

Ebola Virus Disease Outbreak Response, Supplies and Lessons Learned Update

UNICEF Supply Division

July 2015

Replaces previously posted version dated 15 December 2014

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Ebola Virus Disease: Personal Protective Equipment and Other Ebola-Related Supplies

This update reports on the full suite of UNICEF Ebola Virus Disease (EVD) supplies required in high- and low-risk EVD exposure settings. It includes preliminary lessons learnt and links to information on pipeline therapeutic and medical interventions.

1. Summary

- The Ebola Virus Disease (EVD) outbreak in West Africa has reached 27,642 documented confirmed, probable and suspected cases and over 11,261 deaths (as of 15 July 2015) and principally affected three countries with widespread and intense transmission (Guinea, Liberia and Sierra Leone). WHO declared Liberia as Ebola-free on May 9th 2015. However, 6 new cases were reported after June 29. The origin of transmission is under investigation, although genomic sequencing strongly suggests a re-emergence of the virus. Cases of Ebola persist in Guinea and Sierra Leone.
- No licensed treatment or vaccine for EVD currently exists. Supportive care, containment and transmission prevention are the currently broadly available interventions. UNICEF procures and stocks essential medical and hygiene supplies and EVD personal protective equipment (PPE) for front-line workers, caregivers and patients in support of EVD outbreak response and preparedness.
- UNICEF, in collaboration with WHO, Médecins Sans Frontières (MSF) and other stakeholders supporting the supply of appropriate PPE options to the EVD outbreak, developed product specifications of essential supplies to assist UNICEF Country Offices (COs) and Governments in EVD planning, preparedness and response. While some PPE can be used in both high- and low-risk settings, protective suits (coveralls) that pass the liquid test [EN14605:2005](#) and made of fabric passing viral penetration test ([ISO 16604:2004](#)) provide the ultimate protection against viral infection for medical and non-medical staff in EVD outbreak settings, and are sourced by UNICEF. UNICEF has revised the PPE components list for use in high-risk settings (Table 1), following feedback from in-country visits and consultation with local government partners and front-line workers.
- Supply of appropriately specified PPEs has been sufficient to meet demand and stock-outs are no longer reported at site level. UNICEF has 17 long-term arrangements (LTAs) with awarded EVD PPE suppliers, which expanded UNICEF's supply base for these commodities and improved supply dynamics.
- UNICEF continues to be involved in consultations with industry and partners to further develop the performance and suitability of key supplies for EVD outbreak response, as well as conducting a reflection on its response to identify key lessons learnt and corrective measures to inform future emergency responses interventions.

2. Background

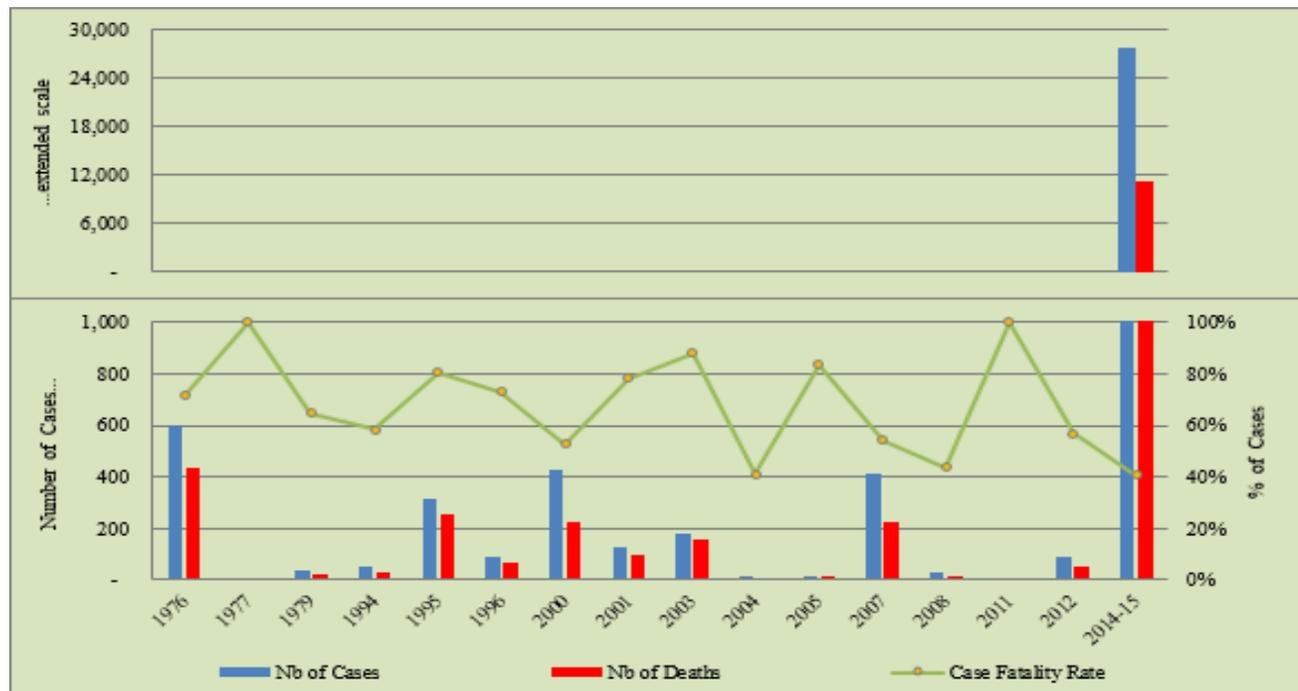
EVD (previously known as Ebola haemorrhagic fever) is a virulent disease with a case fatality rate (CFR) that can reach up to 90%. The virus is transmitted through direct contact with infected human or animal bodily fluids, internal organs and skin tissue.¹ It is not transmitted through air, water or food.² EVD occurs primarily in remote areas of Central and West Africa; however, the current outbreak in

¹ World Health Organization, [Ebola Virus Disease](#), WHO, Geneva, April 2014.

² Centers for Disease Control and Prevention, [Ebola](#), CDC, Atlanta, August 2014.

West Africa includes urban centres. There have been 24 documented previous outbreaks since 1976, each averaging ~100 cases and a CFR of 66%. The current outbreak has reached 27,642 cases and over 11,261 deaths (15 July),³ with a CFR of over 41% (Figure 1). However, this figure could be materially higher as the outcomes for many cases are unknown. 26 million people, including 10.3 million children live in the areas affected by Ebola. WHO declared Liberia Ebola-free on May 9th 2015.⁴ However, 6 new cases were reported after June 29. The origin of transmission is under investigation, although genomic sequencing strongly suggests a re-emergence of the virus. Cases of Ebola persist in Guinea and Sierra Leone.

Figure 1 EVD Outbreaks, Cases, Deaths and CFR



Source: WHO.

The incubation period, from time of infection to symptoms onset, is between 2-21 days. Patients are only infectious when symptomatic. There is currently no licensed treatment or vaccine for EVD. Only supportive care and intensive prevention through isolation and containment can be broadly provided.⁵

UNICEF is working closely with WHO, MSF, the International Medical Corps (IMC) and the International Federation of Red Cross and Red Crescent Societies (IFRC), as well as other partners and communities on outbreak response to share information on how to prevent the further spread of EVD and care for those already affected. The latest updated information and materials critical to assist countries dealing with EVD and outbreak response management is available [here](#).

UNICEF has prepared a [field guide for UNICEF staff](#)⁶ to explain EVD epidemiology, describe UNICEF's roles and responsibilities, and what can be done to prevent and prepare for an EVD outbreak. The information and resources are available in different languages on the UNICEF Ebola SharePoint

³ World Health Organization, [WHO: Ebola Response Roadmap Situation Report](#), WHO, Geneva, 15 July 2015.

⁴ World Health Organization, [The Ebola Outbreak in Liberia is Over](#), WHO, Geneva, 9 May 2015.

⁵ World Health Organization, [Frequently Asked Questions on the Ebola Disease](#), WHO, Geneva, August 2014.

⁶ Field guide for UNICEF staff only.

site. UNICEF has also prepared a [practical guidance tool to help COs](#) assess and mitigate the risks to health supply chains in a time of Ebola outbreak. UNICEF has developed a supply-planning tool for use in planning, preparedness and response.⁷

3. EVD Personal Protective Equipment (PPE) and Body Bags

Common selection specification for EVD PPE supplies and burial cadaver bags (body bags) for response to countries affected by Ebola have been agreed between all stakeholders based on the risk hazard assessment identified by each treatment centre, and the infectious agent transmission in each facility during medical intervention and care. “High-risk” areas include treatment or isolation facilities accommodating patients (suspected or confirmed), laboratories and mortuary. “Low-risk” areas include facilities used for service preparation, stores, laundry and disinfection. In addition to universal precautions, EVD PPEs include protection for the head, eyes, respiration, body, hands and feet, mucosal membranes in both high- or low-risk areas. Precautionary measures in high-risk areas should include patient isolation and protective clothing. In low-risk areas, universal precautions is required with basic PPEs (gloves, mask and goggles).

UNICEF participated in WHO’s EVD PPE guideline development meeting in early-October 2014 together with the United States Centers for Disease Control and Prevention (CDC) and MSF. UNICEF provided technical support and assistance in developing the rapid guideline document released by WHO at the end-October 2014, helping to identify the appropriate EVD PPE technical specifications, standards and guidance to determine and define the context and end-use function of the equipment.

UNICEF updated and published the EVD [PPE components supply list and the specifications](#) required for high-risk settings including EVD treatment units/centres (ETU/Cs), holding centres and for burial teams in March 2015. Table 1 below provides a summary of that information. The quantities of components in the draft kit will continue to be updated with input from the field and refined through consultation with stakeholders. The kit includes substitute, or alternate products for some PPE items that could be difficult to source in sufficient quantity to meet the needs without compromising the safety level of the biological barrier against EVD.

Table 1 EVD PPE Components Supply List for High-Risk Settings

Body Barrier Area	PPE Product	Reusable or Disp.	Substitute PPE Product(s) and Notes	Reusable or Disp.
Body inner layer	Tunic, surgical, woven. Sizes M, L and XL.	Reusable	Alternative sizes of same item.	-
Body inner layer	Trousers, surgical, woven. Sizes M, L and XL.	Reusable	Alternative sizes of same item.	-
Head inner layer	Cap, surgical, non-woven, disposable.	Disp.	Cap, surgical, woven, reusable.	Reusable
Head inner layer	Hood, protection.	Disp.		
Body and head outer layer	Coverall, protective, Cat. III, liquid / spray tight, with or without hood, tested against viral penetration. Sizes M, L, XL and XXL.	Disp.	Coverall, protective, Cat. III, limited splash / spray with or without hood, tested against viral penetration, sizes M, L, XL and XXL, worn with apron with sleeves made of same coverall fabric.	Disp.
Body and head outer layer	Apron with sleeves (gown), protective, Cat III, liquid or spray tight, with or without hood, tested against viral penetration. Sizes, L, XL.	Disp.	Gown, surgical, standard/ high performance.	Disp.
Body outer layer	Aprons, surgical, disposable.	Disp.	Apron, rubber, heavy duty.	Reusable

⁷ The tool is a working document and is currently subject to review.

Nose and mouth	Mask, high filtration/Respirator, (grade FFP2 or N-95 liquid splash resistant, without valve, single use.	Disp.	Surgical Mask type IIR, single use.	Disp.
Hands	Gloves, examination nitrile, non-sterile, single use, sizes S, M and L.	Disp.	Alternative sizes of same item.	-
Hands	Gloves, surgical, single use, sterile.		Gloves, examination nitrile, long cuff, non-sterile, single use, sizes S, M, L.	
Hands	Gloves, utility, rubber or nitrile, heavy duty.	Reusable	None. Gloves heavy duty, latex.	-
Face and eyes	Face shield, fog resistant, full-face length.	Reusable	Face shield, clear with head bank, fog resistant, full-face length.	Disp.
Face and eyes	Goggles, protective, wrap around, panoramic view, plastic, fog resistant, with indirect side vent.	Reusable	Either face shield or goggles depending on procedure.	-
Feet and legs	Boots, lightweight PVC or rubber, heavy duty (impermeable and puncture proof), anti-slip, closed, sizes 41, 43 and 45.	Reusable	Alternative sizes of same item.	-
Feet and legs	Optional: Overboots, with PVC sole and elasticized top.	Disp.		

Source: UNICEF Supply Division.

Body bags for infection control in particular must meet minimum specifications to ensure safe disposal of cadavers (Table 2). The material codes and specification references for the catalogued items are also available in the aforementioned published the PPE components supply list.

Table 2 Body Bag Infection Control Specifications

Aspects	Specifications
Use	- Single use, disposable.
Zipper	- Full-length U or J-shaped zipper with double runner. - High quality black or white smooth running with teeth made of nylon. - Large plastic or tissue loops on each of the zip-runners to allow for easy manipulation. - Zipper to be sewed into the body bag fabric with double stitch. - Stop for the zipper to be reinforced into the body bag.
Impermeability	- Non-porous, body fluid leak-proof during corpse handling and transportation.
Labelling	- Integrated transparent label pouch for identification tag; Pouch to be 10 cm x 15 cm (l x w). - Product label to indicate product short description and size in cm and inches.
Material strength	- Highly tear-proof and puncture resistant.
Seams	- Entirely heat-sealed seams with minimum 10 mm seal-width.
Material	- Non-PVC; Linear enforced PE, EVA or PEVA (Polyethylene, Ethylene, Vinyl Acetate). - Must not contain chlorides.
Thickness	- 300 to 400 um.
Degradability	- Disintegration in soil over a period of 5-8 years.
Volume	- Carry capacity of 120 kg (adult) / 50 kg (child).
Handle fittings	- Min 6 padded carry handles integrated and reinforced into the body bag using same materials.
Colour	- White.
Dimensions	- Unfolded: 220 x 100 cm (l x w) (adult) / 120 x 80 cm (l x w) (child).
Supply format	- Folded 45 cm x 35 cm (l x w).
Shelf life	- Shelf life at least 6 years.

Source: UNICEF Supply Division.

UNICEF completed a competitive tender for essential PPE and is engaged with awarded suppliers in LTAs that increase the procurement efficiency for affected EVD countries. UNICEF also supports the non-affected countries with supplies related to emergency preparedness. The tender led to an increase in the number of suppliers and brands being available through UNICEF and a geographic expansion to UNICEF's PPE supplier base. The monthly production capacity of coveralls available to UNICEF increased from 80,000 units to 300,000 units by March 2015. The price range for a full PPE set ranges currently from US\$40-\$52 and the variation mostly relates to quality, standards, place of production

and supply availability of each manufacturer. While all PPE equipment provides the highest level of protection against EVD (Category 3); type 3 products are more expensive as they can withstand a higher amount of tensile stress. Type 4 products are cheaper, lighter and can withstand a lesser amount of tensile stress than type 3.⁸ Even though the price for some PPE components were reduced during the tender in 2014, some items did not have any price reduction and some even increased.

As part of the [UN Mission for Ebola Emergency Response \(UNMEER\)](#) framework, UNICEF supported a complementary approach aimed at reducing household transmission through the establishment of Community Care Centres (CCCs). CCCs complement ETU/Cs. They are simple, temporary structures that offer suspected EVD patients an isolated area where they can receive supportive care in the comfort of their community. Each CCC has an eight to ten-bed capacity. UNICEF built 65 CCCs in the three affected countries providing 608 beds (Table 3).

Table 3 UNICEF CCCs Built in Guinea, Liberia and Sierra Leone

	Guinea	Liberia	Sierra Leone	Total
Number of CCCs	6	13	46	65
Number of beds	48	152	404	608

Source: UNICEF Supply Division.

Evidence from the three affected countries suggests that in high-risk settings, on average 3.4 EVD PPE sets per day / per bed are used in ETUs and CCCs. Based on this and depending on the specific EVD PPE items chosen to make up a set, the monthly volume of EVD PPE sets used by front line health workers operating in CCCs containing eight to ten beds range between 810-1,020 PPE sets a month, at a cost of US\$16,300-US\$20,400. The monthly EVD PPE volume and costs for ETUs varies more widely depending on the number of beds in the unit. For both CCCs and ETUs, monthly EVD PPE demand and cost estimates also depend on the bed occupancy rate (BoR) in the specific Centre or Unit.

4. EVD Lessons Learnt

The overall demand for PPEs and related supplies was in flux through to end-2014, as country plans were repeatedly updated in response to the changing pattern of the outbreak. UNICEF worked with WHO to establish greater clarity on the needs and to increase transparency through improved global demand forecasts. UNICEF and WHO launched a portal end-2014 communicating the demand forecast and countries' pipelines.

WHO conducted surveys during 1Q 2015 on staff experience on PPE use and associated procurement. The findings noted that respondents revealed some supplies where not optimal in terms of thermal comfort for front-line workers. Table 4 describes some key findings from the survey:

Table 4 WHO Innovative PPE Equipment Online Survey Results

Item	Key comments
Eye protection	Discomfort from nosepiece covered by eye protection cover and fog build up.
Nose and mouth protection	Elastic bands caused discomfort as well as preference for integrated hood and face cover.
Hands protection	High variance in heavy duty gloves quality and a need for gloves that tighten at the wrist.
Body protection	Thermal comfort not optimal, easier doffing requirements and loops for thumbs.

Source: WHO.

UNICEF is engaged with PPE manufacturers and outbreak response partners to further develop performance and suitability measures of key PPE supplies for EVD outbreak response.

⁸ For more information see UNICEF updated and published [PPE components supply list and the specifications](#).

While recognising that the outbreak is still ongoing, UNICEF undertook an EVD response lessons learnt exercise in early 2015 to identify key areas requiring corrective measures and possible further evaluation. UNICEF has yet to finalize and publish its findings, and the recommendations on these are forthcoming. Some key emerging highlights include UNICEF's proactive negotiation role with suppliers in the production and delivery of PPEs, as well as defining their technical specifications. The review also identified a number of challenges concerning the availability of data, management of information, and the performance monitoring system. A lack of human resource capacity meant reporting was not always consistent.

5. Pipeline Therapeutic and Medical Interventions

WHO are evaluating pipeline products that could eventually be used for EVD diagnostics, prophylaxis and therapeutics. Most of the prophylaxis and therapeutics products are currently in pre-clinical or Phase 1 studies, with limited immediate availability (even if appropriate regulatory and ethical clearances were given). The development of these products have been generously financially supported, including substantial grants (sometimes greater than \$100 million), from various governments.

More information on treatment and vaccines is available through the following link:

EVD Essential Medicines and Health Products:

<http://www.who.int/medicines/empEbolaqa/en/>

WHO assesses and lists accepted in vitro diagnostics (IVDs) to be used in EVD diagnosis through an Emergency Use Assessment and Listing (EUAL) procedure. More information is available through the following link:

EVD diagnostics:

http://www.who.int/diagnostics_laboratory/procurement/purchasing/en/

6. Next Steps

- UNICEF's 17 LTAs for PPEs and other Ebola-related suppliers expire on the 31st of July 2015. UNICEF will review with partners the need to extend the duration of LTAs based on the Ebola outbreak situation.
- UNICEF will prepare procurement strategies for anticipated purchase of EVD vaccines and Rapid Diagnostics Tests (RDTs) as these products get closer to licensure.
- UNICEF will continue to work with the different PPE manufacturers to maintain a diverse supplier base, and will continue to look for opportunities to increase supply capacity and reduce lead times for delivery. UNICEF has updated its standards to establish supplier arrangements for EVD PPE to meet demand for low- and high-risk settings and is engaged with industry and partners to further develop performance and suitability of key supplies for EVD outbreak response.
- UNICEF will explore set-packing EVD PPE kits for high-risk setting until the containment of EVD or availability of licensed, safe and effective EVD treatments.
- UNICEF will continue to survey the EVD prophylaxis and therapeutics markets to assess the potential availability, production capacity and timing for scale-up of emerging EVD interventions that could be opportunistically used.
- Findings and recommendations from the assessment of UNICEF's lessons learned, will be reviewed and shared with partners as appropriate.

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Other UNICEF information notes can be found at http://www.unicef.org/supply/index_54214.html.