

**Composing a 'fit-for-purpose' health workforce for future Ebola outbreaks in
a resource-limited setting**

Lessons learned from the Ebola response in West Africa 2014/2015

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Title

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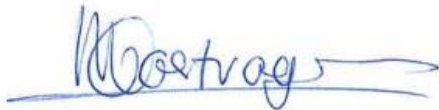
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ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
CHV	Community Health Volunteer
CHW	Community Health Worker
EOC	Emergency Operation Centre
ETU	Ebola Treatment Unit
EVD	Ebola Viral Hemorrhagic Disease
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
HMIS	Health Management and Information System
HR	Human Resources
HRH	Human Resources for Health
HW	Health Workforce
IDSR	Integrated Disease Surveillance Response
IMS	Incident Management System
IPC	Infection and Prevention Control
iNGO	international Non-Governmental Organization
MoH	Ministry of Health
MoHPH	Ministry of Health and Public Hygiene
MoHS	Ministry of Health and Sanitation
MoHSW	Ministry of Health and Social Welfare
NGO	Non-Governmental Organization
SL	Sierra Leone
TB	Tuberculosis
UN	United Nations
UNMEER	UN mission for Ebola Emergency Response
USD	United States Dollar
VHF	Viral Hemorrhagic Fever
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

GLOSSARY

Abuja declaration	In April 2001, the African Union countries set a target of allocating at least 15% of their annual budget to improve the health sector and urged donor countries to scale up support.
Epidemic	The occurrence in a community or region of cases of an illness, specific health-related behavior, or other health-related events clearly in excess of normal expectancy.
Health	A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.
Health system	All organizations, institutions, resources and people whose primary purpose is to improve health. To deliver quality services to all people, when and where they need them.
Incident Management System	Approach to manage a public health emergency, includes principles such as modular organization, incident action planning, manageable span of control, resource management, integrated communication, and chain of command.
Infection and Prevention Control	Measures to ensure the protection of those who might be vulnerable to acquiring an infection both in the general community and while receiving care due to health problems, in a range of settings. Establishment of hygiene is the basic principle.
International Health Regulations	International legal instrument to help the international community to prevent and respond to acute public health risks that have the potential to cross borders and threaten people worldwide.
Lassa fever	An acute viral hemorrhagic disease caused by the Lassa virus that is transmitted from contacts with (contaminated fluids of) rodent; having similar symptoms to Ebola. The disease is endemic in parts of West Africa.
Low- or middle income country	For the current 2016 fiscal year, national economies are defined as those with a gross national income (GNI) per capita, calculated using the World Bank Atlas method: low-income economies are those with a GNI of \$1,045 or less in 2014; middle-income economies are those with a GNI per capita of more than \$1,045 but less than \$12,736.
Mental health	A state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community.

Purchasing Power Parity (PPP)	An international dollar as a hypothetical currency that is used as a means of translating and comparing costs from one country to the other using a common reference point, the US dollar.
Public Health	The science of preventing disease, prolonging life and promoting health through the organized efforts of society.
Sensitization	Process to make oneself or others aware of and responsive to certain ideas, events, situations, or phenomenon.
Stigma	Derogatory of attitudes, beliefs and behaviors directed toward people living with the diseases and those presumed to be infected (in relation to Ebola).
Universal Health Coverage	All health services people need could be accessed without any (financial) barriers; in order to obtain a strong and well-run health system, an efficient financing health services, access to essential medicines and technologies and sufficient capacity of well-trained, motivated health workers is required.
Viral Hemorrhagic Fever	General term for a severe illness, often associated with bleeding, that may be caused by a number of viruses, such as <i>Arenaviridae</i> , <i>Bunyaviridae</i> , <i>Filoviridae</i> and <i>Flaviviridae</i> .
WHO health system building blocks	A framework that focuses on the following six components; governance/leadership, health care finances, health workforce, medical products/technologies, information and research, service delivery. All address access to and quality of health services and are essentially interlinked with each other and overlap partly.

ABSTRACT

Introduction: The Ebola outbreak in West Africa in 2014/15 had a tremendous impact on the countries of Guinea, Liberia and Sierra Leone (SL). More than 28,000 people were infected and about 11,000 deaths were reported. Moreover, the entire functioning of the affected countries was paralyzed and health services were interrupted for a long time. The Ebola epidemic demanded specialized health care, which added an extra burden on the pre-existing insufficient health workforce (HW). Health workers played a central role in containing the Ebola epidemic. At the same time, these health workers were exposed to high risks of getting infected, and many of them lost their lives.

Objective: The main aim of this thesis was to identify and discuss the role of the HW in addressing this Ebola outbreak, in order to provide recommendations for the national governments (Ministry of Health; MoH) in the sub-Saharan setting with limited resources. The influences of the pre-existing human resources for health (HRH) systems and the related socio-cultural and political environment were analyzed as well.

Methods: To achieve this objective a literature review was performed. The analytical framework of Fuijta et al. (2011) was used, slightly adapted for this assessment, to critically assess the responsiveness of the HW during this Ebola outbreak.

Findings: The main focus of the Ebola response of the national governments of Guinea, Liberia and SL and the supporting partners was concentrated on the production of extra health workers by scaling up the Ebola training capacities. Other elements of the HRH system (as illustrated in the framework) were minimal developed omitted in the Ebola response. Additionally, the authorities of Guinea, Liberia and SL neglected the influences and potentials of the community in the control of the epidemic for a long time. Good practices of Ebola responsiveness in Nigeria, Uganda and DRC illustrate the importance of having the availability and readiness of well-trained health workers and the close partnership of the government with community members, including the collaboration with informal health workers. Furthermore, a swift and adequate response of the HW relies inevitably on clear and well-implemented health structures and strategies.

Conclusion & Recommendations: In order to enhance the responsiveness of the HW in an Ebola outbreak within a resource-limited setting, it is recommended to have health workers who are well-trained in outbreak management and motivated to participate in the response. The national MoH should ensure the capacity and take ownership in implementing clear HRH strategies and plans, both at national and decentralized levels, regardless of whether there is a health emergency situation or not. In times of an Ebola outbreak, the MoH should coordinate the response, including facilitating training initiatives, recruiting and deploying extra (temporal) health workers and volunteers, ensuring adequate salaries and incentives and maintaining a good collaboration with the local communities. Monitoring and evaluation of the HRH management during an outbreak is vital, in order to draw conclusions afterwards which will help improve the coordination for the future.

Key words: Ebola, West-Africa, response, health workforce, HRH

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INTRODUCTION

“As a medical doctor with a background in tropical medicine, I worked in West Africa between 2013 and 2015. In this period an outbreak of the Ebola Hemorrhagic Viral Disease erupted in Guinea and soon spread to many countries in the region of West Africa. The epidemic even spread intercontinental and was followed by the announcement of a public health of global concern by the World Health Organization (WHO).

I worked in different projects for several non-governmental organizations. Working as a medical professional in the field, I noticed many challenges in this health emergency, mostly challenges that were influenced by pre-existing and long-lasting economical and governmental constraints in the affected countries. It made me realize the complexity of an emergency response, and the many actors involved. I questioned many times how the response could be improved in possible future outbreaks in similar low-resource settings.

During my last visit in West-Africa (July 2015), the Ebola outbreak was finally on its return and the people were fighting to halt the last flare-ups of new positive cases. With the end of the crisis in sight, the massive impact on the countries became more clear. The economic losses, the closed schools, disrupted families, increased numbers of orphans and the cessation of basic health interventions such as vaccination programs. Guinea, Liberia and Sierra Leone were hit hardest faced new challenges in rebuilding their society.

My own experiences are the start off point of this thesis. I am highly interested in the Ebola outbreak in West Africa, to analyze lessons learned and evaluate risk factors for an adequate response. Since the source of the disease is not completely clear and no vaccination is available yet, it is possible that a similar Ebola outbreak will occur in the future. This thesis aims to contribute to more effectively organized Human Resources for Health (HRH) responses in future Ebola outbreaks. The ultimate goals are to avert the outbreak in an early phase, to prevent local, regional, or even global spread, and to mitigate the impact on the affected population.

On a personal note, I hope to return working in the sector of public health emergencies after finishing my Master’s degree in International Health and my training as General Practitioner (starting March 2017).”

“The Ebola epidemic is having a negative impact on my daily life, with regards to my work in the wards, and the surgeries we perform, because you don't know if the people you are working with have been exposed or not. It's really stressful... The attitude of people towards the Ebola outbreak is negative, because most people don't believe there is Ebola. They think health workers are killing their people.” Augustus 2014

In memory of Joseph Heindilo Ngegba, Community Health Officer and student of Capacare’s surgical trainings program, Sierra Leone, who died of an Ebola infection

CHAPTER 1: BACKGROUND

1.1 Ebola Hemorrhagic Viral Disease

Ebola was discovered in 1976 in the Democratic Republic of the Congo and since then caused ca. 22 outbreaks, primarily in Central Africa. It was December 2013 when Ebola emerged in Guinea first. However, it took up to three months to confirm the diagnosis; in March 2014, the World Health Organization (WHO) announced an Ebola outbreak. Soon Ebola spread to the neighboring countries of Liberia and Sierra Leone (SL) and in a later phase, also to Nigeria, Mali and Senegal. The last three countries could avert the outbreak quickly and efficiently (1,2).

The Ebola virus is part of the Filoviridae family, that also includes the Cuevavirus and Marburg virus (3). There are five Ebola species: Zaire, Bundibugyo, Sudan, Reston and Tai Forest. The Zaire species caused the outbreak in West-Africa in 2014/15. It is currently believed that infected fruit bats or primates are the natural virus hosts. The main transmission route from animals to humans is through consumption of infected animals or fruits with infected animal saliva. Person-to-person transmission is possible via direct contact with infected bodily fluids, not only but including sexual contact, and by contaminated materials such as blankets or mattresses. The virus may persist in bodily fluids after recovery for an unknown time and recurrence of the disease is possible (3,4).

After an incubation period of 2 to 21 days, Ebola causes various symptoms such as general weakness and headache, followed by gastro-enteric symptoms and severe bleeding due to multi-organ failure. The diagnosis of Ebola should be laboratory confirmed by blood sample. Currently, there is no specific Ebola treatment available and only supportive care improves survival. Several vaccination trials are currently being conducted (3,4).

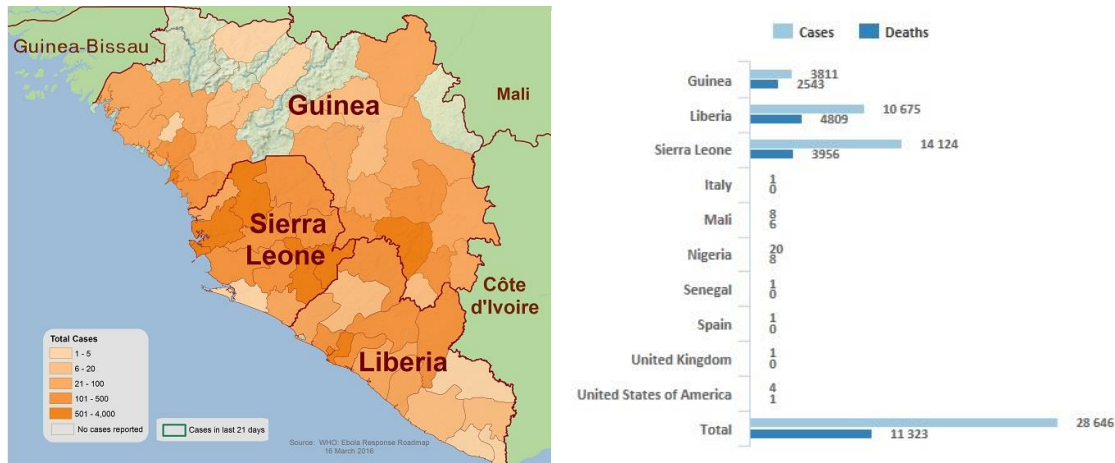
1.1.1 Infection control measures

An Ebola outbreak requires a multidisciplinary response. Strict infection control measures are pivotal, such as disinfection of contaminated materials with chlorinated water, barrier nursing by wearing personal protected equipment (PPE) and isolation of suspect or positive Ebola patients until recovery. Contact tracing is imperative to avert further spreading of the disease, All people who have had contact with a sick Ebola patients, needs to be watched for signs of illness for 21 days (4). Extensive sensitisation of the local communities is necessary to inform them and to reinforce avoiding physical contact with sick or possibly infected people, safe burial ceremonies and contact tracing (1,3,5). In the 2014/15-Ebola outbreak, these measures and precautions were slowly implemented as a result of shortage of staff (6).

1.1.2 Numbers of the 2014/15-Ebola outbreak

With the declaration of West-Africa being Ebola free in January 2016; in total 28,666 Ebola cases were reported of which 11,323 confirmed deaths (Figure 1B). Due to limited laboratory capacity and poor registration and coordination in the early phase of the outbreak, these numbers are most likely gross underestimates. The case fatality rate varies among the involved countries, with an average of 40.8% (2,3). The epidemic was most severe in Guinea, Liberia and SL. The three most affected countries had similar weak health systems, longstanding financial constraints and a recent history of violent conflicts. Combined, these factors present at least partly a clarification for the lack of coordinated response on the Ebola outbreak (6,7). The spread of Ebola outside of West-Africa to the USA and Spain was immediately averted and was mainly the effect of infected international health workers travelling back home (2).

Figure 1 A. The geographical distribution of Ebola in the three most affected countries (2) B. numbers of Ebola cases and deaths in all affected countries worldwide, March 2016 (8)



1.1.3 National and international response

Guinea, Liberia and SL quickly announced a national state of emergency and established a national task force (5,9). A special meeting for all governments of West-African countries was convened by the WHO mid-2014 in Ghana. The 'Strategy for Accelerated Response to Ebola Outbreak in West Africa' was launched to interrupt the ongoing Ebola transmission in the region and to mitigate the impact (10). The Ebola epidemic was declared as a 'Public Health Emergency of International Concern' in August 2014 by the United Nations (UN) Security Council when Ebola spread to international borders. This marked the start of the international support, including the UN mission for Ebola Emergency Response (UNMEER), the first-ever UN emergency health mission. More than 40 organizations and 58 foreign medical teams deployed an estimated 2,500 international personnel (of whom 1,300 medical personnel) in partnership with the Ministries of Health (MoH) and thousands of national staff. It is suggested that the lack of experience in providing the highly specialized Ebola care may have played a role in the delay in international support (5). However, the extensive support of the international community was of enormous importance in the Ebola response.

1.2 Impact of the Ebola outbreak

It took until January 2016 to completely eradicate Ebola from the three most affected countries, and in this time the economic and industrial development had come to a complete stop. Direct and indirect effects of an (health) emergency in low- and middle income countries are extremely disruptive and often long-lasting, because of the fragile health systems, while interrupting or overburdening public and health services due to the emergency (11,12).

1.2.1 Social impact

Due to the declaration of a state of emergency, social life was highly disrupted. Nighttime curfews were installed, social gathering was prohibited, land borders were closed and consequently trade and travel were severely restricted (13). In West Africa there is a high mobility compared to elsewhere in the world, these actions had a high impact on daily life (14). The culturally sensitive burial rites were banned, as these practices include touching the deceased body and thus carry an

extremely high risk of spread of the Ebola virus. Special burial teams were established to ensure safe and dignified burials of Ebola deaths (15).

In June 2014, all schools in the three countries closed because of the epidemic and they were not reopened until 2015. Children were greatly affected, as nearly 20% of all Ebola cases occurred in children under 15 years old and more than 17,300 children were orphaned. An increase in teenage pregnancies was reported, as girls and women are often vulnerable to violence and rape during epidemics (16-18).

1.2.2 Economic impact

Projections of the Worldbank estimated a loss of \$2.2 billion GDP in 2015 in the three most affected countries. In SL, the GDP growth rates changed from 20.2% in 2013 to 11.3% at the end of 2014 and to -13% in 2015. In Liberia and Guinea, reduced GDP growth prospects were observed as well. All three countries faced declining agricultural production, particularly domestic food production. In SL about 50% of the workforce in the private sector was lost due to Ebola (2,16,19).

1.2.3 General health impact

The need for specialized Ebola health care included an increased need for hospital beds and medical supplies. The surge of Ebola patients soon exceeded the bed capacity and overwhelmed the local health system. As alternative care, isolation of patients in their own houses was conceded and 'home hygiene kits' were massively distributed to protect the caregivers (15,20). The repurpose of many health facilities towards Ebola care led to reduced availability of basic health services. There were significant declines in the number of non-Ebola related hospital attendances and admissions, as well as in major surgery procedures during the Ebola outbreak (17,21). Imperative vertical health programs such as community tuberculosis (TB) services and nutrition programs were no longer functioning (20). It was concluded that the indirect effects of the Ebola outbreak were higher than the direct deaths (22). Also the life expectancy in the three countries was negatively affected by the Ebola outbreak: in Liberia, this was calculated as a reduction of 5.56 years reduction, in SL between 1.38 – 5.10 years and in Guinea less than 1.20 years (23). It needs to be mentioned that more research is needed to get better insight in the overall health effects, especially on the long term, of the Ebola crisis.

1.2.4 Impact on infection health care

Vaccination coverage decreased substantially. As an example, the measles immunization coverage decreased in all three countries; in Liberia from 71% to 55% and in SL 99% to 76% before and during the Ebola outbreak. In Guinea, 215 measles cases were reported in 2014 compared to 59 the year before (24). In Liberia 60% of the 144 HIV clinics were closed and in SL 80% of the clinics for pregnant HIV-women closed. This is likely associated with an increase of vertical HIV transmission to the newborn babies (25). Estimations showed an approximate 50% reduction in health care services leading to the loss of approximately 10,600 lives to HIV, TB and malaria (22).

1.2.5 Impact on maternal and pediatric health

Women and children were most vulnerable to reduced health care. In Guinea, child health services were more affected compared to other services (26). In Liberia, a large drop in utilization of maternal health care services was documented (27). An average 75% increase in maternal mortality in West Africa is attributed to the Ebola outbreak (28). Effects of the HW shortage in the three most affected countries on maternal and child mortality are shown in table 1. The HW shortage was twofold: on

one hand the higher mortality amongst nurses and doctors, on the other hand the sudden closure of local clinics and relocation of local health personnel to Ebola clinics.

Table 1. Effects of the loss of health workers from Ebola on maternal, infant, and child mortality (28).

	Doctors, nurses, and midwives			Maternal mortality ratio (per 100 000 livebirths)			Infant mortality rate (per 1000 livebirths)			Under-5 mortality rate (per 1000 livebirths)		
	Stock pre-Ebola	Stock post-Ebola	% change	Pre-Ebola (2013)	May 2015	% change (95% CI)	Pre-Ebola (2013)	May 2015	% change (95% CI)	Pre-Ebola (2013)	May 2015	% change (95% CI)
Guinea	5395	5317	-1%	650	897	38% (26 to 50)	65	69	7% (-2 to 15)	101	110	10% (-2 to 21)
Liberia	1029	946	-8%	640	1347	111% (76 to 145)	54	64	20% (-4 to 43)	71	91	28% (-5 to 61)
Sierra Leone	1153	1074	-7%	1100	1916	74% (51 to 97)	107	121	13% (-3 to 29)	161	191	19% (-4 to 41)

1.2.6 Impact on mental health

During the Ebola epidemic, few efforts addressed the psychosocial wellbeing of the population. An Ebola outbreak is associated with key predictors of mental problems, particularly orphaning of children, stigmatization of affected families and survivors due to stigma and exposure to traumatic events including mass mortality (7). Mental health issues, among other medical issues, are reported in over 10,000 Ebola survivors (3,4). Also, many health workers were disproportionately impacted and traumatized by their tasks during the Ebola response, since they faced loss of colleagues, inadequate health supplies and distrust and hostility of the local population towards them (1,7,13,29).

CHAPTER 2: STUDY OVERVIEW

2.1 Problem statement

The impact of the almost two-year long Ebola epidemic in West-Africa is unabatedly severe. The pre-existing resource-limited settings of the three most affected countries made the response to Ebola extremely challenging. The role of the health workers is key in meeting the needs of Ebola health services, spreading prevention measures, conducting surveillance and contact tracing. A strong quantitative (sufficient numbers) and qualitative (appropriately trained) health workforce not only depends on a well-organized and resourced health system but also on the acceptance and trust by the communities. Pre-existing insufficient health care systems and (sometimes) disrupting community influences were predisposing factors for the fast spread of the Ebola disease in West-Africa.

2.1.1 Impact on health workforce

The impact of the Ebola outbreak on the HW was enormous. Long working hours, increased levels of stress and limited resources made it extremely challenging for health workers to do their work (14,30). Prior to the Ebola outbreak, topics for continuous education for health workers were mostly clinically oriented and knowledge on Ebola, infection and prevention control (IPC) and public health were limited, as West Africa was never exposed to this disease (14). Particularly in the beginning of the crisis, this knowledge gap led to suboptimal implementation of IPC measures and Ebola care, as health workers were anxious of becoming ill themselves (30,31).

Most striking was the loss of health workers to Ebola. It is known from previous outbreaks in Central Africa of Marburg virus and Ebola that deaths are disproportionately concentrated among health personnel. Epidemiologic disease data gathered over the last decades show that on average 9% of the health workers died during each epidemic of a VHF (29) Many health facilities had to close during the Ebola outbreak because of insufficient qualified health workers (5). In the three most affected countries, a total of 876 HW were infected of whom 522 died, shown in table 2 (29). In SL, 11 specialized physicians and the national medical expert on viral hemorrhagic fevers (VHFs) died because of Ebola infection (15). In figure 2 the distribution of infected health workers in the three most affected countries is depicted in the period from January 2014 to March 2015. Calculations illustrate that in Guinea 0.2% of the entire population died because of Ebola compared to 1.45% of all health workers. In Liberia, these numbers are 0.11% and 8.07%, respectively, and in SL 0.06% and 6.85% (28).

Table 2. Total of Ebola infections and deaths of the population and among health workers (percentage of infected and deceased health workers in relation to the numbers of the population), in Guinea, Liberia and Sierra Leone (2)(4)

	Country					
	Guinea		Liberia		Sierra Leone	
	Population	Health workers	Population	Health workers	Population	Health workers
Ebola infections	3,814	202 (5.3%)	10,678	378 (3.5%)	12,124	296 (2.4%)
Laboratory confirmed Ebola infections	3,358	Not available	3,163	Not available	8,706	Not available
Ebola deaths	2,544	109 (4.3%)	4,810	192 (4.0%)	3,956	221 (5.6%)

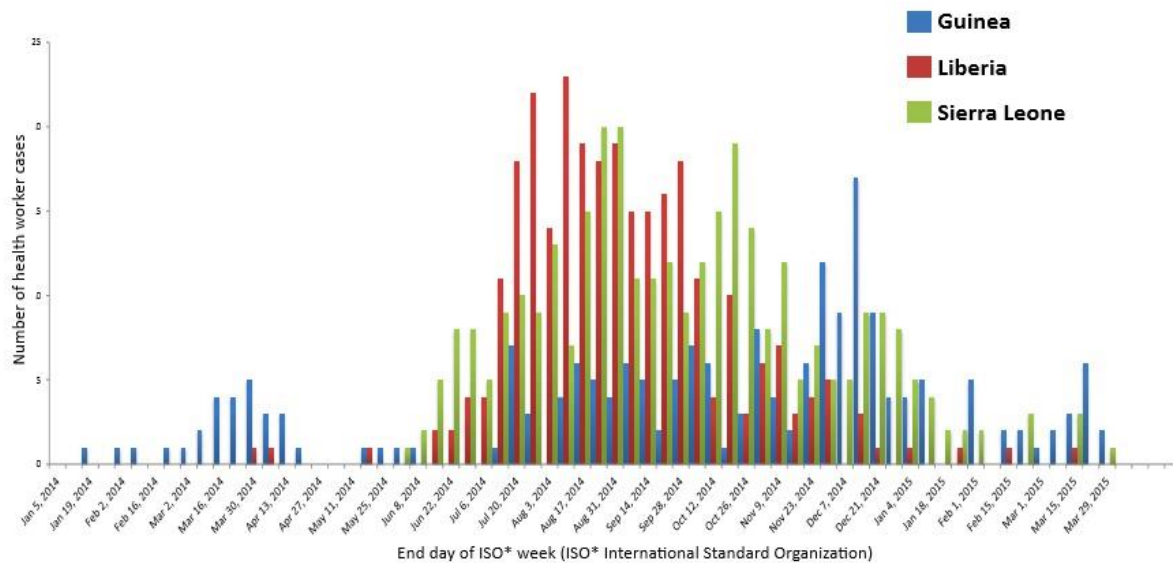


Figure 2. Ebola confirmed and probable cases of health worker infections by country and by week of onset, 1 Jan 2014 to 31 May 2015 (29)

The shortage of health workers during the Ebola response was even more pressing due to pre-existing low numbers of health workers and their insufficient skills, for example on IPC, to delayed payments leading to dissatisfaction among health personnel, and to the lack of new graduates (5,9,28). Prior to the Ebola outbreak there was just 1 physician per 10,000 patients in Guinea, 1 per 10,000 patients in Liberia, and 1 per 50,000 patients in SL (32). In the WHO’s report in 2013, a minimum for the total health workforce of 59.4 physicians per 10,000 population was suggested. Noteworthy, these thresholds are set as illustration of HR trends, rather than benchmarks that should be achieved (33).

In order to fight Ebola effectively, the WHO asked initially for 12,000 and later for 20,000 extra health workers in the affected countries, and an extra 1,000 international experts (15). To illustrate the need for health workers, in an Ebola Treatment Unit (ETU) for every one doctor and three nurses, about 26 water, sanitation and hygiene (WASH) staff are required (34). Table 3 shows the various cadres of health workers during the response in the period of January – June 2015 in Guinea, Liberia and SL. It is obvious that the support from international staff was significant. Many NGOs and multilateral organizations assisted the national governments in combating the Ebola epidemic in various areas and directly received large amounts of international financial aid. Relatively little national funding (less than 2%) was earmarked for strengthening the national HW (5,35). Although the national coordination of the multi-sectorial responses were led by national bodies, albeit with the support of international partners, iNGOs missed guidance and consequently actions and projects often overlapped (36).

Table 3. Overview of the health workforce, composed of international and national staff in Guinea, Liberia and Sierra Leone January–June 2015 (37)

	GUINEA	LIBERIA	SIERRA LEONE	GRAND TOTAL
INTERNATIONAL STAFF	610	700	861	2,171
Contact tracing and community surveillance	33	195	167	395
Laboratory	14	16	25	55
Safe and dignified burial	12	14	25	51
Ebola treatment center	157	155	368	680
Community care center	31	10	39	80
Social mobilization	74	56	16	146
Sub-national hub	289	255	221	765
NATIONAL STAFF	25,150	24,723	15,730	65,603
Contact tracing and community surveillance	1,067	6,235	5,333	12,635
Laboratory	63	71	112	246
Safe and dignified burial	549	621	1,125	2,295
Ebola treatment center	1,509	1,491	3,542	6,542
Community care center	595	187	761	1,542
Social mobilization	20,790	15,608	4,415	40,813
Sub-national hub	578	510	442	1,530
GRAND TOTAL	25,761	25,422	16,590	67,773

Box 1. The role of the health workforce in their general practices and in health emergencies

Over the last decades, various international reports have emphasized the urgency of political action and enhancement of financial resources for health workers globally, since there is an urgent need for expanding the HW in all countries worldwide, including high-income countries (109). Comprehensive investment in the HW is needed to achieve and sustain universal health coverage, to assure global health security and to support economic growth. Investing in health workers creates employment opportunities and brings sustainable socio-economic growth in the short- and long term (115,116). It is believed that investment in a strong and committed HW is paramount to improve responsiveness towards future epidemics (28,29,93). Heymann and colleagues give a big importance to health workers by calling the HW “the core of global health security”. According to them, skilled health workers are the first line of defence of individual health security and hence play a considerable role in containing an epidemic (112). The ultimate HW is a desirable mix of various cadres of health professionals (109). The idea of active involvement of community health workers (CHWs) in the HW is gaining grounds among experts (113). In this way, health education and promotion can be organized close to the community and preventive and curative primary health care to be supported (109). Especially, in rural areas with limited services and/or insufficient health workers, CHWs may be significant supplementary in addressing basic health problems (95,119). The WHO is currently developing a guideline on the active role and viable contribution of CHWs in health emergencies (93,120).

2.1.2 The national health systems before the 2014/15-Ebola outbreak

Prior to the Ebola outbreak the three most affected countries had a weak health system and poor health services. There were significant deficiencies in all the WHO ‘building blocks’ for a sustainable health system; 1) insufficient national health funding with high figures of corruption, 2) poor infrastructure with limited access to electricity and running water, 3) shortage of medicines and medical supplies, 4) limited or non-existent health information and surveillance systems, by which

the initial epidemiological Ebola trends were not accurate, 5) weak ownership of the national authorities and 6) insufficient HW as described before (5,15,38). This all contributed to the unpreparedness of the national health systems for such an epidemic with extensive impact, and subsequently their inadequate responses (36). The insufficiencies the HW faced during the Ebola outbreak were obviously related to the prevalent shortcomings of the national health systems and particular to the HRH mechanism.

2.1.3 Socio-cultural and political factors in the Ebola response

Prior to the outbreak, there was lack of confidence by the population in the health system, which may be related to the recent violent conflicts and longstanding corruption in all three countries (14). Poor access to health facilities with limited resources and the poor density and distribution of inadequately trained health workers resulted in poor utilization of available services. The Ebola epidemic led to amplification of the mistrust and to anxiety and fear within the local communities. For instance, patients feared to contract Ebola by coming to a health facility or were hiding from contact tracing, leading to increased transmission risks within the communities (5,26,27). The deep-rooted distrust towards the health system hampered and delayed the national Ebola responses (5,17,39). There were even violent incidents and riots in the slums of Monrovia, Liberia and attacks towards health workers and journalists in Guinea (13). Many health workers were excluded from the community due to lack of understanding of their work and the disease. Rumors that international medical teams were intentionally spreading Ebola and accusations of incompetence of the national responses by the media impeded the scope of public health messages (13,14). The first official messaging to provide information to the population did not meet the needs. Local and cultural beliefs aggravated the mistrust in the national authorities and health providers (5). In addition, many communities were hard to reach, due to poor infrastructure and limited radio signals and telephone networks (40).

2.2 Justification

Concerning the 2014/15 Ebola outbreak in West-Africa, data on the various roles of the health workers involved in the response is limited. There is a knowledge gap when it comes to the preferred composition of the HW, consisting of formal and informal health workers, during an Ebola epidemic. Furthermore, there are no guidelines for the national HRH specifics to align their practices in the response. From the most severely affected countries, Guinea, Liberia and SL, little is known regarding the involved health workers. For the aforementioned gaps, this thesis will assess successful approaches of other Ebola responses in order to gain better understanding of the role of the HW in an Ebola response. It is likely that the pre-existing weak health systems and longstanding trust issues among the community and national authorities, have had a negative impact on the execution of the Ebola response. However, there is no supporting documentation on the specific role of the health workers given these pre-existing difficulties. This thesis will identify and discuss the role of the HW in the 2014/15 Ebola outbreak, in order to make recommendations to better assure an adequate response of the HW in a resource limited country, considering the pre-existing contextual factors.

2.3 Objectives

2.3.1. Overall Objective

- To identify and discuss the role of the health workforce in addressing an Ebola outbreak in sub-Saharan countries, in order to provide recommendations to better assure adequate response of the health workforce regarding an Ebola outbreak in a resource-limited setting.

Specific Objectives

- To assess and compare the response of the health workforce in addressing the Ebola outbreak in 2014/15 in Guinea, Liberia and Sierra Leone.
- To describe the HRH systems and related socio-cultural and political factors that influenced the health workforce response regarding the Ebola outbreak in these three countries.
- To describe opportunities, challenges and lessons learned regarding the role of the health workforce dealing with an Ebola outbreak in resources-limited settings.
- To provide recommendations for national governments (MoH) to better assure adequate response of the health workforce regarding an Ebola outbreak in sub-Saharan countries with limited resources.

2.4 Methodology

To answer the general and specific objectives of this thesis, a literature review was conducted. The literature review included scientific published and grey literature, and was performed by means of searching documents in Science Direct, PubMed, PLOS and Google Scholar. Websites of the Worldbank, the United Nations (UN), WHO and Centers for Disease Control and Prevention (CDC) were searched for relevant documents. Additionally, documents and reports on specific national policies on health policy, HR planning and national Ebola responses were studied.

The following keywords and when possible Medical Subject Headings (MeSH) terms were used: human resources for health (HRH), health workforce (HW), health personnel, physicians, nurses/midwifery, community health workers (CHW), community health volunteers, voluntary health worker, village health workers, informal health worker, Ebola epidemic, EVD outbreak, Ebola health emergency, Ebola outbreak control, preparedness and response, impact Ebola, Guinea, Liberia and Sierra Leone. The specific definitions on HW, health workforce, CHWs and Ebola health needs are found in Annex 1.

The search was iterated combining different search terms. Additional relevant studies were obtained by examining the references of each selected publication. The literature review addresses three case studies of the most affected countries in the 2014/15 Ebola outbreak; Guinea, Liberia and SL. Subsequently, opportunities and challenges deducted from the three case studies are assessed. In addition, examples on successful interventions will be studied through literature review, focusing on previous Ebola responses in Nigeria, Uganda and Democratic Republic of the Congo (DRC). Lessons learned from the three case studies and analyses of good practices were used to propose recommendations to national governments, and in particular the MoH, on composing a 'fit-for-purpose' health workforce that can respond to a future Ebola outbreak in a sub-Saharan country, a resource-limited setting.

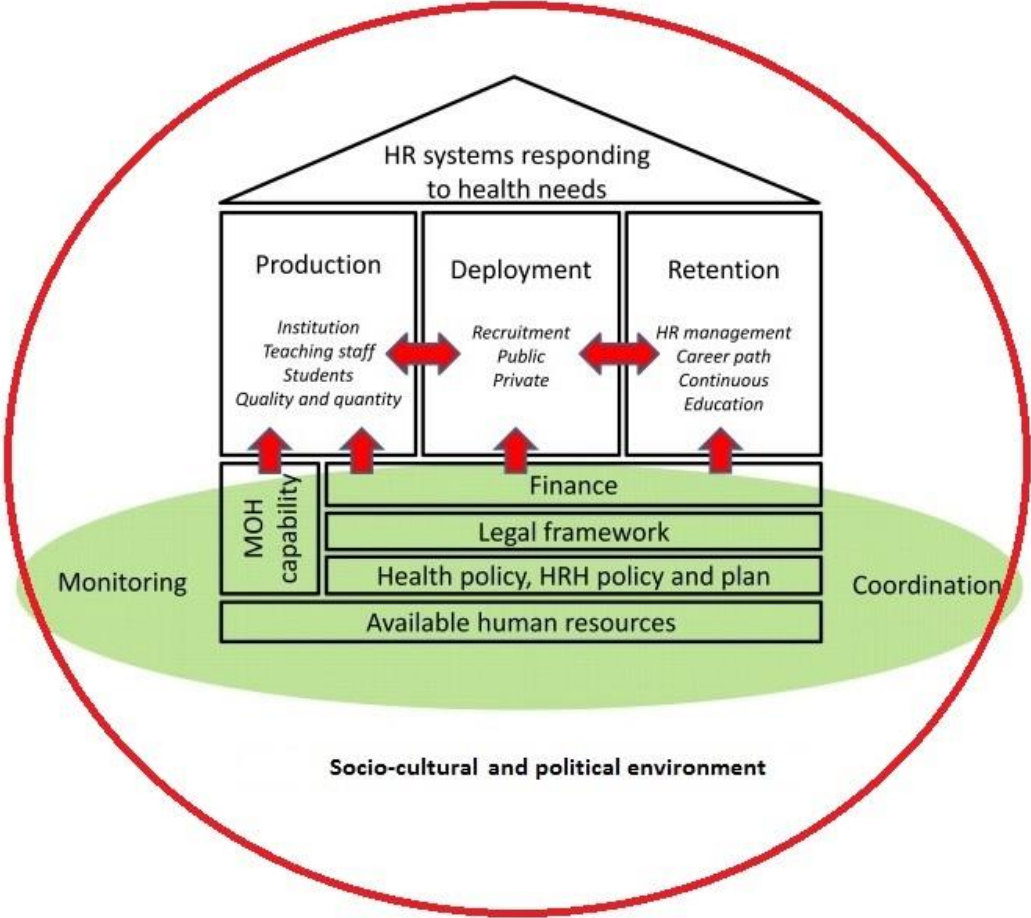
2.5 Conceptual framework: Human resources for health system development: analytical framework - The 'house'-model

The analytical framework of Fujita et al. (2011) is based on experiences from three post-conflict countries (Afghanistan, DRC and Cambodia) and illustrates key elements of the HRH system and its linkages in a fragile system (41). This comprehensive framework identifies the contributing factors of the complex HRH process in a simplified manner and was therefore chosen as basis for the multiple factors influencing the HW in an Ebola outbreak in resource-limited settings.

The framework, also called the 'house'-model (figure 3) needs to be explained through its composition. The foundation of the model was used to describe the national health systems, elaborating on the available HRH, most recent HRH policies and planning and national health policy, finances and the MoH capability. Evidence on the legal framework in Guinea, Liberia and SL was scarce and is of limited influence on the responsiveness of the HW during the Ebola crisis, and therefore excluded in this thesis. Following, monitoring and coordination is depicted on, as base of the model and cutting across the foundation. As suggested by Fujita et al., a careful analysis of the country-specific socio-cultural and political structures is needed. Considering the importance of these contextual factors in the response of the 2014/15 Ebola outbreak and the potential influences on the health workers, as described before, the model is adjusted with an extra circle around the entire house, depicting the socio-cultural and politic environment, as shown in figure 3. The pillars in the model are the key elements in the process of the HRH system, and support the roof. The pillars describe the production, deployment and retention processes of the HW. Originally, the pillars were designed based on traditional professional cadres and are therefore not fully applicable to the setting of the recent Ebola crisis, where the composition of the HW consisted of both formal and informal health workers. Finally, the roof illustrates the HR response to the health needs; what were the challenges and opportunities in the Ebola response? In line with the objectives of this thesis, the specific Ebola health needs of the population will be discussed.

The conceptual framework was used as a guidance to structure this thesis, and relate to the subheadings of the chapters 3 and 4.

Figure 3. Conceptual framework; adopted from “Human Resources for health system development: analytical framework – the ‘house’-model”(41)



CHAPTER 3: CASE STUDIES: Guinea, Liberia, Sierra Leone

This chapter aims to identify the opportunities and challenges for the HW in the response to the Ebola epidemic in Guinea, Liberia and SL. In annex 2 detailed country information can be found, whereas the key demographic features of the three countries are summarized in table 4 (see below).

First, the overall national Ebola response per country will be described. Following, the conceptual framework will be used to identify and discuss the responsiveness of the HW in the outbreak as well as the influencing factors prior and during the Ebola crisis. Opportunities and challenges of the HW in their response in the Ebola outbreak will be summarized in table 8, at the end of this chapter.

Table 4. Socio-economic and health related indicators in Guinea, Liberia and Sierra Leone – prior to the 2014/15-Ebola outbreak (42-44)

		Country		
		Guinea	Liberia	Sierra Leone
Population features	Population (2015)	12,609,000	4,503,000	7,076,641
	Population living on < \$1 (PPP international dollar) a day (%) (2007 – 2013)	40.9 %	83.8 %	56.6 %
	History of civil unrest	Yes (ended in 2013)	Yes (ended in 2003)	Yes (ended in 2002)
National health care system	Responsible governmental body	Ministry of Health and Public Hygiene	Ministry of Health and Social Welfare	Ministry of Health and Sanitation
	Health expenditure of GDP (2014)	5.6%	10.0 %	11.1 %
	Out-of-pocket expenditures as % of private expenditure on health (2012)	88.0 %	40.6 %	76.1 %
Human resources (2013)	Number of physicians per 10,000 population	1.8 (2014)	0.1	0.2
	Number of nurses/midwifery per 10,000 population	1.4 (2014)	2.7	1.7
	Use of traditional healers	High	High	High
Health indicators (2013)	Life expectancy both sexes (years)	58	62	46
	Maternal mortality ratio per 100,000 live births	650	640	1,100
	Infant mortality rate (under 1 year of age) per 1,000 live births	64.9	53.6	107.2
	Child mortality rate (under 5 years of age) per 1,000 live births	100.7	71.1	160.6

3.1 Guinea



Figure 4. Map of Guinea (44)

3.1.1 National Ebola response

Ebola's first case ever in West Africa occurred in Guinea. Unexperienced with such an outbreak, several different ministries of the Guinean government were involved in the early Ebola response. A state of emergency was declared 13 August 2014. Technical and financial support was offered by international partners: in total, Guinea received more than \$ 330 USD million donations (45). The response was soon reorganized according to the Incident Management System structure, with the establishment of the '*Cellule nationale de la coordination contre l'Ebola*' and a specific emergency intervention plan. A senior physician from the Ministry of Health and Public Hygiene (MoHPH) was appointed as the Ebola coordinator and was responsible for the alignment of involved partners and funding (39,47-49). Regional alert and response teams were set up, mainly to improve contact tracing and to progress monitoring actions at decentralized levels (15).

Although Integrated Disease Surveillance and Response (IDSR) had been implemented in 2002/03 and many health workers were trained along, communication lines between different levels were poor and there was no functioning early-warning mechanism. As a consequence, the source of the Ebola epidemic could not be monitored adequately and follow-up of Ebola contact faced many difficulties. With international support the IDSR mechanism was strengthened during the outbreak (5,48,50,51). However, an evaluation analysis of the MoHPH in 2015 reported that mismanagement of health information for decision-making and management of services, particularly at the decentralized level hampered the Ebola response (48).

Box 2. Integrated Disease Surveillance and Response' strategy

In response to severe outbreaks of infectious diseases, the 'Integrated Disease Surveillance' (IDS) strategy was adopted in 1998 by the Member States of the Africa Region of the WHO, which was transformed in 2001 to the 'Integrated Disease Surveillance and Response' (IDSR). It aims to strengthen the core capacities of the national and of the public health surveillance and response. Activities at each level for early detection, notification and response are outlined. The WHO framework for monitoring and evaluating surveillance and response systems for communicable diseases was designed around structures, quality and process (103,121).

Socio-cultural, economic and political environment

In the initial phase of the outbreak, the reality and gravity of the Ebola virus was denied by the government. Notably, the Ebola crisis was used by political parties in the context of the upcoming elections, where electoral campaigns were preferred over education of the communities on Ebola, causing conflicting and accusatory dissemination of information. Representatives of opposite political parties were excluded from national Ebola committees and communities that sympathized certain political parties were favored in receiving public control services (5,15,39,48).

Historical drivers of conflict had elicited the misinterpretations of national actions and the distrust in central authorities, already long before the Ebola outbreak. Community resistance was a major barrier in Guinea's Ebola response, fuelled by the conflicting messages of opposite politicians and the poor involvement of the community members in controlling the epidemic. Especially in rural areas, the community refused safe burials, cooperation with contact tracing teams and adherence to Ebola health services, as these actions were considered to interfere with cultural customs. It led to numerous cases of violence towards health workers, and even the murder of Ebola awareness campaign members. The government reacted by ordering military actions, which aggravated the tensions and chaos, and excluded the involved communities longer from access to Ebola health services. In a later phase, rural radio stations successfully broadcasted messages delivered by local leaders and underlined the sensitization initiatives (5,15,39,48).

3.1.2 The health system prior to the Ebola outbreak

Available HRH

Long before the outbreak, Guinea struggled having a sufficient numbers of health workers. Figures of 2009 showed that there were just 1.2 physician and 1.6 nurse per 10,000 population (51). These numbers did not change much over the course of five years, as shown in table 5 (43). Estimates made in 2013 forecasted even declining numbers of recruited health workers, since about 33% was at least 45 years old (44,52). About 50 - 75% of the qualified personnel practiced in the capital city Conakry, where only 15% of the population lived (5,49).

Table 5. Numbers of health worker cadres in Guinea, 2014 (43)*

	Numbers per 10,000 population	Percentage (%) of total health workforce (public and private)
Nurses	1.4	13
Midwives	0.5	4
Laboratory technicians	0.16	1.5
Physicians	1.8	16
- General physicians	1.3	12

*Note: does not add up to 100% because not all cadres were mentioned

Lack of career profile, low wages, lack of incentives, weakness of the supervisory capacities and poor working conditions especially in remote areas were reported as demotivating factors for health workers, undermining the availability and quality of health services (48,50). There is no national trainings program for the HW, hence trainings were poorly planned and coordinated by the MoHPH, resulting in a misbalance among certain cadres not meeting the staff requirements, for instances a shortage of midwives (50,51). However, Guinea did have a nationwide trainings program for community health volunteers (CHVs). Thousands of CHVs were trained by the MoHPH to provide health education and basic curative care and moreover, to reduce community resistance to health providers, especially deep-rooted in remote areas (48).

Health policy, HRH policy and planning

A report from 2013, focussing on HRH for maternal and neonatal health care, aimed to be the incitement of a 'national strategic plan for HRH development' (51). However, no subsequent national policies or strategy is available (50,51). The most accurate national health policy before the Ebola crisis was the '*Plan Stratégique de développement Sanitaire 2003 - 2012*' (50). Here upon, central and decentralized development action plans were launched, often based on the available resources rather than on the actual health needs (5,48,50,51).

MoPH capability

The institutional capacity for HRH management was very weak as there was insufficient expertise and funding, since only 10% of the operating finances was budgeted for administration and healthcare structures. Recruitment and (re)distribution strategies, job descriptions, continuing education strategies and formalized decision-making on managerial level were absent, leaving many health workers unemployed in the public sector, eventually leading to attrition of the HW (44,50,51,53).

Finance

About 90% of the operating budget structure of the MoPH was allocated to the salaries of the HW (50). There was no national system in place for the provision of financial incentives or other amends, such as housing in hard-to-reach areas (43).

3.1.3 Monitoring and coordination

The national HR management information system was dysfunctional at all levels of the health system, due to shortage of personnel, resources and software. The private health sector was excluded from the information system and hence was only scarcely controlled by the MoPH. Neither a HR information system, nor a performance monitoring system were available (44,50,51). Coordination, planning and monitoring and evaluation functions were poorly managed at all levels. There was weak institutional coordination of government sectors and administrative tasks and data collection in regards to monitoring and evaluation took mainly place on central level. Adequate governance from central to district level was lacking, as well as inter-sectorial collaboration and coordination (5,48,50,51).

3.1.4 Composition and roles of health workforce during the Ebola outbreak

Production

Despite the many deaths among the health workers, the density of formal health workers was increased from 1.3 professionals per 10,000 inhabitants prior to the outbreak, to 2.6 after the crisis. Many extra mainly temporary health workers were recruited and trained (48). Trainings aimed to raise the level of knowledge and skills on IPC among local health workers. According to the Global Ebola Response report (2015), there were 1,067 contact tracers and surveillance mobilizers, 63 laboratory technicians, 549 burial team members, 2,104 Ebola health workers and 20,790 social mobilizers in Guinea, shown in table 3 (chapter 2, page 17)(37). Additionally, 500 health workers were trained in supervision of Ebola care. Often training was conducted by independent partner organisations with their own agenda and implementation in the national health system was omitted (48,51).

During the Ebola epidemic, CHVs were engaged in the national response. Their tasks included supporting to surveillance, strengthening communication with the communities and sensitizing

them, along their regular community-based services (48,54). Further initiated at community level were early warning committees, called ‘village watch committees’, aiming “to engage community leaders and secure public cooperation in case detection, contact tracing, and safe burials”. This initiative was established by partnership of INGOs and civil societies. For the benefit of a national four-day emergency campaign (2015), including door-to-door visits, about 2,000 teams consisting of community and health workers were formed under the guidance of UN partners and the national government. Ebola survivors, traditional healers and religious leaders were involved as well (15, 37,39).

Deployment

The already deployed health workers and CHVs were managed by the MoHPH. The temporary staff on Ebola response activities were often not integrated with the (district) health system (48). Further documentation on recruitment and deployment processes of the health workers in the Ebola response is not available.

Retention

Due to limited (protective) resources, many health workers lost their lives because of an Ebola infection (table 2, chapter 2, page 15). In a preliminary report of the WHO mid-2015, the following categories of health workers with an Ebola infection were reported; 57 (30%) medical workers, 86 (45%) nursing workers, 7 (4%) midwives, laboratory workers 9 (5%), 1 (1%) community workers and 13 (7%) other workers (see annex 1 for the categorization). More than half of the infected health workers, 56% deceased (29). As a consequence about a quarter of the health facilities had to close (15).

The recruitment of temporary staff in the Ebola response was enabled by external payment assistance. No additional documentation on the payments of salaries or incentives was found, nor on other measures to motivate and retain health workers in the national Ebola response.

3.2 Liberia



Figure 5. Map of Liberia (54)

3.2.1 National Ebola response

Four months after the first Ebola case was identified in Liberia, a state of emergency was announced by the Liberian government on 6 August 2014. The government appealed for (extra) international assistance and a national Ebola trust fund was established (39,56). Liberia received in total \$1 billion

USD aid, mainly from foreign donations (46,57). The initial National Ebola Task Force was replaced by the National Incident Management System (IMS) and Emergency Operations Center (EOC) in July 2014. Further, a 'National Ebola Response Strategy' was launched in order to focus more on health within the national response (39,58-60). To improve the quality of the Ebola surveillance activities, the pre-existing weak monitoring and evaluation unit from the Ministry of Health and Social Welfare (MoHSW) was strengthened, including the Integrated Disease Surveillance and Response (IDSR) system that was only partially installed at the time Ebola hit Liberia (15,56,61).

Daily meetings for up-to-date decision-making took place with accurate information dissemination towards all actors and was led by the EOC. Various Ebola task forces were established at district levels with clear communication lines towards the national level, also enabling the degree of community and civil organization participation (15,39,56,62). For the existing County Health Teams, a IMS-based framework was assigned to manage their leadership and to coordinate the involved partners, all under the guidance of the MoHSW (61). Despite standard national guidelines, the initial coordination and management of the multiple international actors was strenuous. Improved cross-sectoral coordination helped to reduce overlap and duplication of response activities contacted by various actors (20,56). The intense international involvement focused more on cure and less on prevention of further spread (39,64).

Socio-cultural, economic and political environment

In the early phase of the outbreak, messages announced by the government suggested certain death due to an Ebola infection. Terrified by the messages, rooted in longstanding trust issues towards the national authorities and health providers, communities assaulted health workers and refused to adhere to the Ebola control measures (55). For instance, the introduction of cremation of Ebola deads at the peak of the epidemic, led to secret burials (40). Military interventions took place in order to avert social unrest and to restrict social mobilization. It is even believed that all of interventions together, aggravated the lack of confidence towards the government and excluded the local population in the response for too long. Hence, it took months before community members and civil organizations participated actively in response activities (39,56). In August 2014, the eventual collaboration of the MoHSW with local and traditional leaders, as with the National Traditional Council of Liberia, which represents all 16 tribes in-country, led to better understanding of the control measures within the communities and hence their adherence to it. This partnership contributed highly to the success of the community mobilization, although according to community leaders the response would have been more effective if they had been recognized and engaged in an earlier stage (15,39,56,62).

3.2.2 The health system prior to the Ebola outbreak

Available HRH

Liberia has longstanding issues with having sufficient numbers of skilled health workers. Figures of 2009 recorded 8,553 national health workers, of whom 1,393 nurses, 60 medical doctors and 286 physician assistants. Moreover, of the HW only 48% was skilled and 30% worked in the capital's county, where almost half of the population lives (65,66). Progress has been made by the MoHSW to address these HRH shortcomings, prioritizing the nursing cadre, unfortunately neglecting the other cadres, as figures of 2009 and 2010 clearly illustrate (see table 6). The misbalances among cadres hardly changed, as in 2013, there were 2.7 nurses/midwives per 10,000 inhabitants and only 50 doctors for the whole country (42,56). Maldistribution across levels of care and counties still was a major challenge at the time Ebola erupted in Liberia (65).

Table 6. Change in national health workforce in Liberia 2009-2010 (66)

	2009 Deficit	2010 Deficit	Deficit reduction
Physician Assistant	46	31	33%
Registered Nurse	46	0	100%
Certified Midwife	263	207	21%
Laboratory Technician	32	34	-6%
Operating Theater Technician	90	80	11%
Anesthetist	77	21	73%

The formal HW was supported by a national network of community health volunteers (CHVs), consisting of 8,052 volunteers in 2013 and included (trained) traditional midwives and household health promoters. They served as a link towards the community-based services and provided education and treatment of common infectious conditions, mainly in hard-to-reach areas (65,67).

Health policy, HRH policy and planning

The 'Emergency HRH Plan 2007-2011' was the basis of the re-organization of the national HW with priority on the nursing cadres (64). Medical training institutions and in-service trainings were reinforced, as well as task-shifting initiatives, such as physician assistants to fill up for the critical shortage of physicians (66). Furthermore, great efforts were made supported by international partners in rebuilding the health system that included decentralized capacity building (56,61). The latest national health policy document was the 'National Health and Social Welfare Policy and Plan for 2011–2021' and focused mainly on access to basic services, expanding the package health services and increasing the HW. Policies on professionalizing certain cadres and decentralizing the employment of some cadres of unskilled workers were to be adopted by the MoHSW (56,69).

MoHSW capability

Various national health policies such as guidelines on recruitment and placement of national workers were lacking, or were slowly implemented due to insufficient technical capacity from the MoHSW. The national health system remained fragmented and 'top-to-down' organized, whereas subnational health structures, such as the County Health Teams, were unable to recruit their own staff, despite the fact that national HRH officers were deployed at county level (39,56,62,68).

Finance

In order to scale up the HW, the MOHSW introduced a regional incentive package and standardized the salaries and allowances, being uniform to the salaries paid by iNGOs. These measures contributed to an increasing number of national nurses and the decreased outflow to the public sector. CHVs received only an incentive payment and were not on the government payroll (66).

However, by the time Ebola erupted, about 41% of the national HW was not on the governmental payroll and relied, mainly senior officers and doctors, on international partners for their payments of salary or incentive (56,61,68,69). The fact that the transition process to shift the employment of health workers from iNGOs to the government was prolonged, precipitated the motivation of the health workers for their job (55).

3.2.3 Monitoring and coordination

In line with the decentralization strategy, a HR information system (HRIS) was implemented at all levels. Professional HRH registers were however reported to be unreliable (66,68,69). Just before Ebola hit the country, an integrated HRIS was launched to strengthen the national health system (65). Evaluations of its effect are not available. Additionally, HRH census and analysis of staff requirements and needs were obtained by the MoHSW, in order to enhance HRH strategies and planning, such as the projection of minimum staffing requirements, as part of the package health services (67,68). As stated before, the implementation of the national decentralization policy went slow, resulting in many of the decentralized units not having sufficient capacity for the overall coordination and management of their (HRH) services (65).

3.2.4 Composition and roles of health workforce during the Ebola outbreak

Production

As part of the early national Ebola response, the national IPC task force organized training on IPC, case management and safe burials in partnership with WHO, since the pre-existing knowledge of the health workers was low (15,20,66,70). Additionally, 21 IPC specialists were trained and deployed into the County Health Teams (69). The existing network of CHVs was scaled-up through a country-wide 'train-the-trainer' program implemented by community Ebola task forces and the County Health Teams partnering with international actors; about 15,000 community mobilizers and 5,800 contact tracers were trained by more than 800 public health trainers (15).

The recruitment and training process of health professionals was constraining, led by fear of the health workers of becoming infected themselves by treating Ebola patients. Although, many extra (temporary) health workers were trained by various partners in the Ebola response (19). According to the Global Ebola Response report (2015), there were 6,235 contact tracers and surveillance mobilizers, 71 laboratory technicians, 621 burial team members and 1,678 Ebola health workers in Liberia, shown in table 3 (chapter 2, page 17) (37). About 2,500 American military personnel assisted in reconstructing Ebola health facilities, running laboratory services and training health professionals (70).

Deployment

County Health Teams were strengthened by the MoHSW, to deliver Ebola response actions throughout the country (55). A significant part of the extra recruited (temporarily) Ebola health workers were directly recruited and deployed by (i)NGOs. However, no clear overview is available on the total health workers participating in the Ebola response and their specific cadres.

To expand the network of CHVs, the ministry of internal affairs and ministry of youth and sports and iNGOs recruited new volunteers for various outreach and sensitization activities, either in collaboration with the County Health Teams, or independently (56,65,68). In the recruitment process for the various Ebola responders, local and culture preferences were not taken carefully into account and consequently, there were no full confidence of the communities (39,56).

Retention

During the epidemic, the MoHSW disbursed the normal wages and the additional hazard allowances of all health workers involved in the Ebola response. Nonetheless, the payments were frequently irregular, due to delays in the HRH data verification process (46,56). This led to persistent dissatisfaction about the salaries and demotivation amongst the health workers, even leading to

strikes (39,56,61). Furthermore, the health workers had limited access to protective equipment, credible incentives, insurances benefits, which aggravated their demotivation (39).

As shown in table 2 (chapter 2, page 15), many Liberian health workers got infected with Ebola and died. According to a preliminary report of the WHO mid-2015, the following categories of health workers with an Ebola infection were reported; 16 (7%) medical workers, 120 (53%) nursing workers, 15 (2%) midwives, laboratory workers 15 (75), 3 (1%) community workers and 14 (6%) other workers (See annex 1 for the categorization). Of all the infected health workers, 71% died (29).

3.3 Sierra Leone



Figure 6. Map of Sierra Leone (71)

3.3.1 National Ebola response

In response to the Ebola epidemic, the national government announced on 31 July 2014 a national state of emergency, that lasted for one year (15). SL received about \$ 618 million USD aid donations (56). An Emergency Operations Centre (EOC) was established under the responsibility of the Ministry of Health and Sanitation (MoHS). Soon the EOC was transformed into an independent coordination structure; the National Ebola Response Centre, that performed at both national and district levels through District Ebola Response Centres. The National Ebola Response Centre, in conjunction with international partners, was responsible for the coordination between donors and implementing partners, including mobilization of finances and human resources (72). Various national Ebola related policies and strategies were developed and implemented, with the 'narrative accelerated EVD Response plan' as core policy (10,74).

At the time Ebola hit SL, the national government was impassive and relied heavily on international assistance. The lack of ownership by the government persisted during the Ebola response and no proper coordination was provided. The fact that the Integrated Disease Surveillance Response (IDSR) mechanism was not operational, made it challenging for the authorities to track the course of the outbreak (56,75). Army officers were responsible for the District Ebola Response Centres and were supervising the existing District Health Management Teams, however they were not qualified for their position, and implementation of local measures was often delayed by central decision-making (30,76). Hence, the District Health Management Teams were often poorly resourced and felt being neglected in the response (75).

Socio-cultural, economic and political environment

Before the Ebola crisis, the local population associated health services with making money, corruption and mismanagement (56,78). Insufficient and inaccurate messages from the government to the communities, for instance saying that the disease was incurable, resulted in fear and aggravation of lack of confidence in the national authorities and health services (5). These perceptions were fuelled by the media, accusing the government of incompetence in the response towards the epidemic (5,6,56). Travel bans and, in a later phase, total lockdowns, were perceived with reservations by the locals since it restricted food availability and their incomes. Nonetheless, control interventions were relatively easily implemented by collaborating with locally trusted organisations and by using existing chieftdom authorities. The fact that national and local politics were working closely together historically and the leaders of 149 chieftdoms were officially recognized by the government, facilitated the community involvement in the Ebola response. For instance, the national ban on traditional funeral practices were imposed by the traditional leaders successfully (75). Additionally, the president himself called upon all community members to step up to the Ebola fight and warned them with issuing fines otherwise. The response was overwhelming and thousands of volunteers were mobilized for the 'door-to-door' strategy, an extensive country-wide sensitisation campaign. The intensive cooperation among the government and community members contributed highly to the Ebola response (56,77). In addition, civil societies took initiative themselves to combat the Ebola virus. A successful example is from the Pujehun district, that became the first Ebola-free district in the country. The poor and remote district put quickly Ebola preventive measures in place, such as banning social gathering and organizing their own contact tracing system, with the help of religious and youth leaders, and did not wait for actions from the central government (77,79).

3.3.2 The health system prior to the Ebola outbreak

Available HRH

Over the last decade the national HW tripled in numbers (76). For instance, the number of medical officers increased from 62 in 2005 to 116 in 2011. Despite the expanded HW, vacancy rates of specific cadres remained high, as shown in table 7 (78). Moreover, the unequal distribution of the HW persisted, particular disadvantaging remote areas. The poor living conditions of the remote areas made it challenging to attract and retain health workers. Identified as the core of the constraining development of the HW, were irregular in-service trainings and educational institutions with poor capacity and not following up the national HW requirements (78,80).

Table 7. Vacancy rates of health worker cadres in SL, 2011 (79) Note: M&E = monitoring and evaluation

Staff Category	Authorised	No. In-post	Vacancy Rate
Specialists (includes Specialists in management position)	75	41	44%
Registrars (All)	70	5	93%
Medical Officers (All)	116	79	32%
House Officer	66	40	39%
Radiographer	16	0	100%
Physiotherapist	13	1	92%
Orthopaedics	52	18	66%
Rehabilitation	285	15	95%
Medical Electronic Engineer	26	0	100%
Medical Equipment Technician/Electrician	96	17	82%
Nutrition & Catering	318	54	83%
M&E	248	14	93%
Environmental Health Aide	540	171	68%
Maternal & Child Health Aide	2640	1892	28%
Nursing Aide/Assistant	1008	1098	+8%
Darkroom Attendant	56	n/a	n/a
Laboratory Aide/Attendant	221	78	65%
Pharmacy	412	197	52%
Medical Laboratory Science	685	183	73%
Refractionist	52	5	90%
Community Health	839	566	33%
Epidemiology	29	1	97%
Health Education	284	5	98%
Environmental (Sanitary) Health	1029	200	81%
Nurses	4536	1746	62%
Midwives	400	76	81%
Senior Ward Sister / Midwifery Officer	100	6	94%

Health policy, HRH policy and planning

Prioritized HRH issues were addressed in 2010, as part of the policy 'Free Health Care Initiative' (FHCI), that targeted free-of-charge access of medical services for pregnant women, lactating mothers and children under five. These HRH reforms incorporated uplifts of salaries, maintaining a 'clean' governmental payroll, and improving attendance through absentee monitoring systems (78,81). An early evaluation analysis regarding the absentee monitoring system in 2013, reported about 10% drop in absences among the health workers (80).

The national HRH policy 'Human Resources for Health Strategic Plan 2012–2016' aimed to have skilled and motivated country-wide HW, to be achieved by strengthening the HRH governance and management at all levels, production of health workers related to HR requirements and national health needs, among others (79). Also in the 'National Health Sector Strategic Plan 2010-2015', targets regarding advancing the national HRH mechanism were presented, but at the time the Ebola epidemic erupted in SL, these targets were not yet achieved (56,80).

MoHS capability

The MoHS had staff shortcomings and a poor infrastructure, and was reported to be bureaucratic and too centrally organized. Although the FHCI led to improved HR management and workforce

planning within the MoHS, the realization of HRH related policies was often problematic and delayed the recruitment process while surpassing local managers in staff selection. At the time the Ebola outbreak started, the HRH strategy 2012–2016 was not yet implemented, and the HRH training policy only partly (78,80,82-84).

Finance

Following the FHCI, certain performance incentives were realized by the MoHS; 1) allowances were absorbed into the basic pay, however they were insufficient at primary health care level, resulting in low remuneration, and 2) a performance based financing mechanism, which was not fully operational and payments were often delayed, thus surpassing its aim of enhancing the performance of the health workers (78,81,82).

3.3.3 Monitoring and coordination

The HR information system was not functioning well, as data on HRH collected manually, and the monitoring systems on the performances of HRH cadres were very weak (56,81,83,84). Finally, the coordination mechanism remained weak, lacking good decentralized HRH management structures (56,82,83). For instance, until 2011, there was no central coordination of training of the HW in line with the national HRH needs. Also, the lack of communication between finance and HRH functions in the MoHS hampered the payroll verification. Just prior to the Ebola crisis, the Health Service Commission was to be functional, to better coordinate HR policies within the MoHS. No evaluating information was yet available on the performance of this body (82,83).

3.3.4 Composition and roles of health workforce during the Ebola outbreak

Production

At the beginning of the outbreak, the government estimated the need of 21,000 additional health professionals (76). Various training initiatives were developed by the MoHS in partnership with international actors, to enable scaling up of the HW. More than 10,000 national and international health workers at national and district levels were trained on IPC in the national Ebola training academy (85,86). To rapidly reach all workers at the primary health units, a ‘train the trainers’ model was used, that easily expanded the numbers of trainers, eventually reaching the community health level. It was implemented by the MoHS and the district health management teams partnering with NGOs (85). Contact tracers and health supervisors were supported by special Ebola chiefdom taskforces, which enhanced their tasks (5,77). In regards to the ‘door-to-door’ sensitization campaign, about 30,000 voluntary social mobilizers were trained and with support from the police and army, reaching 1.5 million households to educate the population on Ebola and preventive measures (56,88).

According a Global Ebola Response report (2015), there were 5,333 contact tracers and surveillance mobilizers, 112 laboratory technicians, 1,125 burial team members, 4,303 Ebola health workers and 4,415 social mobilizers in SL, shown in table 3 (chapter 2, page 17) (37). These numbers were still insufficient, moreover the level of 17.2 skilled health personnel per 10,000 people before the outbreak, dropped to 3.4 per 10,000 during the crisis, due to the desertion and loss of health workers (5,14,85).

Deployment

Many of the health workers already worked officially in the health facilities at the time the epidemic erupted. The MoHS asked volunteers to support them, however without placing them on the

national payroll (30). Other temporary Ebola health workers were directly recruited and deployed by (i)NGOs. The national army and police with the help of the British army supported the HW. Specifics on the deployment processes of the MoHS and various partners could not be found.

Retention

The MoHS introduced a financial incentive scheme for all health workers in the Ebola response, to compensate for increased exposed infection risks (30,89). Many health workers reported the risk allowance and trainings opportunities to be valuable and motivating during the Ebola epidemic, however only if these were regularly disbursed and allocated to the right workers since not all health workers were verified ('ghost-workers') (15,30,35). Other reported motivating factors were centred around personal motivating factors such as religion and job satisfaction (88). On the contrary, health workers appealed for more supervision, increase of salaries, provision of accommodation and training for (new recruited) non-technical staff, in order to retain them (30).

SL lost many health workers to an Ebola infection, shown in table 2 (chapter 2, page 15). The preliminary report of the WHO mid-2015 reported the following categories of health workers with an Ebola infection; 10 (3%) medical workers, 167 (57%) nursing workers, 9 (4%) midwives, 24 (8%) laboratory workers, 20 (7%) community workers and 16 (5%) other health workers (See annex 1 for the categorization). Of all infected health workers, 69% died (29). Among the health workers who died, there were 11 specialized physicians and the national medical expert on VHF (15).

3.4 Opportunities and challenges of the health workforce in the Ebola response

See table 8 (page 36/37) for the summary on the opportunities and challenges of the HW in their response in the Ebola outbreak in Guinea, Liberia and SL, illustrating the roof of the adapted 'house'-model (figure 3, page 22).

Table 8. HR systems responding to Ebola health needs in Guinea, Liberia and Sierra Leone: what are the opportunities and challenges

		Countries					
		Guinea		Liberia		Sierra Leone	
		Opportunities	Challenges	Opportunities	Challenges	Opportunities	Challenges
Foundation	Health system prior to Ebola outbreak		Low numbers skilled and motivated health workers; and maldistribution	Relatively strong nursing cadres	Low availability of certain health worker cadres and maldistribution of HW	Important national HRH reforms were implemented	Low availability of certain health worker cadres and maldistribution of HW
			Very scarce HRH policy and planning	Efforts made to strengthen decentralized health structures	Weak capability MoHSW; central HRH management, HRH policies poorly implemented		Weak capability MoHS; central HRH management, problematic realization HRH policies
	Monitoring & coordination prior to Ebola outbreak		Absence of well-functioning HR information system		Incomplete national HRH register and governmental payrolls		Poor HR information system
			Weak institutional coordination of government sectors at all levels		Limited ownership of national government, with reliance on international support		Weak ownership of national government and district health management teams
Pillars	Workforce response during Ebola outbreak	Increased numbers of health workers; due to many trainings and recruitment of temporary staff	Temporary health workers were not integrated in (district) health system	Strengthening of existing health structures, including decentralized deployment	Irregular payments of salaries and incentives; led to demotivating health workers	Hardship allowances perceived positive by health workers	Trainings implemented by MoHS and district teams partnering with NGOs
		Use of existing CHVs and		The pre-existing network of CHVs			

		formation of 'village watch committees'		successfully used in response			
Environment	Socio-cultural and political environment Prior and during Ebola outbreak	Positive impact of involvement of community and key community leaders	Longstanding distrust towards national authorities deeply rooted in communities	Positive influence of community key leaders in advocating community	Lack of confidence towards national authorities	Good partnership national and local politics and community leaders facilitated community engagement	Lack of confidence towards national authorities
			Political turmoil hampered the Ebola response		Engagement of community in late phase of response		Engagement of community in late phase of response

CHAPTER 4: GOOD PRACTICES OF HEALTH WORKERS IN EBOLA RESPONSES

This chapter assesses briefly various successful response interventions of health workers in various Ebola outbreaks, under the guidance of the adapted 'house' -model. Both Uganda and DRC have experienced several Ebola outbreaks over the last decades, which were contained with relatively limited spread. Also, Nigeria, Mali and Senegal were capable to avert the Ebola outbreak in 2014 quickly and consequently mitigated the impact (2,6,89). Similar to the three most affected countries, these five countries also face, fragile infrastructure, not fully professionalized health services and the longstanding struggle to ensure a sufficient, well-trained and motivated HW (90). Nonetheless, these countries were able to contain the epidemic in a much more efficient way than the three most affected countries. Therefore, these were selected to elaborate on the good practices in their responses.

4.1 The national health system

4.1.1 Health policy, HRH policy and planning

The reason that Nigeria addressed the Ebola outbreak in 2014 so well, was based on previous successes in responses towards cholera and polio outbreaks, whereupon health prevention infrastructures were implemented successfully. Consequently, when Ebola hit Nigeria, an Emergency Operation Centre (EOC)/Incident Management System (IMS) was quickly to be established (39,97-99).

Also, Uganda learned relevant lessons from a cholera outbreak and the various Ebola outbreaks the country encountered in the past. Thereby, the 'Integrated Disease Surveillance and Response' (IDSR) strategy has been effectively operational since many years. Following, clear strategic plans of action were developed and up-dated through regular meetings at national and sub-national levels. These structures facilitated the quick setting up of a National Task Force by the national government, MoH and international partners in times of Ebola (6,95,100,101).

4.1.2 MoH capability

In Nigeria, Uganda and DRC it was the national government together with the MoH that took fully responsibility for the Ebola responses, as well as for the formation and deployment of the engaged health workers (39,95,97).

4.1.3 Finance

Also, in Nigeria, Uganda and DRC the disbursements of salaries and risk incentives of the Ebola health workers were coordinated by the MoH, often with financial support from international partners (39,95,97).

4.2 Monitoring & coordination

The Nigerian government established an Ebola Strategic Coordination Unit and all partner organizations and donors were expected to work through these national structures. Besides, comprehensive and innovative epidemiological and surveillance interventions attaining community level were swiftly organized too. Border closures and travel restrictions were therefore not necessary (39,97-99).

Also in Uganda, the overall responsibility of the Ebola responses was with the national government, that constituted clear coordination and communication mechanism at national and district levels. To improve early detection, special community case definitions on various illnesses were standardized along traditional beliefs (6,95,100-103). Effective interventions in DRC in order to optimize detection of active cases was accomplished by free access to health services, where normally fees were required and the installation of a mobile laboratory at the outbreak site delivering swift results among others (15,39).

4.3 Composition of the health workforce in the Ebola response

4.3.1 Production

The immediate formation of rapid response teams to be actively involved in the front line of the Ebola fight is seen in Nigeria, Uganda and DRC. These teams consisted of physicians, nurses, laboratory experts, epidemiologists, data and logistics specialists and psychologists. All team members were well-trained and had experiences in outbreak management, due to various national educational programs on health emergency responses. The Ugandan health authorities have an inventory of designated health professionals, who were to be employed immediately, both on national and district level, when an emergency occurs (39, 96-98, 102).

In addition, special training programs were organized as part of the Ebola response, in order to improve certain skills and knowledge of the health workers. In Nigeria, an Ebola training unit was set up and trained not merely health workers, as well as morticians, military personnel, teachers, port workers and government officials (39,104). In Uganda, countrywide trainings for all health workers on IPC, surveillance and response management, including IDSR were conducted by the rapid response members under the responsibility of the MoH. The corresponding training guidelines are regularly updated (95,100).

Moreover, community health workers and volunteers were mobilized and reallocated in favor of Ebola health services. In Nigeria, CHVs, who normally act as the community source for health information on specific infectious diseases and received an Ebola awareness trainings, participated in the Ebola response, mainly to reach the population in rural areas (39, 91,93,104). The Ugandan 'village health teams' were of great help in reaching out to the local communities, since they normally collaborated closely with local and religious leaders in order to provide health education, enhanced mutual understanding and trust during the response (6,94-96). The community relays in DRC educated and informed the local population on preventive Ebola practices, and supported the crisis management staff with conducting surveys and introducing interventions in the community (39).

4.3.2 Deployment

The Nigerian Ebola Strategic Coordination Unit was responsible for the individual contracts to the rapid response team members and other Ebola health workers, regular payments of salaries and incentives and provision of adequate equipment. Most of the members of the rapid response teams were already deployed in the national polio program (39,97,98). In Uganda, the rapid response team members are to be quickly contracted and deployed if necessary outside their normal daily job by the MoH/National Task Force (93). Furthermore, senior officers were deployed from the national level to the district level to strengthen the coordination with the district task forces (94). The MoH of DRC,

selected health workers based upon their experiences in Ebola management and personal dedication to commit to humanitarian responses (39).

4.3.3 Retention

In general risk allowances were introduced in order to compensate health workers for the potential infection risk in their Ebola job. In DRC, provision of protective equipment was provided along. In Nigeria, disbursement was done by the Federal MoH and in Uganda risk allowance were mostly initiated by (i)NGO. In both countries, the allowances were perceived positive. Thereby, Ugandan health workers were reported to be intrinsically motivated despite the experienced increased workloads with higher levels of responsibility (39,89,101).

In both DRC and Nigeria, various continuous training initiatives maintain IPC and Ebola knowledge and awareness among health workers. Especially in DRC health workers knew how to alert and act, contributing their determination to respond and subsequently facilitating quick identification and control (15, 39).

4.4 Socio-cultural and political environment

Notable in all successful responses is the good collaboration of the authorities with the communities. Such was done very well in Nigeria, where the Federal MoH maintained good relationships with the community through civil society organizations and religious leaders during the Ebola epidemic. As a result, the sensitization campaigns, mainly focused on preventive measures, as well as addressing misinformation and rumors were widely accepted by the communities. Contributing to this, was the fact that social media was extensively used to disseminate real-time information on local Ebola situations by the authorities, and therefore directly available for the HW and population. Thereby, special courses were organized for local journalists, since the media played an important role in influencing the community's perception on Ebola and the response, in both a positive and negative way (39,97,98,99).

Also, the successes of the Ebola responses in Uganda depended on the close relation of the national authorities with the community and the enthusiasm of the community to participate in the responses. Beneficial for the enhancement of the community, was the long-standing culture of openness about HIV both on the politicians and community level. Thereby, for many years, the civil society participated in the highest national health policy organ, which improved their ownership in the Ebola responses (6,93,94,96).

The past of Ebola epidemics educated the communities in DRC, and in the last outbreak in 2014 it was the community that was the core of the response. Community leaders were enforcing control measures and civil society organisations monitored and reported behaviour changes among the population, hence defining the best interventions to organize. The national government of DRC underpinned the importance of community involvement, such that the minister of the MoH visited Ebola affected areas in the early days of the outbreak in 2014. Health workers were motivated, the population sensitized and local authorities advocated consequently. The expertise and response capacity of DRC can be derived from the fact that psychosocial support was provided to affected patients and their families (15,39).

CHAPTER 5 DISCUSSION: *What are the lessons learned?*

The 2014/15 Ebola outbreak in West Africa hit hardest in Guinea, Liberia and SL. The resource-limited settings of these countries and the fragile socio-cultural and political environment made the containment of the Ebola outbreak extremely challenging. More than 11,000 people died directly as a result of the epidemic and many lives have been impacted.

Due to the epidemic, specific health needs arose in a short period of time, alongside the basic health needs. Using the metaphor of the 'house'-model, the roof of the house, illustrating the HR response to the health needs, became larger and heavier (41). Crucial in the response was to meet the Ebola health needs of the population as soon as possible. Thereupon the number of health workers was increased through training, recruitment of temporal workers and re-allocating CHWs. Less focus was on the other components of the model, such as retention, coordination and monitoring of the HW. Interestingly, Fujita described this same development in the case studies that founded the model, which were also countries with a troubled recent history and with politic changes underway (41). It is understandable that the initial focus of the national governments was on enlarging training capacity, considering the urgency to scale-up the HW in response to the high burden of Ebola health needs. Thereby, strengthening the other aspects of the 'house'-model, e.g. HRH policy, framework and finances is time-consuming and requires certain technical aspects. All together this made the 'house'-model in the West African countries unstable, having only one firm pillar without solid foundation and to support a very heavy roof.

Prior to the Ebola epidemic, the HW pool was already insufficient in Guinea, Liberia and SL. The relatively high losses among health workers due to an Ebola infection aggravated the shortcomings of the HW during the outbreak. Despite the many training initiatives, the need for health workers remained high throughout the response. The total HW expanded in Guinea, but was still inadequate to cover all the health needs in the country. Unfortunately, no specifics on the cadres of the extra health workers were available. However, nurses, nurse-aids and community health workers were covering the major portion of the HW before the outbreak in the three countries. The HRH measures and trainings were also centered around these cadres in the response. In Nigeria and Uganda, a cluster of health professionals, consisting of physicians, nurses, laboratory experts, epidemiologists, data and logistics specialists, is continuously on standby in case of a sudden public health emergency. They are well-trained in outbreak management and kept regularly updated by the MoH. An interesting side effect of training during the epidemic was the improved infection control behaviour among health professionals in Guinea post-Ebola (26).

The pre-existing national HRH mechanisms, forming the foundation of the 'house'-model, were not only marginally developed in Guinea, Liberia and SL, but also mainly centrally organized, resulting in long recruitment and deployment processes before the Ebola outbreak. Attempts for decentralization remained often theoretical or were poorly implemented. One of the few good examples of sustainable implementation of decentralized deployments was the recruitment of new community health volunteers during the outbreak under the responsibility of existing County Health Teams in Liberia. Often, the recruitment and deployment of new health workers during the epidemic was directly organized by iNGOs. It is known that, particularly in emergency situations, iNGOs act mostly short-term and quick results are key (5). There is usually less support for long-term planning and coordination. Besides, the deployment period of international workers, providing technical assistance, was often short-term and the high turn-over led to fluctuations in the Ebola programs and trainings. As a result, there was no sustainable implementation of key HRH features in the national health systems of Guinea, Liberia and SL. There was no integration of new health workers in the health structures nor were continuous training initiatives developed.

The payment of hardship allowances is considered as one of the most motivating factors for health workers to compensate their stressful work in an Ebola epidemic (30,88). However, extra payments did not solve the issues of poor health infrastructure, limited resources such as protective gear and medicine (mainly in remote areas) and the great risk health workers were taking during the Ebola response. Therefore, other motivational factors are likely to have played a role as well as health workers did step up to combat the epidemic despite the problems mentioned. Indeed, surveys conducted in SL just before and during the Ebola outbreak, mention job satisfaction (intrinsic motivation), training possibilities, adequate supervision and provision of accommodation as other motivations (30,88). Additionally, as health workers face considerable stress levels and risk mental problems, psycho-social support deserves attention during and post-Ebola, as was done during the last Ebola outbreak in DRC (15,39).

Documentation on the overall coordination and interlinkages of the three pillars of the 'house'-model - illustrating key elements of HRH mechanism during the Ebola crisis - is only scarcely available from Guinea, Liberia and SL. On the contrary, it is known that the national governments of Nigeria, Uganda and DRC took ownership in coordinating the recruitment, deployment and training of the health workers who were engaged in the Ebola responses (39,95,97).

The pre-existing fragility of the health systems in the three severely affected countries is often mentioned as one of the main reasons for their inadequate Ebola response. Another important factor is that over the last decades, Guinea, Liberia and SL have allocated consistently less than 15% of their GDP to health, which is not in line with the Abuja declaration. It can be questioned if the Ebola responses could ever have been organized adequately with such underfunded health systems. However, the solution is multifactorial and not only dependent on funding, as illustrated by the relatively successful responses of Nigeria, Uganda and DRC. These countries did not have a highly-developed health system either, including not reaching the Abuja declaration. The difference in response can be partly explained by the fact that Nigeria and Uganda were able to establish immediate response interventions based on existing health structures regarding preventing infectious diseases. In Nigeria, the polio-prevention system was used as template for an Ebola response system. Uganda had long-standing experiences combating the HIV epidemic and learned important lessons from the repetitive Ebola epidemics in the country. Guinea, Liberia and SL did not have similar health structures and subsequently there was no guidance for the HW nor for the communities to respond properly, as they were not familiar with prevention and control interventions.

Illustrative for the insufficient Ebola responses of Guinea, Liberia and SL were the high levels of distrust of the population towards national authorities and health providers, along with deeply-rooted cultural and superstitious beliefs considering health related problems. It has even been suggested that this may have unnecessarily prolonged and intensified the Ebola epidemic. The national governments of Guinea, Liberia and SL did not start to consider the community members as fellow partners until late in the outbreak, when deteriorating effects on the country were already taking place on large scale. The delayed collaboration is remarkable, as the success of Ebola responses in Nigeria, Uganda and DRC was evidently underlined by the intense collaboration between public health authorities and the affected communities, from the very beginning of the epidemic. A strong feature of the Ugandan way of responding towards an Ebola outbreak, was the open national culture of dealing with its HIV problems, both within the community and amongst politicians. This tolerance benefitted the Ebola responsiveness and community engagement. The question rises why these clear lessons were neglected by the national authorities of Guinea, Liberia and SL, resulting in a severe delay in involvement of the communities. Fear for economic setbacks

and loss of (international) investments might have contributed to the delayed actions of the national authorities. Other factors were the top-to-down approach of the national systems, in which communities were regarded as inferior (5,15). In Guinea, the Ebola response was even used for the political agenda, with the result of the exclusion of communities from opposite political parties from certain control services. The fact that a district in Sierra Leone was declared Ebola-free because of swift control measures taken by the locals themselves, showed that the civil societies were motivated to fight the Ebola. Furthermore, involved international partners addressed the Ebola response from their own perspective, rather than looking into the local socio-cultural context, which resulted in them bypassing comprehensive sensitization and community mobilisation plans and concentrating merely on curative solutions.

Curative and preventive (public) health care are essential factors in an Ebola response, but just as important are dissemination of adequate, clear and truthful messages towards the community. Messaging needs to be adjusted to the cultural and local customs. The variety of tribes and languages in West-Africa is extensive and there is a strong oral tradition. Many publications described the contributively role of these key community members and informal health workers with regards to surveillance, contact tracing, health promotion and behaviour change during an Ebola outbreak (14)(101)(102). An example from Uganda illustrates this as special health interventions were aligned with traditional beliefs, leading to improved early detection of infected people in rural areas. Again, the community can supplement the shortcomings of the national health systems and the deficiencies of the HW, making rigorous control measures such as quarantining of villages and restriction of mobilisation unnecessary, as the latest responses in Nigeria and DRC illustrated.

Fortunately, Guinea, Liberia and SL have launched a national Ebola recovery plan on how to (re)build the health system in a sustainable way (48)(65)(74). Elements of particular interest are the improvement of the capacity of health workers and continuous training programs, strengthening of the national recruitment frameworks and monitoring systems, enhancing financial and non-financial incentives and overall HRH coordination. In perspective of the 'house'-model, all the elements of the model will be addressed, while the national governments are striving for more leadership and ownership.

Limitations

This analysis of health workforce issues during the most recent Ebola outbreak has, of course, some limitations. First, given the fact that the 2014/15 Ebola outbreak is multifactorial, a Master's thesis is by far unable to provide a full analysis. By simplifying and combining elements and stakeholders, the most important factors have been highlighted and analyzed in this assessment. The adapted 'house'-model greatly helped to give structure to scrutinizing this complex epidemic and to formulate recommendations to the national governments. Although French articles have been included in the literature review, it is possible that relevant French articles have been missed. Thereby, documentation on Guinea was underrepresented compared to Liberia and SL. This literature review was conducted when the Ebola outbreak had only just come to an end, therefore it is likely that not all evaluations and analyses have already been published. It is likely that many documents and evaluation analyses are only for internal communication and therefore do not cover all factors involved in the epidemic. In addition, of all assessed countries under- and misreporting is to be expected as a result of poor surveillance and information systems. Most articles on the 2014/15 Ebola outbreak focus on epidemiological and technical aspects of the epidemic. There were very little publications on HRH specifics.

Besides these limitations, this thesis shows that an Ebola outbreak can be contained efficiently and timely by health workers when the available HW is well-trained in outbreak management and motivated to participate in the response. The national MoH should ensure their capacity and take ownership in implementing clear HRH strategies and plans, both at national as decentralized levels, regardless of whether there is a health emergency situation or not. In times of an Ebola outbreak, the MoH should coordinate the response, including facilitating training initiatives, recruiting and deploying extra (temporal) health workers and volunteers, ensuring adequate salaries and incentives and maintaining a good collaboration with the local communities.

CHAPTER 6: CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

The 2014/15 Ebola outbreak had devastating effects in Guinea, Liberia and SL, whereas e.g. Nigeria escaped relatively unharmed. The pre-existing fragile health system with shortcomings in both staff and resources plus the relatively high losses amongst health workers during the outbreak, put a heavy burden on the response activities. The assessment in this thesis was focused on the role of the HW addressing an Ebola outbreak, and the influence of the pre-existing HRH systems and related socio-cultural and political factors on this response.

By using an analytical framework, the adapted 'house'-model as proposed by Fujita et al (2011), challenges and opportunities of the HW were identified in the Ebola response in Guinea, Liberia and SL. Good practices of Ebola responses of Nigeria, Uganda and DRC were studied as well, in order to provide recommendations to MoHs in future Ebola outbreaks in a resource-limited setting.

The response activities in the three countries concentrated around a quick up-scaling of the HW, whereupon many trainings initiatives were developed, mainly led by the government in partnership with international partners. There was considerably less focus on deployment and retention, the other two pillars of the 'house'-model. Furthermore, the collective engagement of community members started too late, thus missing out on deep understanding of the cultural and local customs, which showed to be pivotal in implementing control measures.

In conclusion, a fit-for-purpose health workforce heavily relies on continuous training in order to guarantee motivation to engage in response activities, and adequate supervision. In line with the good practices of Nigeria, Uganda and DRC, a rapid response team should be allocated in order to respond immediately in case of a future Ebola outbreak. Adequate ownership of the national government with clear decentralized structures having their own responsibilities in decision-making are also fundamental. Therefore, resource-limited countries should focus on strengthening the structures of the health system and HRH system as depicted in the 'house'-model, especially when there is not yet a health crisis. With the help of closer partnership between national authorities and the community, restoring of the deep-rooted distrust can be achieved.

6.2 Recommendations

The following recommendations aim to enhance the responsiveness of the health workforce in an Ebola outbreak in a resource-limited setting;

- To develop updated national HRH policies and planning, with integration of the roles and functions of the formal and informal HW, including emergency specifics.
- To allocate a number of national health workers as Ebola responders in rapid response teams, to train and brief them regularly and ensure their readiness at any given time;
- The rapid response teams should preferably consist of well-trained and experienced physicians, nurses, laboratory experts, epidemiologists, data and logistics specialists.
- To ensure routine IPC-trainings for all health workers and community workers/volunteers by the MoH, to be captured in national policies, with regular updates of guidelines and training initiatives for trainers.
- To strengthen MoH capacity and its decentralized structures, in order to align HRH processes, such as recruitment, deployment, retention and coordination, to assure a more committed HW that is resilient for potential future outbreak responses.

- To expand the ownership of the national governments as part of the national response activities in a possible future Ebola outbreak; the establishment of a special emergency HRH task force should be considered, including early warning system to re-allocate health workers if necessary in the response.
- To expand partnership between government and (key) community members and civil society organizations on a regular basis, starting preferably outside a health emergency in order to enforce mutual trust.
- In a future Ebola response, there should be more attention on analysis, monitoring and evaluation of HRH management; to be able to draw conclusions afterwards which will help improve the coordination even more.

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ANNEX 1: Definitions

Definition of health workforce

The health workforce is defined by the WHO as “all people engaged in actions (promotion, protection and/or improvement) whose primary intent is to enhance health” (90). This definition is in line with WHO’s definition of health systems as all activities with the primary goal of improving health, like family caregivers, health volunteers and community workers. Due to lack of information on this group, they are excluded as official formal health workers, although are to be described as informal health workers (90).

The most important cadres of health workers in the Ebola response 2014/15 were (as published in ‘Ebola infections in Guinea, Liberia and Sierra Leone - A preliminary report, 2015’ (29));

Medical workers	Doctor, MD, physician assistant, medical student, médecin, stagiaire en médecine
Nursing workers	Nurse, nurse aide, nurse assistant, Maternal and Child Health (MCH) Aide, vaccinator, infirmier/infirmière, Assistant Technique en santé (equivalent to nurse aide)
Midwifery workers	Midwife, traditional birth attendant (TBA), matronne, sage-femme
Community health-care workers	Community health worker, community health volunteer, community health assistant, agent communautaire
Laboratory workers	laboratory technician, laboratory aide
Other workers	Ambulance worker, ambulancier, brancardier, ambulance driver, pharmacist, dispenser, pharmacy technician, pharmacien

Definition of community health workers

Community health workers should be members of the communities where they work, should be selected by the communities, should be answerable to the communities for their activities, should be supported by the health system but not necessarily a part of its organization, and have shorter training than professional workers (103).

Definition of Ebola health needs

No precise definition of Ebola health needs was found in the literature; therefore the following definition is composed after carefully assessing the existing literature;

1) To be able to obtain early case detection of suspect cases 2) To ensure adequate knowledge on signs and symptoms within the population, and to empower them to organize themselves to respond; 2) To have accessible health services for suspect cases; 3) Early isolation of suspect cases with timely testing of blood with adequate referral of suspect case; 4) adequate treatment of positive case, including sufficient bed capacity and IPC measures; 5) adequate care of deceased case; safe burial (Based on WHO Clinical management of patients with viral hemorrhagic fever (104)).

ANNEX 2: Country information of Guinea, Liberia and Sierra Leone

West Africa

West-Africa, the most western region of the continent Africa, comprises of 16 middle- and low-income countries, which have a predominantly Islamic population with a wide diversity of culture traditions. In the 15th century, the first European trade settlements were established, later becoming colonies of which African slavery was one of the major trades. Only Liberia retained its independency. After World War II, sub-Saharan nations became autonomous. Since then, many countries have been engaged in political instability, military coups and violent conflicts. The main economic sectors in the region include mining (diamond, bauxite and rutile), agriculture and fisheries. Although the GDP grew at a rate of 5.89% annually over the past 10 years, still 50% of the population lives under the poverty line of \$1.25 per day (32,105,106).



Figure 7. Map of West Africa (107)

Guinea

Guinea became independent from its French colonizers in 1958. Decades of recurrent socio-political instabilities in the country followed, partly evoked by the civil wars in Liberia and SL. In 2013, just before the Ebola crisis, violence erupted caused by the electoral process.

Guinea is a republic and is organized in eight administrative regions, further subdivided into almost 2,000 districts. Conakry is the national capital.

At the time of the Ebola crisis, there were about 12 million people living in Guinea. Estimated annual population growth were set at 2.8%. Three Guineans out of four were illiterate and the poverty rate increased between 2002 and 2005, going from 49.2% to 53%. The Ministry of Health and Public Hygiene (MOHPH) is responsible for the national health system, that is organized in a pyramidal structure on three levels; central, intermediate and peripheral. Over the last decade an average of 4-

5% of the total national budget was allocated to health, which resulted in a severely underfunded health system. Half of the population, especially in rural areas had limited access to health services and the majority of the health facilities were underequipped and had no running water, electricity or latrines. Almost all vertical programs, such as HIV prevention, depend on donor funding (43,49,50). See table 4 (chapter 3, page 22) for key health related indicators of Guinea.

Liberia

Liberia proclaimed its independence in 1847, after it was founded and controlled by former African American slaves. Two decades of devastating civil war ended in 2003 and peaceful democratic elections were held two years later.

Liberia is a republic and divided into fifteen counties, and further subdivided into 90 districts, that consists of smaller clans. Monrovia is the national capital. Liberia has approximately 4 million inhabitants.

The Ministry of Health and Social Welfare (MOHSW) is the government ministry responsible for the provision of all health-related services. The national health service delivery system comprises primary, secondary and tertiary levels with a variety of direct service providers; government, faith-based organizations, NGOs and the private sector. After 2003, with the financial support of international partners, great efforts have been made over the years to rebuild the system in order to provide minimum levels of health services, including abolishment of user fees. In 2012, out-of-pocket expenditure accounted for 51% and the total per capita health expenditure was \$65. The total expenditure on health was 10.0% of GDP in 2014. In 2014 there were 725 health facilities in Liberia, one health facility for 5,500 people, which were unequally distributed (5,55,59,63,65). See table 4 (chapter 3, page 22) for key health related indicators of Liberia.

Sierra Leone

Sierra Leone became independent from the United Kingdom in 1961. It suffered from several periods of political instability with a 10-year lasting civil war that ended in 2001. Freetown is the national capital. The country is divided into 12 districts and further sub-divided into chiefdoms, governed by local paramount chiefs. About 7 million people were living in SL when the Ebola erupted (78).

The Ministry of Health and Sanitation (MoHS) is responsible for the country's public health system, comprises peripheral health units, district hospitals and regional/national hospitals. Besides, private services and traditional medicine play an important role in providing health to the population; almost half of the hospitals are owned by private, non-governmental and faith-based organizations and about 45% of the deliveries are assisted by traditional birth attendants. In 2013, 7.5% of GDP was allocated to health, whereas the actual disbursements were even lower and coming down to \$14 per person. The health sector relied heavily on donors and out-of-pocket payments from patients; national health expenditure in 2013 covered just 6.8% of all health expenditures (5,55,78,85,109). See table 4 (chapter 3, page 22) for key health related indicators of Sierra Leone.