protect from exhaled droplets. If marked 'IIR' (surgical masks Type IIR), they are also splash-resistant and protect the wearer's mucosae and skin from fluid splashes. Surgical masks don't require fit testing.

A **respirator** instead protects from the inhalation of droplets and particles. However, most respirators are not certified 'splash-proof', especially if they are provided with an exhalation valve. They require a fit test. If exhalation protection is provided by an FFP respirator instead of a surgical mask, the use of a respirator **without valves** is mandatory.

A splash-proof respirator is needed in settings where there is not only the exposure risk to secondary aerosolisation but also to splashes from bodily fluids (e.g. during nursing and treatment of EVD patients).

Assigning type of PPE according to the healthcare setting (workplace and activities)

The type of patient (level of probability of EVD and level of symptoms) and the level of clinical intervention will often determine the type of healthcare setting (level of specialisation) that a patient is managed in. It remains important to continuously assess the transmission risk of the activities performed to ensure staff safety. In this table different levels of PPE are assigned depending on the workplace (healthcare setting specialisation level) and on the activity (risk of the clinical procedure) including transferring the patient to specialised settings.

Distance measures are also advised to avoid unnecessary direct contact with the patient and avoiding any kind of contact with the patient's bodily fluids.

Table 4. Type of PPE based on healthcare setting specialisation level for IDHC and clinical procedure

<i>(The area of the figure represents the proportion of patient care)</i>	Level of healthcare setting specialisation (workplace)	Clinical procedures (activity)	Staff protection approach
	1. Specialised treatment centres for IDHC	First assessment of patients with possible IDHC ('infection triage') Barrier nursing Invasive monitoring and treatment: e.g. mechanical ventilation, hemofiltration and other organ support interventions, pharmaceutical circulatory support, Non-invasive monitoring and treatment	PAPRs and/or PPE for IDHC "nursing and treatment"* Decontamination of HCW before doffing* Targeted vaccine or pharmaceutical prophylaxis if available
	2. University hospitals and other advanced care hospitals qualified for IDHC	First assessment of patients with possible IDHC Infection triage History taking Oral patient status updates Distance support measures (providing food and other necessities from a distance)	PPE for IDHC "nursing and treatment"* Wipe disinfection of HCW before doffing * a. Discharge of patient to specialised treatment centres for IDHC if necessary. Roster of multidisciplinary staff trained in PPE for IDHC use. (suggested minimum of 20 HCW) Regular refresher training
	3. Primary healthcare settings and entry points	PPE for IDHC "first assessment" (>1.5 meters distance) b. Transfer to specialised treatment centres for IDHC or hospitals qualified for IDHC Regular refresher training for all staff potentially involved in first assessment	

* European Centre for Disease Prevention and Control. *Safe use of personal protective equipment in the treatment of infectious diseases of high consequence.* Stockholm: ECDC; 2014.

Non-specialised centres detecting IDHC possible or probable cases prioritise patient transfer ideally to a treatment centre specialised in IDHC or at least to a hospital qualified for IDHC (roster of HCW trained in safe use of PPE for IDHC).

5.2 Assigning type of PPE based on the transmission risk of EVD (patient based)

The level of PPE protection has to be selected after a risk assessment based on the local regulations and planned operations for each disease/pathogen. Another important criterion for choosing the right type of PPE is the level of transmission risk, which is defined on the basis of an assessment of the patient's condition at the point of care and the nature of the planned medical process. A generic approach stratifies between processes with low and high transmission risk. The levels need to be specified for any high risk pathogen.

Allocating resources and using staff in the most effective way according to the identified risk is needed to ensure an effective and safe use of PPE and protective measures.

Assessing the patient's risk of exposure to EVD

↓ Low risk patient:

In the 21 days before the onset of symptoms:

- not having any high risk criteria AND
- having been in an [area with community transmission](#);

OR

having had contact with a probable or confirmed EVD case.

- casual contact with a feverish but ambulant and self-caring patient, sharing a seating area or public transportation; receptionist tasks.

↑ High-risk exposure criteria* (any of the following):

- close face-to-face contact (e.g. within one metre) without appropriate personal protective equipment (including eye protection) with a probable or confirmed case who was coughing, vomiting, bleeding, or who had diarrhoea; or had unprotected sexual contact with a case up to three months after recovery
- direct contact with any material soiled by bodily fluids from a probable or confirmed case
- percutaneous injury (e.g. with needle) or mucosal exposure to bodily fluids, tissues or laboratory specimens of a probable or confirmed case
- participation in funeral rites with direct exposure to human remains in or from an affected area without appropriate personal protective equipment
- direct contact with bats, rodents, primates, living or dead, in or from affected areas, or bushmeat.

See Ebola virus disease case definition for reporting in the EU:

http://ecdc.europa.eu/en/healthtopics/ebola_marburg_fever/EVDcasedefinition/Pages/default.aspx

Assessing the risk of the intervention/procedures in symptomatic patients or high exposure risk in the past 21 days

↓ Low transmission risk intervention:

First assessment (including 'infection triage'), history taking of patient with prodromal symptoms, providing food and other necessities at a distance from a symptomatic patient; any kind of care-giving for persons without symptoms but with a documented high exposure risk in the past 21 days.

↑ High transmission risk intervention:

High transmission risk: Nursing and treatment of a symptomatic patient, clinical examination, taking blood and all types of invasive procedures, such as intubation and surgery among others.

According to the EVD symptoms for risk of transmission:









↓ **Low risk symptoms:** Fever, unspecific prodromal symptoms.

↑ **High-risk symptoms:** Vomiting, diarrhoea and/or haemorrhage.

For temperature screening staff safety, see the technical report by ECDC: Entry and exit screening measures:








<http://www.ecdc.europa.eu/en/publications/Publications/Ebola-outbreak-technicalreport-exit-entry-screening-13Oct2014.pdf>

Table 5. Scenarios based on risk assessment (specific for EVD)

Patient's risk of exposure to EVD	Patient with low exposure risk in the last three weeks history				Patient with high EVD exposure risk in last three weeks history			
	↑ High-risk symptoms	↓ Low-risk symptoms:	↑ High-risk symptoms	↓ Low-risk symptoms:	↑ High-risk symptoms	↓ Low-risk symptoms:	↑ High-risk symptoms	↓ Low-risk symptoms:
EVD symptoms risk of transmission	↑ High-risk symptoms	↓ Low-risk symptoms:	↑ High-risk symptoms	↓ Low-risk symptoms:	↑ High-risk symptoms	↓ Low-risk symptoms:	↑ High-risk symptoms	↓ Low-risk symptoms:
Risk level of activity	↑ High transmission risk intervention	↑ High transmission risk intervention	↓ Low transmission risk intervention	↓ Low transmission risk intervention	↑ High transmission risk intervention	↑ High transmission risk intervention	↓ Low transmission risk intervention	↓ Low transmission risk intervention
Type of PPE								
Scenarios	Clinical examination of a vomiting patient coming from an area with EVD community transmission	Clinical examination of a patient with unspecific prodromal symptoms coming from an area with EVD community transmission	History taking of a patient with diarrhoea reporting contact with a probable or confirmed EVD case	History taking of a traveller with fever coming from an area with EVD community transmission	Clinical examination of a vomiting patient reporting direct contact with bodily fluids from a confirmed case	Surgery of a patient with fever reporting direct contact with bodily fluids from a probable case	Providing food from a distance (>1.5 metres) to patient with diarrhoea reporting participation in funeral with direct exposure to human remains in an affected area	Providing food from a distance (>1.5 metres) to a feverish patient reporting direct contact with living bats, from affected areas

* See: European Centre for Disease Prevention and Control. *Safe use of personal protective equipment in the treatment of infectious diseases of high consequence*. Stockholm: ECDC; 2014PPE for first assessment components:

Table 6. PPE list for first assessment

Picture	Material	Specifiable aspects
	[+ / +] Surgical Type IIR face mask (Appropriate in VHF as long secondary aerosolisation is excluded)	
	[+ / +] FFP2 respirator (First choice in air borne transmitted diseases)	Different sizes and models; FFP2 (US occupational safety and health standards: N95)
	Impermeable gown	
	[+ / +] Face shield (appropriate in VHF as long as secondary aerosolisation is excluded)	
	[+ / +] Goggles (first choice for airborne diseases)	Different sizes and models; anti-fog coating; no or covered ventilation openings preferred
	Nursing gloves (double layer)	Different sizes, materials and models; latex and nitrile; non-sterile (nursing)
	[+ / +] Hospital scrubs [+ / -] Casual clothes	Different sizes Re-usable or single use

Picture	Material	Specifiable aspects
	<p>[+ / +] Clogs (Fluid tight on the front) [+ / -] Casual shoes</p>	<p>Different sizes, preferable with non-slip soles;</p>
	<p>Hand disinfectant</p>	<p>On alcohol, phenol or aldehyde basis; placed at the point of care (red zone), in donning areas (green zone) and doffing areas (yellow zones)</p>
	<p>Hair covers</p>	<p>Different models</p>

Users of PPE for 'first assessment' should wear scrubs. In some settings, like some out-patients clinics or social services; this might not be possible in a timely situation. In this case, casual clothes can be worn. Casual clothing needs to be discarded after the patient is referred to a specialised setting. As environmental exposure cannot be excluded, all exposed clothes and shoes should be discarded as infectious waste.



If some of the listed materials are not available, a rapid analysis of the situation needs to be done in order to assess the suitability of the PPE in place. White coats and basic surgical masks should not be used if any of the listed material above is available. In case the PPE for first assessment is not complete, built on the available components and reinforce distance measures avoiding any kind of contact.

The benefits of using shoe covers are exceeded by the risk of exposure during removal. Shoe covers get ripped very easily and doffing shoe covers may increase the high risk of exposure. Disposal of casual shoes is preferred over disinfection of shoes potentially exposed to contaminated environment.

PPE for first assessment donning (putting on) and doffing (taking off)

Follow existing guidance in the use of gowns for IDHC: World Health Organization, How to put on and take of personal protective equipment is available from: http://www.who.int/csr/resources/publications/PPE_EN_A1sl.pdf

Key points

- First assessment is done in two steps, first encounter (triage) and PUI care and full history taking.
- By using distancing measures (more than 1.5 metres) and PPE for first assessment, the infection risk can be significantly reduced.
- Minimise direct contact nursing, such as diagnostic and treatment activities, if only wearing PPE for 'first assessment'.
- In case EVD is suspected in a patient, additional actions are needed, such as contacting the competent public health authorities and the designated hospital qualified for treatment of EVD. Consider transferring the patient at an early stage.

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