

## **Personal protective equipment (PPE) in the context of filovirus disease outbreak response**

**Technical specifications for PPE equipment to be used by  
health workers providing clinical care for patients**

**October 2014**



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# Personal protective equipment (PPE) in the context of filovirus disease outbreak response

## Technical specifications for PPE equipment to be used by health workers providing clinical care for patients

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### 1. Introduction

This document provides technical specifications incorporating WHO recommendations for personal protective equipment (PPE) to be used by health workers providing clinical care for patients with filovirus infection (Ebola and Marburg). Recommendations for PPE were developed in accordance with WHO Rapid Advice Guideline procedures. These recommendations are available at [http://apps.who.int/iris/bitstream/10665/137410/1/WHO\\_EVD\\_Guidance\\_PPE\\_14.1\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/137410/1/WHO_EVD_Guidance_PPE_14.1_eng.pdf?ua=1).

### 2. Recommendations and related specifications

#### 1a. Protection of the mucosae of the eyes, nose and mouth

##### Recommendation 1

All health workers should have the mucous membranes of their eyes, mouth and nose completely covered by PPE while providing clinical care for patients with filovirus disease in order to prevent virus exposure.

*Strong recommendation, high quality evidence for protecting mucous membranes compared to no protection.*

##### Recommendation 2

All health workers should use either a face shield or goggles while providing clinical care for patients with filovirus disease in order to prevent virus exposure.

*Strong recommendation, very low quality evidence for the comparative effectiveness of face shields and goggles for the prevention of filovirus transmission to health workers.*

Technical description of goggles (Recommendation 2)
Good seal with the skin of the face
Flexible frame to easily fit all face contours without too much pressure
Covers the eyes and the surrounding areas and accommodates for prescription glasses
Fog and scratch resistant
Adjustable band to secure firmly so as not to become loose during clinical activity
Indirect venting to reduce fogging
May be re-usable (provided appropriate arrangements for decontamination are in place) or disposable
Quality compliant with standards:
• EU standard directive 86/686/EEC, EN 166/2002

<ul style="list-style-type: none"><li>• ANSI/ISEA Z87.1-2010</li></ul> <p>or equivalent</p>


<b>Technical description of face shield (Recommendation 2)</b>
Made of clear plastic and provides good visibility to both the wearer and the patient
Adjustable band to attach firmly around the head and fit snuggly against the forehead
Fog resistant (preferable)
Completely covers the sides and length of the face
May be re-usable (made of material which can be cleaned and disinfected) or disposable
Quality compliant with standards:
<ul style="list-style-type: none"><li>• EU standard directive 86/686/EEC, EN 166/2002</li><li>• ANSI/ISEA Z87.1-2010</li></ul>
or equivalent



### Recommendation 3

Health workers should wear a fluid-resistant medical/surgical mask with a structured design that does not collapse against the mouth (e.g. duckbill, cup shape) while caring for patients with filovirus disease in order to prevent virus exposure.

*Strong recommendation, low quality evidence when comparing medical/surgical mask with particulate respirator for transmission of filovirus infections.*

The mask should be fluid resistant when used with goggles. Fluid resistance is not required if the mask is used together with a face shield.

<b>Technical description of fluid-resistant medical/surgical mask (Recommendation 3)</b>
High fluid resistance
Good breathability
Internal and external faces should be clearly identified
Structured design that does not collapse against the mouth (e.g. duckbill, cup shape)
Quality compliant with standards:
<ul style="list-style-type: none"><li>• EN 14683 Type IIR performance</li><li>• ASTM F2100 level 2 or level 3</li></ul>
or equivalent

	duck-bill or pouch
	half-sphere or cup shape
	flat-fold
flexwing (not pictured)	

**Recommendation 4**

Health workers should use a fluid-resistant particulate respirator while caring for patients with filovirus disease during procedures that generate aerosols of body fluids in order to prevent virus exposure.

*Strong recommendation, moderate quality evidence when evidence on aerosol-generating procedures for other pathogens is also considered.*

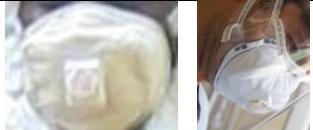
Not all N 95 particulate respirators are necessarily fluid resistant; only N 95 respirators labelled as “surgical N95 respirator” are tested for fluid resistance.

The particulate respirator should be tested for fluid resistance when used with goggles. Fluid resistance is not required if the particulate respirator is used together with a face shield.

<b>Technical description of particulate respirator (Recommendation 4)</b>
Shape that will not collapse easily
High filtration efficiency
Good breathability
Quality compliant with standards for surgical N95 respirator:
<ul style="list-style-type: none"> <li>• NIOSH N95, EN 149 FFP2, or equivalent</li> </ul>
Fluid resistance :minimum 80 mmHg pressure based on ASTM F1862, ISO 22609, or equivalent

duck-bill or pouch

half-sphere or cup shape
flexwing (not pictured)
Quality compliant with standards for particulate respirator worn with full-face shield:
Only to be used together with a face shield
<ul style="list-style-type: none"> <li>• NIOSH N95, EN149 FFP2, or equivalent</li> </ul>

	duck-bill or pouch
	half-sphere or cup shape
	flat-fold
	cup shape with valve
flexwing (not pictured)	

## 5b. Gloves

### Recommendation 5

All health workers should wear double gloves while providing clinical care for patients with filovirus disease in order to prevent virus exposure.

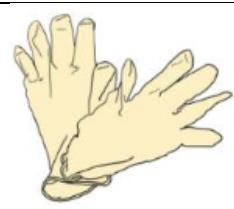
*Strong recommendation, moderate quality evidence for double gloving as compared to single glove use.*

### Recommendation 6

Nitrile gloves are preferred over latex gloves for health workers providing clinical care for patients with filovirus disease in order to prevent virus exposure.

*Strong recommendation, moderate quality evidence on effectiveness and safety of nitrile gloves over other alternatives*

Technical description of gloves (Recommendations 5, 6)
Nitrile
Non-sterile
Powder free
Outer gloves preferably reach mid-forearm (e.g. minimum 280mm total length)
Different sizes
Quality compliant with standards:
<ul style="list-style-type: none"> <li>EU standard directive 93/42/EEC Class I, EN 455</li> <li>EU standard directive 89/686/EEC Category III, EN 374</li> <li>ANSI/ISEA 105-2011</li> <li>ASTM D6319-10</li> </ul>
or equivalent



### 5c. Gown / coverall

#### Recommendation 7

Health workers should wear protective body wear in addition to regular on-duty clothing (e.g. surgical scrubs) while caring for patients with filovirus disease in order to prevent virus exposure

*Strong recommendation, high quality evidence for using protective body wear as against using no protection, based on accumulated evidence from other infections with similar modes of transmission*

#### Recommendation 8

Compared with other forms of protective body wear, the choice of PPE for covering clothing should be either a disposable gown and apron, or a disposable coverall and apron; the gown and the coverall should be made of fabric that is tested for resistance to penetration by blood or body fluids or to blood-borne pathogens.

*Conditional recommendation, very low quality evidence comparing effectiveness of gowns and coveralls*

<b>Technical description of disposable gown (Recommendation 8)</b>	
Single use	
Length, mid-calf to cover the top of the boots	
Avoidance of colours which are culturally unacceptable, e.g. black	
Light colours preferable to better detect possible contamination	
Thumb/finger loops to anchor sleeves in place	
Quality compliant with either of two standards, depending on resistance of materials:	
	<ul style="list-style-type: none"><li>• Option 1: tested for resistance to fluid penetration : EN 13795 high performance level, or AAMI level 3 performance, or equivalent</li></ul>
OR	
	<ul style="list-style-type: none"><li>• Option 2: tested for resistance to blood-borne pathogen penetration: AAMI PB70 level 4 performance, or equivalent</li></ul>
A line drawing of a green gown, showing a long-sleeved top and a full-length skirt. It is positioned in the bottom-left corner of the table's body area.	

<b>Technical description of disposable coverall (Recommendation 8)</b>	
Single use	
Avoidance of colours which are culturally unacceptable, e.g. black	
Light colours preferable to better detect possible contamination	

<p>Thumb/finger loops to anchor sleeves in place</p> <p>Different sizes available – large size especially important</p> <p>Quality compliant with either of two standards, depending on resistance of materials:</p> <ul style="list-style-type: none"><li>• Option 1: tested for resistance to blood and body fluid penetration: meets or exceeds ISO 16603 class 3 exposure pressure, or equivalent</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Option 2: tested for resistance to blood-borne pathogen penetration: meets or exceeds ISO 16604 class 2 exposure pressure , or equivalent</li></ul> <p>Note: for each of the two options mentioned above, different products may be available. The overall material described in option 2 is associated with higher heat stress and less breathability; this reduces continuous wearing time and results in more frequent changes compared to option 1.</p>


**Surgical scrubs** are for use as regular on-duty wear and are not considered PPE. Details are provided for ease of procuring these items. Scrubs are preferable to street clothes while the health worker is on-duty.

<b>Technical description of surgical scrubs (trousers and tops)</b>
Tightly woven
Minimum linting
Non-sterile, reusable or single use
Top/tunic : short sleeves
Trouser : drawstring waist enclosure
Different sizes



#### Recommendation 9

The choice of aprons should be, in order of preference:

1. Disposable, waterproof apron
2. If disposable aprons are not available, heavy duty, reusable waterproof aprons can be used if appropriate cleaning and disinfection between patients is performed.

*Strong recommendation, very low quality evidence comparing effectiveness of disposable and reusable apron*

<b>Technical description of waterproof apron (Recommendation 9, 1.)</b>
Disposable or single use
Made of polyester with PVC-coated, or other waterproof material
Straight apron with bib
Minimum basis weight: 250g/m <sup>2</sup>
Covering size : approximately 70-90cm width x 120-150cm height, or standard adult size
Option 1: Adjustable neck strap with back fastening at the waist
Option 2: Neck strap allowing for tear-off with back fastening at the waist

<b>Technical description of heavy duty apron (Recommendation 9, 2.)</b>
Heavy duty non-woven apron
Straight apron with bib
Fabric: 100% polyester with PVC coating, or 100% PVC, or 100% rubber, or other fluid resistant material (e.g. rubber, PVC)
Water proof, sewn strap for neck and back fastening
Minimum basis weight: 300g/m <sup>2</sup>
Covering size : approximately 70-90cm width x 120cm-150cm height
Reusable (provided appropriate arrangements for decontamination are in place)


#### 5d. Foot wear

##### Recommendation 10

All health workers should wear waterproof boots (e.g. rubber/ gum boots) while caring for patients with filovirus disease in order to prevent virus exposure.

*Strong recommendation, very low quality evidence comparing boots with other types of foot wear.*

<b>Technical description of waterproof boots (Recommendation 10)</b>
Nonslip, have a PVC sole which is completely sealed
Knee-high, in order be higher than the bottom edge of the gown
Optional light colour to better detect possible contamination
A variety of sizes to improve comfort and avoid trauma to the feet



### 5e. Head cover

#### Recommendation 11

All health workers should wear a head cover that covers the head and neck while providing clinical care for patients with filovirus disease in order to prevent virus exposure

*Conditional recommendation, low quality evidence effectiveness of head cover in preventing transmission*

<b>Technical description of hood or head cover (Recommendation 11)</b>
Single use
Preferably fluid resistant
Adjustable and immovable once adjusted
Facial opening constructed without elastic, reaching the upper part of the gown or coverall
 Hood
 Surgical head cover

#### Recommendation 12

The head cover is suggested to be separate from the gown or coverall, so that these may be removed separately.

*Conditional recommendation, low quality evidence comparing different types of head covers*