


**Ebola outbreak - What are the main lessons learned for infection control?**  
Prof. Benedetta Allegranzi, Dr. Anthony Twyman, and Dr. Joyce Hightower, World Health Organization  
Sponsored by the World Health Organization Patient Safety Challenge



**World Health Organization**

**Ebola outbreak**  
**What are the main lessons learned for infection control?**

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Hosted by Claire Kilpatrick

[www.webbertraining.com](http://www.webbertraining.com) January 20, 2016

**Magnitude of the Ebola outbreak 2014-15**  
**Combination of determining factors**

- **Geographical:** ease of cross border movements, outbreak in urban areas leading to high transmission
- **Cultural:** religious practices and customs facilitating transmission, care-seeking behavior
- **Structural:** poor roads, infrastructure, lack of access to clean water and basic sanitation, weak health systems with limited capacity to detect and control infectious disease outbreaks in the affected countries,
- **Socioeconomic:** high poverty levels, low literacy rates, post conflict environments),
- **Governance issues:** lack of linkages between central and peripheral levels
- Poor implementation of International Health Regulations

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## Key lessons learned for infection prevention and control (IPC) from the Ebola outbreak

1. Absence of IPC basic measures and infrastructures both in the community and in healthcare settings led to the unprecedented situation of this outbreak

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**Water, sanitation and hygiene in health care facilities**  
Status in low- and middle-income countries and way forward

**WASH IN HEALTH CARE FACILITIES**  
FOR BETTER HEALTH CARE SERVICES

**Newly issued on 17 March 2015**

- **54 countries (LMIC)**
- **66,101 facilities**
- **38% no improved water source**
- **19% no improved sanitation**
- **35% no water and soap for handwashing**

[http://www.who.int/water\\_sanitation\\_health/publications/wash-health-care-facilities/en/](http://www.who.int/water_sanitation_health/publications/wash-health-care-facilities/en/)

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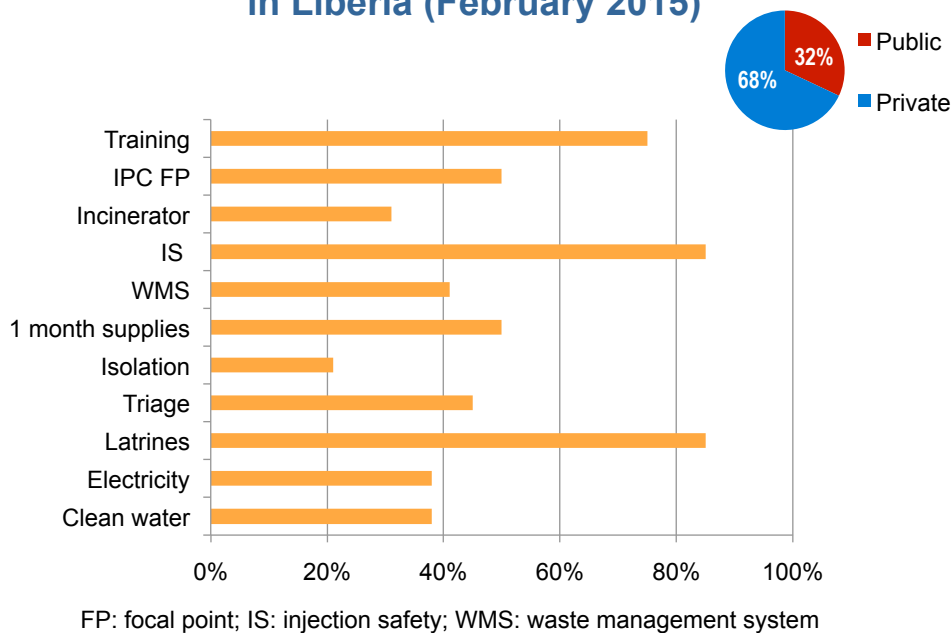
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**Provision of water, sanitation and hygiene services in healthcare facilities**

WHO Regions	Access to an improved water source within 500 m			Access to improved sanitation facilities			Access to soap for handwashing		
	Number of facilities*	Number of countries	Coverage (mean)	Number of facilities	Number of countries	Coverage (mean)	Number of facilities	Number of countries	Coverage (mean)
All	66,101	54	62%	62,524	36	81%	40,536	35	65%
AFRO	52,674	23	58%	51,715	16	84%	31,984	14	64%
AMRO	3,026	16	70%	1,425	11	57%	1,442	11	65%
EMRO	5,778	3	—	5,510	2	—	5,510	2	—
EURO	527	3	—	527	3	—	420	2	—
SEARO	3,596	6	78%	3,347	4	—	1,180	4	—
WPRO	500	3	—	0	0	—	0	0	—

Country	N°of healthcare facilities (HCFs)	Water coverage in HCFs	Sanitation coverage in HCFs	Soap for HW availability
Guinea	1401	13%		
Liberia (2013)	328	50%	91%	54%
Sierra Leone	1264	62%	78%	95%

**IPC assessments in 113 healthcare facilities in Liberia (February 2015)**



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## Improvements of Water Supply



Excavation to lay the pipes



Taps with running water in the operating theatre

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Slide courtesy of Nanah Sesay-Kamara National IPC Coordinator, Ministry of Health and Sanitation, Sierra Leone



### **Key lessons learned for infection prevention and control (IPC) from the Ebola outbreak**

1. Absence of IPC basic measures and infrastructures both in the community and in healthcare settings led to the unprecedented situation of this outbreak
2. Importance of consistency and coordination within & among agencies

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This collage features several WHO documents:

- Personal protective equipment in the context of filovirus disease outbreak response** (October 2014): A rapid advice guideline detailing PPE use for Ebola and Marburg.
- Clinical Management of Patients with Viral Haemorrhagic Fever: A Pocket Guide for the Front-line Health Worker** (26 January 2014): A guide for front-line health workers.
- Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus**: A document providing interim guidance on infection prevention and control.
- Steps to take off personal protective equipment (PPE) including coveralls**: A detailed guide with 14 numbered steps and illustrations for safely removing PPE.
- Key Messages for School Operations in Countries with Outbreaks of Ebola** (February 2015): A document for school settings.
- Rapid Guidance on the Decommissioning of Ebola Care Facilities**: A guideline for safely decommissioning care facilities.
- GUIDELINE ON HAND HYGIENE IN HEALTH CARE IN THE CONTEXT OF FILOVIRUS DISEASE OUTBREAK RESPONSE**: A guideline on hand hygiene.

This collage features documents from the Department of Health and the CDC:

- Management of Hazard Group 4 viral haemorrhagic fevers and similar human infectious diseases of high consequence**: A document from the Department of Health's Advisory Committee on Dangerous Pathogens.
- 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)** (Updated on 20<sup>th</sup> October 2014): A CDC guideline detailing PPE procedures for U.S. hospitals.
- FILOVIRUS HAEMORRHAGIC FEVER: GUIDELINE** (2008) by Medecins Sans Frontieres: A guideline from MSF.

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1. Absence of IPC basic measures and infrastructures both in the community and in healthcare settings led to the unprecedented situation of this outbreak
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3. **Fear factors**, especially in emergency situations can lead to **misplaced focus in IPC** and/or to **wrong IPC practices**

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## Lack of clarity about transmission

### Facts about Ebola

You can't get Ebola through air

You can't get Ebola through water

You can't get Ebola through food

You can only get Ebola from touching bodily fluids of a person who is sick with or has died from Ebola, or from exposure to contaminated objects, such as needles. Ebola poses no significant risk in the United States.

### Ebola

#### What's the difference between infections spread through the air or by droplets?

**Germ spread through the air:** Germs like chickenpox and TB are spread through the air. Airborne spread happens when a germ floats through the air after a person talks, coughs, or sneezes. Germs may land in the eyes, mouth, or nose of another person. If a germ is airborne, direct contact with the infected person is NOT needed for someone else to get sick. Airborne spread diseases include chickenpox, tuberculosis.

**Ebola is spread through droplets:** Droplet spread happens when germs traveling inside droplets that are coughed or sneezed from a sick person enter the eyes, nose, or mouth of another person. Droplets travel short distances, less than 3 feet (1 meter) from one person to another. A person might also get infected by touching a surface or object that has germs on it and then touching their mouth or nose. Droplet spread diseases include plague, Ebola.

**Droplet spread on surfaces:** How do I protect myself from getting sick?  
 • **Wash your hands** often with soap and water. If soap and water are not available, use an alcohol-based hand sanitizer.  
 • **Cover your cough!** Cover your nose and mouth with a tissue when you cough or sneeze. Throw the tissue in the trash after you use it.  
 • **Avoid close contact with people who are sick.**  
 • **Avoid touching your eyes, nose and mouth.**  
 Germs spread this way.  
 • **Clean and disinfect commonly touched surfaces** like doorknobs, faucet handles, and toys, since the Ebola virus may live on surfaces for up to several hours.

**Is Ebola airborne?**  
 No. Ebola is not spread through the airborne route nor through water or food.

**Is Ebola spread through droplets?**  
 Yes. To get Ebola, you have to directly get body fluids like pee, poop, spit, sweat, vomit, semen, breast milk from someone who has Ebola in your mouth, nose, eyes or through a break in your skin or through sexual contact.  
 Air, food, and water do not carry the Ebola germs.

## The PPE Obsession!

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## Other key elements for IPC...

1. **Standard precautions for all patients at all times**
2. Patient triage and isolation
3. Hand hygiene
4. Environmental cleaning and disinfection
5. Cleaning and disinfection of patient care equipment
6. Waste disposal
7. Injection safety and prevention of sharps injuries
8. Laboratory safety
9. Safe post-mortem examination
10. Safe management of dead bodies
11. Management of exposure risk and accidents

## New WHO Guidelines on Personal Protective Equipment (PPE)

Personal Protective Equipment  
in the Context of Filovirus Disease Outbreak Response

Rapid advice guideline

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

What are the benefits and harms of double gloves, full face protection, head cover, impermeable coveralls, particulate respirators, and rubber boots as PPE when compared with alternative less robust PPE for HCWs caring for patients with filovirus disease?



### Guideline development process

- Development of key research questions
- Systematic literature reviews
- Literature review and an online survey on values and preferences of health workers
- Evidence-to-recommendations exercise using the GRADE framework
- Expert consultation
- WHO Guideline Review Committee

**Issued on  
31 October 2014**

<http://who.int/csr/resources/publications/ebola/infection-prevention/en/>

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## How you use PPE is crucial:

- **Essential:** for putting on and removing PPE, **supervision** by a trained member of the team
- Avoid touching or adjusting PPE
- Perform hand hygiene before donning new gloves
- Avoid touching your eyes, mouth, or face with gloved or ungloved hands
- Leave the red zone and remove PPE if you have to urinate or touch your PPE or eyes, mouth, or face
- **For removal:**
  - **Remove the most contaminated PPE items first and PPE protecting eye, nose and mouth mucosae at last**
  - Be careful to avoid any contact between the soiled items (e.g. gloves, gowns) and any area of the face (i.e. eyes, nose or mouth) or non-intact skin
  - Discard disposable items in a waste container

## It's all about spraying everywhere!



18 | Key Measures for Prevention

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## Spraying

- **Spraying chlorine solutions should not be routinely encouraged** (*WHO Interim IPC Guidance 2014*) because:
  - it is not an evidence-based practice, and
  - it can cause virus spread through aerosolization,
  - it gives a false sense of safety (insufficient contact time), and
  - if extensively used, can lead to adverse events among staff and patients
- “**Avoid** cleaning techniques, such as using pressurized air or water **sprays**, that may result in the generation of bioaerosols” (*OSHA Fact Sheet*)
- If spraying chlorine solutions is utilized, **staff should still maintain maximum attention** while manipulating organic material, touching contaminated surfaces, and removing PPE because these may still be contaminated by the Ebola virus

## Cleaning and decontamination process

**WARNING:** chlorine is inactivated when it gets in contact with organic material; therefore, directly pouring chlorine over spills or liquid waste containing blood or body fluids will NOT lead to appropriate decontamination of this waste and of the soiled surfaces

Key principles for environmental cleaning and decontamination:

1. Remove the soiled with a rag or towel or wipe
2. Clean with soap/detergent
3. Disinfect with chlorine solution 0.5%

- *Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008*

- *WHO IPC Interim Guidance. December 2014*

- *CDC Interim Guidance for Environmental Infection Control in Hospitals for Ebola Virus*

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## What was wrong about hand hygiene?

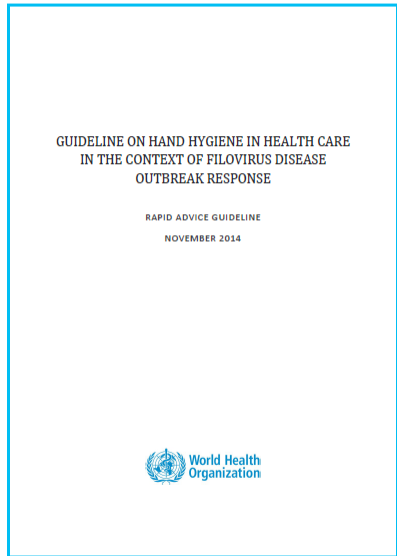
- Use of chlorine solutions?
- Soaking hands in bowls containing chlorine solutions
- Inappropriate technique
- Insufficient contact time
- Inadequate hand hygiene facilities at the point of care
- No hand hygiene between patients
- Not freshly prepared chlorine solutions
- Lack of quality control (adequate concentrations)

22 | Key Measures for Prevention and Control of Ebola Virus Disease



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## New WHO Guidelines on Hand Hygiene in Health Care in the Context of Filovirus Disease Outbreak Response



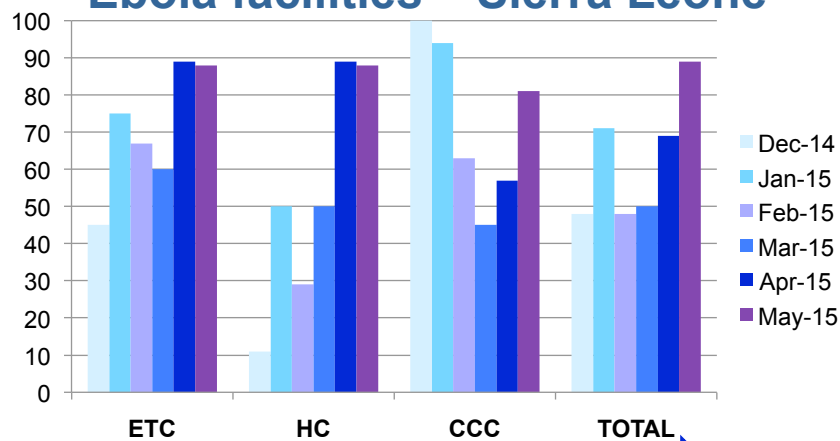
### Guideline development process

- Development of key research questions
- Systematic literature reviews
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- Expert consultation
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**Issued in December 2014**

<http://www.who.int/mediacentre/news/releases/2014/ebola-ppe-guidelines/en/>

## 206 WHO/MOH IPC assessments in Ebola facilities – Sierra Leone



**IMPROVEMENT ACTIONS**



## Key lessons learned for infection prevention and control (IPC) from the Ebola outbreak

1. Absence of infection prevention and control basic measures and infrastructures both in the community and in healthcare settings led to the unprecedented situation of this outbreak
2. Importance of consistency and coordination within & among agencies
3. Fear factors, especially in emergency situations can lead to misplaced focus in IPC and/or to wrong IPC practices
4. **Healthcare workers** have been the frontline victims of these vicious circles

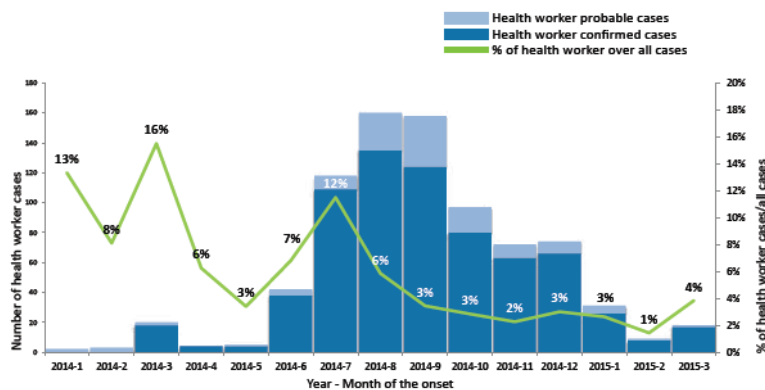
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## EVD in healthcare workers

- HCWs are **21 to 32 times more likely to be infected by EVD** than the general population
- **Total N°EVD in HCWs (3 countries): 815 (3.9% of conf. & probable cases), with 65.5% CFR (418/635)**

Figure 1. Number of confirmed and probable health worker EVD cases over time (and proportion of health worker cases among all cases\* reported) in the three countries combined (Guinea, Liberia and Sierra Leone), 1 January 2014 - 31 March 2015



WHO Interim Report, May 2015, <http://www.who.int/csr/resources/publications/ebola/health-worker-infections/en/>

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## Professional categories

	NON-HEALTH WORKERS ≥15 <sup>+</sup> % [95% CI] (n)	HEALTH WORKERS % [95% CI] (n)		GUINEA % [95% CI] (n)	LIBERIA % [95% CI] (n)	SIERRA LEONE % [95% CI] (n)
Health worker position category <sup>a,4</sup>	Not applicable	N=718* Missing=97	Not applicable	N=191 Missing=8	N=228 Missing=60	N=292 Missing=29
Medical workers		12% [9.3-14.1] (83)		30% [23.5-36.9] (57)	7% [4.1-11.1] (16)	3% [1.7-6.2] (10)
Nursing workers <sup>5</sup>		52% [48.2-55.7] (373)		45% [37.8-52.4] (86)	53% [45.9-59.3] (120)	57% [51.3-62.9] (167)
Midwifery workers		3% [2.0-4.8] (23)		4% [1.5-7.4] (7)	2% [0.7-5.0] (5)	4% [1.9-6.6] (11)
Ambulance workers		3% [1.9-4.6] (22)		6% [2.9-10.1] (11)	1% [0.1-3.1] (2)	3% [1.4-5.8] (9)
Laboratory workers		7% [5.0-8.8] (48)		5% [2.2-8.8] (9)	7% [3.7-10.6] (15)	8% [5.3-12.0] (24)
Pharmacy workers		3% [1.8-4.4] (21)		1% [0.0-3.7] (2)	5% [2.7-9.0] (12)	2% [0.6-4.2] (7)
Community health workers		3% [2.2-4.9] (24)		1% [0.0-2.9] (1)	1% [0.3-3.8] (3)	7% [4.2-10.4] (20)
Trade and elementary workers		7% [4.8-8.6] (47)		5% [2.2-8.8] (9)	8% [4.7-12.2] (18)	7% [4.2-10.4] (20)
All others		11% [8.6-13.2] (77)		5% [2.2-8.8] (9)	16% [11.7-21.7] (37)	11% [7.33-14.7] (31)

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	NON-HEALTH WORKERS ≥15 <sup>+</sup> % [95% CI] (n)	HEALTH WORKERS % [95% CI] (n)		GUINEA % [95% CI] (n)	LIBERIA % [95% CI] (n)	SIERRA LEONE % [95% CI] (n)
Sex	N=15976 Missing=256	N= 814 Missing= 1	p-value	N=199 Missing=0	N=287 Missing=1	N=328 Missing=0
Female	52% [51.1-52.7] (8296)	39% [35.2-42.0] (314)	<0.01	23% [17.0-29.1] (45)	42% [36.0-47.8] (120)	45% [39.9-51.0] (149)
Male	48% [47.3-48.8] (7680)	61% [58.0-64.8] (500)		77% [70.9-83.0] (154)	58% [52.2-64.0] (167)	55% [49.0-60.1] (179)
Age-group	N=15265 Missing=967	N=792 Missing=23	p-value	N=199 Missing=0	N=276 Missing=12	N=317 Missing=11
15-29	36% [35.5-37.1] (5541)	22% [18.8-24.6] (171)	<0.01	29% [22.5-35.5] (57)	15% [10.6-19.2] (40)	23% [18.8-28.4] (74)
30-44	35% [34.1-35.6] (5323)	47% [43.8-50.9] (375)		46% [39.2-53.4] (92)	51% [45.0-57.1] (141)	45% [39.2-50.5] (142)
45+	29% [28.1-29.6] (4401)	31% [27.9-34.4] (246)		25% [19.3-31.7] (50)	34% [28.8-40.4] (95)	32% [26.8-37.3] (101)
Hospitalization	N= 10946 Missing=5286	N=749 Missing=66	p-value	N=189 Missing=10	N=263 Missing=25	N=297 Missing=31
Yes	62% [60.8-62.6] (6754)	77% [73.4-79.6] (574)	<0.01	96% [92.5-98.5] (182)	71% [64.8-76.2] (186)	69% [63.8-74.6] (206)
No	38% [37.4-39.2] (4192)	23% [20.4-26.6] (175)		4% [1.5-7.5] (7)	29% [23.8-35.2] (77)	31% [25.4-36.2] (91)
Final outcome <sup>2</sup>	N=8474 Missing=7758	N=635 Missing=180	p-value	N=196 Missing=3	N=220 Missing=68	N=219 Missing=109
Alive	30% [28.8-30.8] (2523)	34% [30.5-38.0] (217)	0.02	44% [37.3-51.6] (87)	29% [22.8-35.1] (63)	31% [24.6-37.2] (67)
Dead	70% [69.2-71.2] (5951)	66% [62.0-69.5] (418)		56% [48.4-62.7] (109)	71% [64.9-77.2] (157)	69% [62.8-75.4] (152)

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	<b>Circumstances leading to Exposure</b>	<b>Total Citations</b>
<b>1</b>	Insufficient / Inadequate PPE / Inconsistent use of PPE	17
<b>2</b>	Unrecognized Ebola patients	7
<b>3</b>	No soap, chlorine/beach/cleaning supplies, running water, electricity, working waste disposal system	7
<b>4</b>	Isolation Areas/Setup - Improper / Inadequate	4
<b>5</b>	Barrier Nursing - Improper / Inadequate / Absent	3
<b>6</b>	Hygiene / Contaminated Equipment - Surfaces	3
<b>7</b>	Washing hands inconsistencies/inadequacies or no hand washing stations	3
<b>8</b>	Rubbed eyes with soiled glove	3
<b>9</b>	HCW providing nursing care at home	2
<b>10</b>	Cadaver exposure in hospital and public	2

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**Key lessons learned for infection prevention and control (IPC) from the Ebola outbreak**

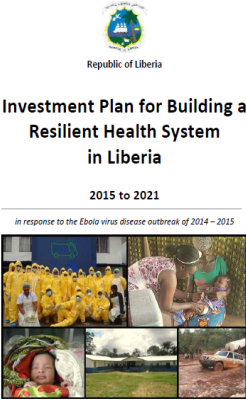


1. Absence of infection prevention and control basic measures and infrastructures both in the community and in healthcare settings led to the unprecedented situation of this outbreak
2. Lack of consistency and coordination within & among agencies
3. Fear factors, especially in emergency situations can lead to misplaced focus in IPC and/or to wrong IPC practices
4. Healthcare workers have been the frontline victims of these vicious circles
5. At least, the Ebola outbreak has given the **opportunity to get IPC on the top of the national and international agendas**

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## National Recovery Plans

 <p style="text-align: center;">Republic of Liberia</p> <p style="text-align: center;"><b>Investment Plan for Building a Resilient Health System in Liberia</b></p> <p style="text-align: center;">2015 to 2021</p> <p style="text-align: center;"><small>In response to the Ebola virus disease outbreak of 2014 – 2015</small></p>	 <p style="text-align: center;">MINISTRY OF HEALTH AND SANITATION</p> <p style="text-align: center;"><b>HEALTH SECTOR RECOVERY PLAN (2015 – 2020)</b></p> <p style="text-align: center;"><small>Government of Sierra Leone working together with partners to</small></p>	 <p style="text-align: center;">REPUBLICQUE DE GUINEE</p> <p style="text-align: center;"><small>Fraternité - Justice - Solidarité</small></p> <p style="text-align: center;">MINISTERE DE LA SANTE</p> <p style="text-align: center;"><b>PLAN DE RELANCE ET DE RESILIENCE DU SYSTEME DE SANTE 2015-2017</b></p> <p style="text-align: center;"><small>Avril 2015</small></p>
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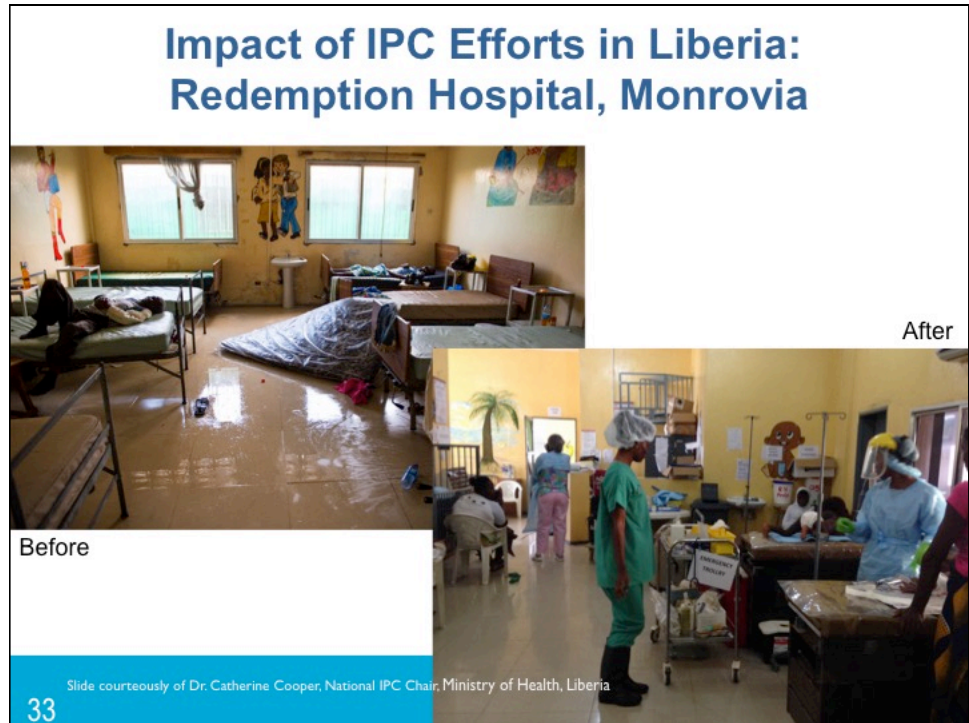
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## Liberia: Background

- At the beginning of the EVD outbreak, there was no organizational unit in MOH dedicated to IPC
- However, multiple structures were established to respond:
  - MOH IPC focal point
  - County IPC focal points
  - IPC task force
  - IPC steering committees
- To sustain a culture of IPC, these structures need to be institutionalized in the Liberian healthcare system in the post-EVD era
- In addition, IPC policy, SOPs, and guidelines must be integrated into the MOH strategy for building a resilient health system

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### Liberia: Top 3 Lessons Learned

1. **Accountability** needs to be enforced. Health facilities need to comply with standards as was done during the response
  - Establishing (or empowering) accreditation bodies (i.e. LMDC, embedded TAs)
  - Patients deserve the right to access SAFE care
2. A better **understanding of risk assessment**
  - Knowing how to identify and categorize risk
  - Applying risk assessment across all essential health services will better integrate IPC across all essential health services
3. There is a need to ensure **realistic expectations** now that these countries are transitioning back to their normal system
  - During the response, there was a great impetus for immediate progress
  - Goal is to create a safety culture, both for patients and HCWs
  - This cannot be done without time and dedication

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## Guinea: Planning Gaps

- Country Level
  - No national department responsible for effective IPC activity
  - No comprehensive national IPC plan or strategy
  - No national or sub-national continuum to rapidly implement IPC response activity
  - No clear IPC direction for the country
  - Country NGO defined their own activities
  - NGOs found back doors and non direct ways of overriding agreed upon standards and activities

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## Guinea: Planning Gap (2)

- International Ebola Response Level
  - No framework for international humanitarian organizations to work within (governance, regulations, standards for engagement, responsibilities or reports)
  - No coherent plan, indicators, tools, documentation or goals
  - Lack of direction and accountability
  - Lack of standardization for quality and harmonization of implementation

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## Guinea: Implementation Gaps

- Decisions for implementation sites for activity
  - Based on sites getting international attention after problems developed
  - Little preventative activity was attempted with the exception of IPC Training which was often seen as non effective despite the evidence of reduction of HCW transmissions where training was done

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## Guinea: Evaluation Gaps

- Inconsistent evaluation information
  - Many assessments and evaluations were done with unclear methods and tools
  - Emphasis placed only on the number of lives touched and not on the quality or efficacy of the activity in the short or long run
  - Many reports were published for the world's consumption without being given to national leaders to use in making decisions

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## Guinea: Solutions

- Clear Progress was made in IPC:
  - Framework for activities and overall goals was established
  - NGO implementing partners agreed on a gap analysis approach for intervention by health districts
  - Tools were harmonized and validated by the MOH
  - Standardization of training materials and criteria of trainers

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## Ebola Lessons Learned: conclusions

1. **IPC/WASH** in healthcare settings is a **cornerstone** of the Ebola response
2. **Need for building upon** the current situation of increased attention on IPC to improve basic structures and standards
3. **Patient safety** and **healthcare workers safety** are equally important during EVD care
4. Need for including **social mobilization** and taking **culture** into account in IPC messages
5. Need for **adequate preparedness**, i.e. meeting minimum requirements for IPC/WASH both in the community and in healthcare
6. **MOH leadership, partners coordination**, and consistent reference to and implementation of **correct IPC standards** are paramount

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