

2017

Liberian health system resilience: lessons from the 2014–2015 West African Ebola epidemic

<https://hdl.handle.net/2144/20857>

Boston University

BOSTON UNIVERSITY
SCHOOL OF PUBLIC HEALTH

Dissertation

**LIBERIAN HEALTH SYSTEM RESILIENCE:
LESSONS FROM THE 2014–2015 WEST AFRICAN EBOLA EPIDEMIC**

by

DEIRDRE ANN ROGERS

B.S., Cornell University, 1993
S.M., Harvard University, School of Public Health, 1998

Submitted in partial fulfillment of the
requirements for the degree of
Doctor of Public Health

2017

© 2017 by
DEIRDRE ANN ROGERS
All rights reserved

Approved by

First Reader

Christopher J. Gill, MD, M.S.
Associate Professor of Global Health

Second Reader

M. Patricia Fabian, Sc.D.
Research Assistant Professor of Environmental Health

Third Reader

Davidson H. Hamer, MD
Professor of Global Health

Professor of Medicine
Boston University, School of Medicine

Fourth Reader

Rose Macauley, MD,
Chief of Party, Advancing Partners and Communities /
Ebola Transmission Prevention and Survivor Services Program
JSI Country Representative, Liberia
John Snow, Inc.

Fifth Reader

Ken Olivola, M.Arch.
Director Boston International Group
John Snow, Inc.

“Perhaps the most embarrassing failure of international development agencies has been their excessive focus on programming for past problems instead of anticipating the challenges of the future.”

–Andrew S. Natsios, Former USAID Administrator

DEDICATION

To Fred and Declan, for their unwavering support.

And for Ernest Knightly.

ACKNOWLEDGMENTS

I would like to thank my dissertation committee including Christopher Gill, Patricia Fabian, David Hamer, Rose Macauley and Ken Olivola for their support in seeing me through completion, and Malcolm Bryant who supported me through the early stages of refining my topic.

I am hugely appreciative of Joel Lamstein, President of John Snow, Inc. (JSI), and Ken Olivola, Director of JSI's Boston International Group, for their continual support as I juggled working full-time with completing my doctoral work.

I also wish to acknowledge the support of all those who greatly contributed to making this dissertation possible, including: the United States Agency for International Development Liberia Mission; Liberia Ministry of Health; non-governmental organization staff who participated in health system capacity assessments and who served on the Incident Management System during the Ebola epidemic; and staff and students from professional health institutions (Esther Bacon School of Nursing and Midwifery, Tubman National Institute of Medical Arts, the Liberian Board of Nursing and Midwifery, and the Liberian Medical and Dental Council). This dissertation would not have been possible without the tireless support and dedication of JSI's Rebuilding Basic Health Services project staff, and in particular of Dr. Rose Macauley for her leadership and guidance.

JSI librarian, John Carper, was an invaluable resource to me throughout the process, for which I am grateful. Thanks to Michele Clark for her encouragement and perseverance. And of course to my husband and son for their support, I thank you.

**LIBERIAN HEALTH SYSTEM RESILIENCE:
LESSONS FROM THE 2014–2015 WEST AFRICAN EBOLA EPIDEMIC**

DEIRDRE ANN ROGERS

Boston University School of Public Health, 2017

Major Professor: Christopher J. Gill, MD, M.S., Associate Professor of Global Health

ABSTRACT

I. Background

Following a review of donor funding priorities and concepts of health system strengthening (HSS) and resilience, this dissertation documents health system resilience factors existing in the Liberian health system in late 2014/early 2015 as the Ebola epidemic flared. The effectiveness of the WHO health system building blocks framework in addressing resilience was assessed, and specific factors that can promote health system resilience for Liberia going forward were identified.

II. Methods

Methods applied as part of this intrinsic case study include document and literature review, analysis of health facility and population-level statistics, and key informant and group interviews at the county and national levels. The methodology allowed for an in-depth assessment of how HSS (using the WHO health system building blocks) and resilience factors (using the WHO-defined key aspects of emergency preparedness) exist (or could exist) within the Liberian institutional and cultural context, and for tentative conclusions to be drawn about the importance of system factors to building specific health system capacities and overall health system resilience.

III. Findings

While dealing with myriad other public health priorities, public health preparedness went largely unaddressed in pre-Ebola Liberia where effectively none of the 16 key components or their 51 essential attributes listed in the WHO table of emergency preparedness were in place. The lack of integration of public health preparedness into HSS interventions left the country vulnerable to public health emergencies.

There are two limitations to the government's Ebola recovery and investment plan: (1) lack of a holistic approach to addressing emergency preparedness; and (2) not integrating emergency preparedness needs and corresponding activities into the existing national HSS framework.

IV. Conclusion

By integrating emergency preparedness and response initiatives into HSS activities, health systems in Liberia and elsewhere can be strengthened to be more resilient, and thus better able to anticipate and adapt to challenges, and ultimately improve the system to be able to anticipate new future challenges. However, strengthening health systems so that they are resilient takes resources, including sector-wide, HSS resources that can be used to build functioning, integrated systems and skilled, networked individuals and groups across sectors.

TABLE OF CONTENTS

DEDICATION	v
ACKNOWLEDGMENTS	vi
ABSTRACT	vii
TABLE OF CONTENTS.....	ix
LIST OF TABLES	xii
LIST OF FIGURES	xiv
LIST OF ABBREVIATIONS.....	xvii
INTRODUCTION	1
Rebuilding Basic Health Services (RBHS) project	2
Improvements in Liberian Population Health Outcomes.....	3
Dissertation Purpose and Public Health Implications.....	5
REVIEW OF THE LITERATURE	6
Donor Funding Priorities	6
Global Health and Development Governance in a Rapidly Changing World	6
Changing Aid Architecture	9
Official Development Aid versus Country Programmable Aid.....	10
Development Assistance for Health: Disease-Specific Funding vs. Health System Support.....	11
Development Assistance for Health in Liberia.....	14
Factors Influencing Effective Use of DAH in Liberia.....	19
Disease-Specific Funding and Fragmentation	25
Health System Strengthening.....	27
How a Health System Influences Population Health: the Determinants of Health ..	27
Management of a Health System	31
Health Systems Constraints to Promoting, Maintaining and Improving Population Health.....	33
What is Health Systems Strengthening?.....	35
Frameworks for Assessing the Health System.....	35
WHO Health Systems Building Blocks: From Disease Silos to Building Block Silos	39
Resilience.....	43
Sustainability vs. Resilience	44
Defining Resilience.....	45
Resilient Health Systems vs. Health Systems with Effective Emergency Preparedness	48
METHODS	51

Aim and Objectives.....	51
Theoretical Framework.....	52
WHO health systems strengthening framework.....	52
WHO Components of Effective Emergency Preparedness Programs.....	52
Study Design.....	55
Data Methods.....	56
Data Sources.....	61
Rebuilding Basic Health Services (RBHS) Project.....	62
I. RBHS Project Data Sources Documenting Health System Capacity.....	66
II. Demographic and Health Survey (DHS) data, 2007 and 2013.....	68
III. HMIS (DHIS2) data, 2009–2015.....	69
IV. Liberia (MOH and WHO) Ebola situation reports, 2014–2015.....	69
V. Open Source GIS data.....	70
FINDINGS OVERVIEW.....	72
2008 Mindset Shift: From Humanitarian Assistance to Development, RBHS 2008–2012.....	72
General Health System Capacity Findings from 2009–2014.....	75
2014–2015 Ebola Virus Disease (EVD) Epidemic.....	76
What was different in Liberia that allowed the exponential spread of Ebola?.....	80
Ranking Priorities According to WHO Emergency Preparedness Components.....	86
Step 1: Priority Ranking of Attributes and Components.....	86
Step 2: Gap Identification: Matching Priorities against Current Response, Resiliency and Recovery Plans.....	90
FINDINGS BY WHO HEALTH SYSTEM BUILDING BLOCK.....	93
Building Block 1: Delivering Essential Health Services.....	93
Objective 1: Liberian Health System Capacities, 2009–2014.....	93
Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System.....	105
Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities.....	107
Building Block 2: Health Workforce.....	110
Objective 1: Liberian Health System Capacities, 2009–2014.....	110
Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System.....	114
Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities.....	116
Building Block 3: Health Information Systems.....	117
Objective 1: Liberian Health System Capacities, 2009–2014.....	117
Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System.....	122
Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities.....	124
Building Block 4: Access to Essential Medicines.....	127
Objective 1: Liberian Health System Capacities, 2009–2014.....	127
Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System.....	133

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities	134
Building Block 5: Health Systems Financing	136
Objective 1: Liberian Health System Capacities, 2009–2014	136
Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System	141
Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities	142
Building Block 6: Governance and Leadership	143
Objective 1: Liberian Health System Capacities, 2009–2014	143
Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System	148
Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities	150
CONCLUSIONS AND SUMMARY RECOMMENDATIONS	154
Creating Resilient Health Systems against Modern Disruptions	154
The Role of County Governments, Donors and Global Governance	156
Pre-existing Conditions	157
From Near Collapse to Resilience: Overarching Recommendations and Logic Model	159
Overarching Recommendation 1: Take an All-Hazards Approach	160
Overarching Recommendation 2: An Integrated WHO Building Blocks Framework	166
Detailed Recommendations by Building Block	171
Building Block 1: Service Delivery	171
Building Block 2: Health Workforce	172
Building Block 3: Health Information	174
Building Block 4: Medical products, vaccines, and technology	177
Building Block 5: Health Financing	178
Building Block 6: Leadership and Governance	179
DISSEMINATION PLANS	183
ANNEXES	184
Annex 1. Liberia Background Maps	184
Annex 2. Individuals Interviewed in the RBHS Mid-term Evaluation, May/June 2011	189
Annex 3. Individuals Interviewed in the 2012 and 2014 Capacity Assessments	197
Annex 4. Advantages and Disadvantages of the Case Study Design	202
BIBLIOGRAPHY	203
CURRICULUM VITAE	220

LIST OF TABLES

Table 1. Data from the two Demographic Health Surveys conducted over the life of the RBHS project.....	4
Table 2. Liberia: ODA Disbursements By Purpose (in USD millions).....	15
Table 3. Health expenditure per capita (current US\$ 2013).....	19
Table 4. Constraints to Scaling up Health Services.....	34
Table 5. Classification of Health Systems Frameworks.....	37
Table 6. Types of Resilience.....	46
Table 7. WHO Key Components and Essential Attributes of Strengthened Health System Emergency Preparedness*	53
Table 8. Data Analysis Summary	60
Table 9. WHO Emergency Preparedness Component and Building Block Priority Scores*	88
Table 10. GOL Post-Ebola Investment Plan Priorities	91
Table 11. RBHS activities in support of provision of health services	93
Table 12: Facilities by county and facility density (shaded cells are counties most severely impacted by Ebola; >100 cases).....	106
Table 13. Emergency Preparedness Assessment Results	108
Table 14. RBHS Project Capacity Strengthening for MOH Health Workforce.....	110
Table 15: County distribution of health workforce based on payroll status (February 2015).....	115
Table 16. Emergency Preparedness Assessment Results	116
Table 17. RBHS Project Capacity Strengthening for MOH Health Information Systems	117
Table 18: Comparison of PRISM Assessments 2012 – 2014.....	121
Table 19: Status of RBHS-supported HMIS Interventions, July 2014.....	122
Table 20. Emergency Preparedness Assessment Results	124
Table 21. RBHS Project Capacity Strengthening for MOH Supply Chain System	127

Table 22. Emergency Preparedness Assessment Results	134
Table 23. RBHS Project Capacity Strengthening for MOH Health Financing	137
Table 24. Emergency Preparedness Assessment Results	143
Table 25. RBHS Project Capacity Strengthening for MOH Governance and Leadership.....	144
Table 26. Emergency Preparedness Assessment Results	150

LIST OF FIGURES

Figure 1. Geographic Trends in ODA and CPA, 1985 to 2005	10
Figure 2. Total ODA, Sub-Saharan Africa, 2009–2013 (millions USD).....	11
Figure 3. ODA by Sector, Liberia 2009–2013.....	16
Figure 4. Per Capita Spending on Health, Liberia and Sub-Saharan Africa, 2009–2013 (USD).....	17
Figure 5. Spending on Health as a Percent of Total ODA, Liberia and Sub-Saharan Africa, 2009–2013	17
Figure 6. Spending on Health, Education and Water Supply and Sanitation as Percent of Total ODA, Liberia and Sub-Saharan Africa, 2009–2013	18
Figure 7. Proportion of Households with Poor Quality or No Toilet, Liberia, February 2015 (2013 DHS data)	20
Figure 8. Proportion of Households with Poor Quality Water, Liberia, February 2015 (2013 DHS data).....	21
Figure 9. Liberia’s Poverty Profile, 2007	25
Figure 10. Contribution of Health Determinants on Health Outcomes: Results from Three Studies.....	29
Figure 11. Health Systems Support versus Health Systems Strengthening.....	38
Figure 12. WHO HSS Framework.....	40
Figure 13. Global Health Initiative HSS Results Framework.....	41
Figure 14. Rebuilding Basic Health Services (RBHS) Project Coverage, November 2008–February 2015	64
Figure 15. Liberian MOH Capacity Building Framework.....	66
Figure 16. Timeline of key events	71
Figure 17. Health Facility Distribution and Population Density, Liberia, February 2015 (2015 HMIS and 2013 DHS data)	74
Figure 18. Relative impact of the 2014–2015 West African Ebola Outbreak	77
Figure 19. Cumulative Ebola Cases and Deaths, Liberia, March 2014–2015	78

Figure 20. Number of confirmed, probable and suspected Ebola cases in the last 21 days, Liberia, Aug 2014–Jul 2015	79
Figure 21. Cumulative number of confirmed, probable and suspected Ebola cases, March 2016.....	79
Figure 22. Cumulative number of confirmed, probable and suspected Ebola deaths, March 2016.....	80
Figure 23. Cumulative Ebola Cases and Case Fatality Rate, Liberia, February 2015 (WHO Situation Report Data)	81
Figure 24. Cumulative Ebola Cases and Population Density, Liberia, February 2015 (WHO Situation Report and 2013 DHS data).....	85
Figure 25. IPT2 in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	99
Figure 26. 4+ ANC Visits in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	99
Figure 27. Skilled Deliveries in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	100
Figure 28. Total CYP in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	100
Figure 29. Measles Coverage (>1yr) in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	101
Figure 30. Penta3 Coverage (>1yr) in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	101
Figure 31. Malaria Diagnosed by RDT (<5yrs) in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	102
Figure 32. Malaria Cases Treated with ACT (<5yrs) in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	102
Figure 33. HCT Services in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	103
Figure 34. OPD Services in the Six Counties with >100 Ebola Cases, Liberia, Aug–Oct 2009–2015.....	103
Figure 35. IA Delivery Schedules from Counties to Facilities.....	130
Figure 36. Distribution of MOH spending (USD) by county (2013/2014)	141

Figure 37. Logic Model Integrating Emergency Preparedness into Health Systems
Strengthening 170

LIST OF ABBREVIATIONS

ACT	Artemisinin-based combination therapy
ANC	Antenatal care
BCC	Behavior change communication
BPHS	Basic Package of Health Services
CHDC	Community Health Development Committee
CHT	County Health Team
CYP	Couple-years of protection
DHS	Demographic and health survey
EBSNM	Esther Bacon School of Nursing and Midwifery
EHT	Environmental health technician
EmOP	Emergency operational plan
EPHS	Essential package of health services
GOL	Government of Liberia
gCHV	(General) community health volunteer
HIS	Health information system
HMIS	Health management information system
HR	Human resources
HSS	Health systems strengthening
iHRIS	integrated human resource information system
IPT2	Intermittent preventive treatment of malaria (in pregnancy), 2 nd dose
JSI	JSI Research & Training Institute, Inc.
LBNM	Liberia Board of Nursing and Midwifery
MOH	Ministry of Health (formerly Ministry of Health and Social Welfare)
NGO	Non-governmental organization
NHSWPP	National Health and Social Welfare Policy and Plan 2011–2021
PBC	Performance-based contract
PBF	Performance-based financing
QA	Quality assurance
RBHS	Rebuilding Basic Health Services

TNIMA	Tubman National Institute for Medical Arts
UNMEER	United National Mission for Ebola Emergency Response
UNMIL	United Nations Mission in Liberia
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization

INTRODUCTION

Liberia suffered two devastating civil wars lasting 14 years from 1989–2003, severely weakening the government health system. As a result, the majority of health services in Liberia were being provided by relief organizations during this same period.^{i ii}

ⁱⁱⁱ The successful transition to power of a popularly elected president in 2005 led to greater political stability and improved security throughout the country.

Within this still relatively new government, the Ministry of Health (MOH)¹ emerged as one of the strongest and most effective among the government's ministries. Between 2005 and 2009, the MOH demonstrated strong leadership and vision by developing a sound National Health Policy and Plan, and through coordinating effectively and transparently with international partners. While the health sector would clearly require substantial external assistance for years to come, it was clear that the MOH was taking the lead in setting national policies, strategies, and plans.²

Nonetheless, a decade after the war ended—despite progress made in building many of the underlying systems necessary for Liberia's growth and development—84% of Liberians continued to live in multi-dimensional poverty³; ranking second worst in the world.^{iv} The UNDP's Human Development Index for 2013 listed Liberia 12th lowest among all countries.^v In early 2014, Liberia was engulfed in a devastating Ebola outbreak, further weakening the already fragile health system.

¹ In 2015, the Government of Liberia moved Social Welfare out from the Ministry of Health and Social Welfare (MOHSW) to join with the Ministry of Gender and Development. For consistency, it is referred to as the MOH throughout this document.

² The cornerstone of the Liberian National Health Plan is the MOH's Basic Package of Health Services (BPHS), now the Essential Package of Health Services (EPHS) which outlines the essential

³ Multidimensional poverty is defined as overlapping deprivations in health, education and standard of living (UNDP)

Rebuilding Basic Health Services (RBHS) project

The Rebuilding Basic Health Services project ran from November 2008 to February 2015 and was the major health intervention in Liberia during this time. At the start of RBHS, Liberia was beginning to demonstrate gradual and encouraging progress in a range of political, economic, and social outcomes. The health sector was as severely impacted as any other by the wars, with limited resources, loss of staff, destruction and deterioration of infrastructure, and major disruption of health systems and programs. Today, the national health system continues to depend on international donors, non-governmental organizations (NGOs), and faith-based organizations—up to 82% of health facilities depend on external assistance to ensure on-going functioning.^{vi}

Funded by the United States Agency for International Development (USAID) and led by JSI Research and Training Institute, Inc. (JSI), RBHS was designed to help transition Liberia's health sector from relief to development by supporting the MOH in increasing access to and use of quality health services through increasingly decentralized health system management. This was to be accomplished through a three-pillared strategic approach: (1) improve and expand service delivery; (2) strengthen the health system specifically in the areas of human resource (HR) management, infrastructure, policy development, monitoring and evaluation; and (3) promote healthy behaviors through behavior change communication (BCC) and community mobilization.

About half-way through the project, USAID changed the focus from service delivery, BCC and community mobilization to capacity development of the MOH at central and county levels. The second half of the project was explicitly guided by the

World Health Organization's (WHO's) health systems building blocks framework.⁴ Thus, the scope of the second pillar of the original three-pillared approach—health system strengthening (HSS)—was significantly broadened in the final three years, and the other two pillars re-formulated and de-emphasized.

Improvements in Liberian Population Health Outcomes

During the first three years of the RBHS project, Liberia saw notable improvements in health outcomes and health services, and the project was credited with supporting improvements by both central and county MOH staff.^{vii} RBHS project and government health management information system (HMIS) data showed increased utilization among a range of health services, including couple years of contraceptive protection provided, deliveries with a skilled birth attendant, coverage of intermittent presumptive treatment for malaria in pregnancy, and HIV testing and counseling. Quality of care also improved, as documented by adherence to clinical standards.^{viii ix x xi}

Over roughly the same time period, the 2007 and 2013 Demographic and Health Survey (DHS) results showed reductions in the infant mortality rate, and increases in antenatal (ANC) visits, deliveries by skilled attendants in facilities, contraceptive prevalence rate, full vaccination coverage, and knowledge of HIV (see Table 1).^{xii xiii}

In the second half of the project, with all health service provision under the direct management of the resource-stretched MOH, some of the health service statistics waned a bit, though net gains were maintained and system capacity improvements

⁴ RBHS provided direct services from 2009–2012 in seven of Liberia's 15 counties: Bomi, Bong, Grand Cape Mount, Lofa, Montserrado, Nimba, and River Gee. In the project redesign in 2012, capacity building activities focused on the Central MOH and Bong, Lofa and Nimba counties only.

documented.^{xiv}

Table 1. Data from the two Demographic Health Surveys conducted over the life of the RBHS project

Indicators	DHS 2007	DHS 2013
Total Fertility Rate	5.2	4.7
Contraceptive Prevalence Rate	11%	19%
Antenatal Care Visits (4+)	66%	78%
Intermittent Presumptive Treatment (2 doses) (IPT2)	31% ¹	48%
Facility-based Skilled Birth Attendance	37%	51%
Pentavalent (3 doses)	50%	68%
Complete Vaccination Coverage	39%	55%
Stunting	39%	32%

¹ Data not collected in 2007 DHS. Figure is from project-supported facility data as of 2009. Same facilities in 2013 reported IPT2 coverage of 51%.

However, in March 2014, seeing Ebola for the first time in Liberia, the country faced the worst Ebola epidemic ever recorded globally.^{xv} The initial Liberian government response was slow, and the health system response inadequate; ultimately impacting their capacity and credibility to respond.^{xvi} The rapid increase in health care worker infections exacerbated fear and doubt among Liberians in the abilities of the already fragile public health system.^{xvii xviii} At the same time, ill-equipped health care workers were refusing to go to work and many health facilities completely ceased to provide services.^{xix xx xxi} The result was a partial collapse of the health system and a need for a massive international response. As Ebola comes under control, the Liberian government is looking to build on both what has worked in the past and new lessons learned to restore essential services and ultimately rekindle efforts to rebuild a more resilient health system.

Dissertation Purpose and Public Health Implications

The dissertation identifies features that promote health system resilience and documents the existence or lack thereof of such characteristics in Liberia in late 2014/early 2015 when Ebola struck. This facilitated an assessment of the successes and limitations of the WHO health system building blocks framework in building resilience, and the identification of specific factors that can promote health system resilience for Liberia going forward. Findings from the dissertation are intended to:

- (1) Help Liberia restructure and rebuild a more resilient health system;
- (2) Inform other countries as they examine their health systems and their resilience to stressors;
- (3) Guide donor and technical assistance agencies investing in national health systems to target their interventions more efficiently and effectively.

REVIEW OF THE LITERATURE

This dissertation, in part, documents improvements in health outcomes and health system capacities over the life of the RBHS project. Despite these improvements, the country's response to the Ebola epidemic proved inadequate. In part this was due to the scale of the epidemic, the multiplicity of donors and partners, and the imperative to act quickly which posed significant challenges for overall response coordination and management. However, it draws into question the scope and focus of donor and Liberian government HSS priorities and interventions over the last decade. This section summarizes (1) official development assistance funding, priorities and actors in recent years; (2) the dominant literature on health systems strengthening, and (3) theories, methods and tools to measure elusive concepts such as capacity, sustainability and resilience, and complex-adaptive systems such as a health system. Subsequent sections document Liberian health system capacity gains according to the WHO HSS building blocks framework, the impact Ebola had on the Liberian health system, and then capacity gains re-analyzed through a resilience lens, followed by conclusions and recommendations.

Donor Funding Priorities

Global Health and Development Governance in a Rapidly Changing World

As the world becomes more interconnected through increased travel on local, regional, and global scales, human populations are increasingly in contact with one another and with animals. Since the majority of infectious diseases are of animal origin (zoonotic), and 75% of emerging zoonoses have wildlife origins,^{xxiii} the increased

frequency of high-risk contacts between wild animal hosts and people allows for more efficient epidemic spread of pathogens such as Ebola.^{xxiii} Human activities including land use changes for agriculture and livestock purposes, resource extraction, and increased human population density and urbanization—all which contribute to lessened wildlife biodiversity—are linked to a multitude of outbreaks, including SARS, Ebola, and Nipah virus.^{xxiv}

A timely example in Liberia involves the palm oil company, Golden Veroleum Liberia, currently being accused of taking advantage of the fear and panic surrounding the Ebola crisis to exploit seven local communities by buying their farmland at deeply discounted prices. The land will be clear-cut and turned into palm oil plantations; further encroaching into the buffer zone between humans and wildlife in Liberia. In addition to the local disease implications there are other health, and potentially economic, implications resulting from lessened local agricultural production of diverse food products such as rice, cassava, and vegetables.^{xxv} Collectively, these smaller, regionalized land use changes have much wider implications.

The growth of major emerging economies such as Brazil, Russia, India, and China has increased the global demand for food, fossil fuels and other resources; increasing pressures on the environment resulting from land use changes and increasing population density and urbanization. Concerns on the impact of these pressures on the climate is demonstrated by global representation and concern expressed the November 2015 UN Climate Change Conference in Paris. Such rapid and recent changes raise questions about whether donor priorities, and actors—including global governance

entities such as the WHO—are still reflective of the current global needs and priorities.

In fact, the recent Ebola epidemic has brought to the forefront questions about WHO's role in global governance and development. WHO was established in 1948 to coordinate international health work; assist governments to strengthen health services; provide technical assistance; provide epidemiological and statistical services; promote better health; eradicate disease; and propose regulations to improve health.^{xxvi} However, as the world becomes increasingly interconnected, global health has also become increasingly complex with more donors and development agencies; donors increased from 38 in 1990 to about 150 in 2000.^{xxvii} During the West African Ebola outbreak, WHO was widely perceived as being slow to respond with technical and coordination assistance, which was largely picked up by Médecins Sans Frontières and existing NGOs already in place in Liberia such as JSI.

World Bank is increasingly visible in the area of health, starting with the Bank's 1993 report *Investing in Health*, and more recently in Liberia where they have dramatically increased their role in funding health services restoration following Ebola.⁵ Other active groups working in global health include United Nations agencies (UNICEF, UNDP) and increasingly their country- and event-specific entities (UNMEER, UNMIL⁶), regional development banks (African Development Bank), and numerous NGOs and foundations (Rockefeller). Also, the G7/8 and G20 are active in global health decision

⁵ Since the start of the Ebola epidemic in Liberia, World Bank has committed \$385 million for Liberia, plus an additional \$260 million for Guinea and \$318 million for Sierra Leone (<http://www.worldbank.org/en/topic/health/brief/world-bank-group-ebola-fact-sheet>)

⁶ UNMIL: United Nations Mission in Liberia; UNMEER: United National Mission for Ebola Emergency Response

making and priority setting, as is the United States Department of State, working jointly with the USAID.^{xxviii} Even the United States Government (USG) military has increased their humanitarian and general development activities in the last decade, including in Pakistan, Haiti, Indonesia, Nepal, and most recently in Liberia as part of the emergency Ebola response.^{xxix xxx} With the myriad of other donors and development partners increasingly stepping in to provide services and serve both coordination and response functions in health emergency situations, the role of WHO is increasingly unclear.

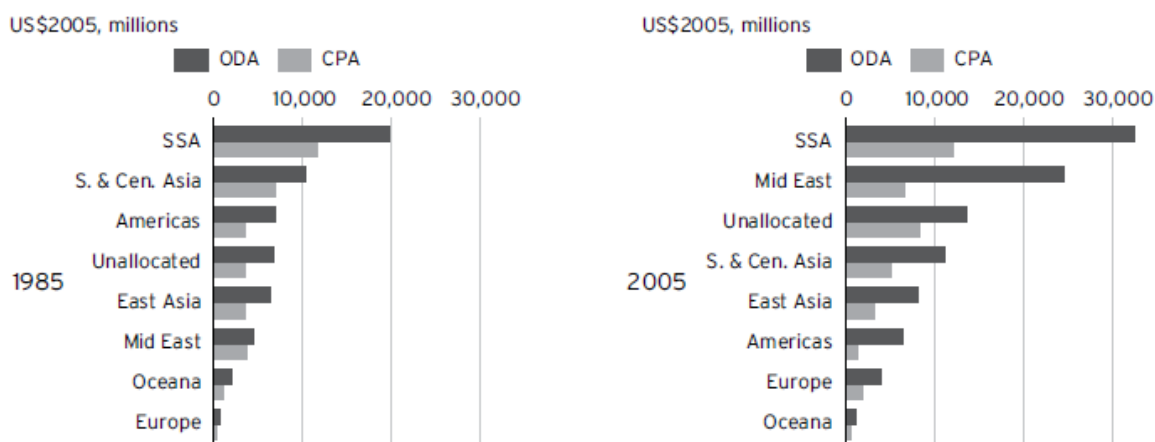
Changing Aid Architecture

As of 2015 there are an estimated 203 major global health agencies and organizations that play a prominent role in improving health, including JSI.^{xxxi}

Of the myriad of actors, many are further specialized within the sector to address specific diseases, regions or sub-populations. For example, the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) was established in 2002 to intensify the global response to specifically address these three major pandemics.^{xxxii} While such specialized agencies and approaches have demonstrated increases in local capacity of both the public and civil service/NGO sectors, promoted community involvement, and strengthened governance of public health, they tend not to be designed using a sector-wide or overall health systems strengthening approach, and thus, as is the case in Liberia, typically result in parallel financial, procurement, reporting and information systems. (See Health Systems Strengthening section below).

Official Development Aid versus Country Programmable Aid

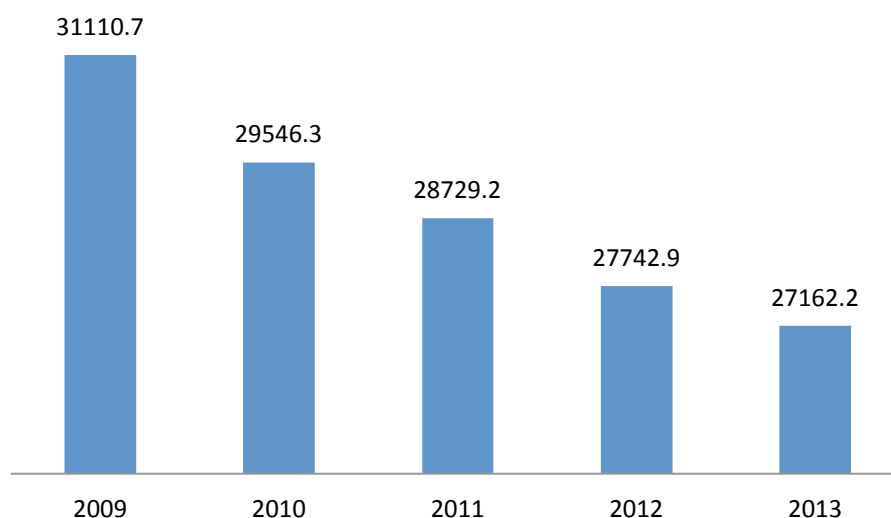
According to a 2007 report, between 1985 and 2005, despite an increase in Official Development Assistance (ODA) funding, the actual real proportion of Country Programmable Aid (CPA)—or the percentage of ODA funds that are available for development projects and programs—has shown almost no increase for sub-Saharan Africa (SSA).^{xxxiii} Figure 1 shows geographic trends in ODA and CPA between 1985 and 2005; showing that while ODA has increased substantially in SSA, funds available to SSA countries for use in development projects and programs have remained virtually unchanged over the 20 year time period.



Source: Homi Kharas, “Trends and Issues in Development Aid” (Wolfensohn Center for Development at the Brookings Institution, November 2007).

Figure 1. Geographic Trends in ODA and CPA, 1985 to 2005

Further, over the past few years, between 2009 and 2013, there have been declining levels of ODA going to those countries most in need, including those in SSA (see Figure 2).^{xxxiv xxxv} So not only has CPA remained stagnant for SSA between 1985 and 2005, but overall ODA has also begun to decline for many countries most in need.



Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*

Figure 2. Total ODA, Sub-Saharan Africa, 2009–2013 (millions USD)

According to the Organization for Economic Cooperation and Development (OECD), the importance of official development assistance is lessening in many countries with the rise of development aid being provided by non-traditional, non-OECD DAC countries. However, for countries such as Liberia marked by long-term conflict and fragility, ODA is expected to continue to play a vital role.

Development Assistance for Health: Disease-Specific Funding vs. Health System Support

Keeping in mind that overall ODA has decreased for SSA in the past few years and that country programmable aid has stagnated, over a much longer time period global development assistance for health (DAH) has indeed increased substantially; from \$6.9 billion disbursed in 1990 to \$35.9 billion disbursed in 2014.^{xxxvi}

However, while DAH increased, the proportion that went for sector-wide

approaches, or health system strengthening (SWAps/HSS)⁷ remained more or less unchanged, and the proportion for maternal health, (comprising some of the worst health indicators in poor countries including Liberia), actually decreased over time. Maternal health outcomes are heavily influenced by strong community outreach and linkages to formal care. In turn, strong outreach and linkages necessitate adequate health systems including adequate facility- and community-based health information, human resources, drugs and medical supplies, among others. Thus, the relative flat funding for HSS interventions may have a double negative impact on maternal health.

Funds for HIV/AIDS increased substantially, largely due to the establishment of the United States President's Emergency Plan for AIDS Relief (PEPFAR). Of the \$458.0 billion DAH provided between 1990 and 2014, the USG alone accounted for over one-third, with 71% of USG funds channeled through USG agencies. Of the USG DAH, 41% was specifically for HIV/AIDS. While PEPFAR funding has resulted in significant reductions in all-cause adult mortality between 2004 and 2008, without equivalent systems strengthening support (e.g., funding for SWAps/HSS), it is unclear how sustainable the improved health outcomes will be. The majority of funding for SWAps/HSS is from the United Nations. ^{xxxvii}

Unlike the United Kingdom (UK), the United States does not tend to support sector-wide activities, including health system budget support. Since budget support

⁷ SWAps/HSS definition: sector wide approach or programs; budget support; health systems strengthening; human resources; health information system; integrated people-centered health services; national health policies, strategies and plans; early warning alert and response system; capacity building; access to essential medicines; access to health technologies, medical equipment, surgical equipment; strengthening regulatory capacity; adequate facilities, construction

necessitates less external technical assistance, this translates into fewer job opportunities for Americans (among likely other economic and political factors)—and thus a tougher sell to the US Congress to approve foreign aid budgets. As a result, the USG tends not to fund general budget support in favor of disease- and, more recently, health sector area-specific interventions (e.g., supply chain, information systems, human resources for health).

In addition to the UK, the Global Fund is among the few donors that funds sector-wide programs. A content analysis of Global Fund Round 8 investments found that a substantial portion, 37% (US\$ 362 million), was allocated to health systems strengthening. However, of that, 62% (\$223 million) was for disease-specific system support, and only 38% (US\$ 139 million) was for generic system-level interventions. Overall, around 82% of health systems strengthening funding (US\$ 296 million) was allocated to service delivery, human resources, and medicines and technology. Very little was allocated to the cross-cutting health sector areas of governance, financing, and information.^{xxxviii}

Between 1990 and 2014 there were 38 primary agencies and organizations providing resources to 146–183 (depending on year) developing countries.^{xxxix} Roughly, this was an average of \$1.2 billion of DAH allocated for HSS, or \$6.6 million per country; that's just over \$276,000 per year per country for HSS over a 24 year period (and that is the proportion of ODA earmarked for health, but not necessarily funds actually available for health interventions (i.e., CPA)).

“Perhaps the most embarrassing failure of international development agencies has been their excessive focus on programming for past problems instead of anticipating the challenges of the future. Black swans* have derailed many a development budget by forcing the reallocation of scarce resources to address game-changing events no one anticipated.”

--Andrew S. Natsios, Former USAID Administrator

Source: *The Future Can't Wait: Over-the-Horizon Views on Development*

* A “black swan” is a metaphor for events that are extreme outliers yet have a major effect. They are typically rationalized by hindsight, as if it could have been expected (i.e., relevant data were available but unaccounted for in risk mitigation programs). Source: https://en.wikipedia.org/wiki/Black_swan_theory

Development Assistance for Health in Liberia

Like overall DAH globally, in Liberia DAH has also increased significantly since 2000. Total ODA disbursements in Liberia rose from \$21.23 million in 2000 to \$506.92 million in 2010.⁸ Over the same time period, ODA disbursements for health, or DAH, increased from \$2.57 million (or 12% of total ODA), to \$89.22 million (or 18% of total ODA).⁹ Net ODA received per capita⁹ in Liberia has increased from \$67 spending per person in 2004, the first year post-war, to \$124 per person in 2013 (current US\$).¹⁰ However, over the past few years, between 2009 and 2013, Liberia has seen a relative decrease in ODA for social infrastructure and services, which includes health and population, education and water supply and sanitation.

⁸ Figures in constant 2009 US\$

⁹ Net ODA per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent).

¹⁰ Source: <http://data.worldbank.org/>

Table 2 documents ODA disbursements from Development Assistance Countries by purpose between 2009 and 2013 in Liberia. It shows a reduction in ODA for Social Infrastructure and Services (and the three sub components of health, education and water), compared to increases in every other area; most notably in energy.

Table 2. Liberia: ODA Disbursements By Purpose (in USD millions)

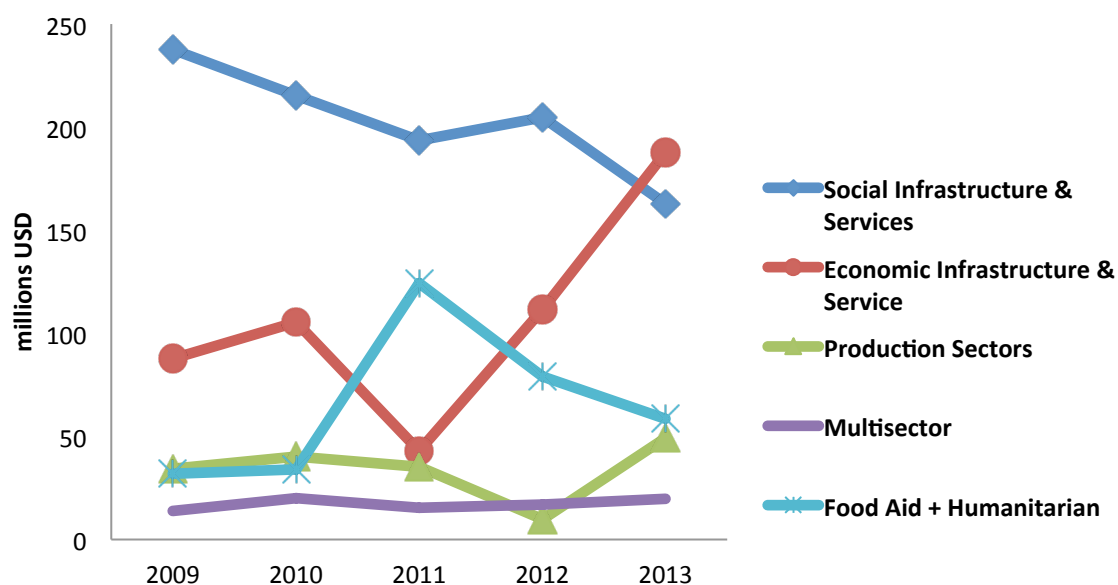
	2009	2010	2011	2012	2013
Population (millions)	3821	3958	4080	4190	4294
Life Expectancy (years)	59	59	60	60	-
Social Infrastructure & Services	237.7	215.4	193.6	204.7	162.7
<i>Education</i>	<i>35.7</i>	48.6	38.1	36.6	<i>29.8</i>
<i>Health & Population</i>	<i>80.7</i>	46.2	37.4	56.3	<i>50.1</i>
<i>Water Supply & Sanitation</i>	<i>7.5</i>	14.1	7.7	11.7	<i>6.1</i>
Economic Infrastructure & Service	87.6	105.3	43.0	111.7	187.8
<i>Energy</i>	<i>31.4</i>	59.3	11.1	94.8	<i>123.6</i>
<i>Transport & Communications</i>	46.3	13.2	29.7	8.3	58.4
Production Sectors	34.3	40.3	35.2	9.8	49.2
<i>Agriculture, Forestry, Fishing</i>	29.7	32.2	34.7	9.2	41.2
<i>Industry, Mining, Construction</i>	4.3	4.5	0.1	0.5	0.2
<i>Trade & Tourism</i>	0.3	3.6	0.4	0.1	7.8
Multisector	13.7	19.9	15.5	16.9	19.6
Program Assistance	14.5	20.1	59.5	38.7	18.4
<i>Food Aid</i>	14.5	20.1	45.7	38.7	18.4
Humanitarian Aid	17.4	13.9	78.5	40.3	40.2
Other & Unallocated/Unspecified	1.9	0.5	1.3	2.4	1.8
TOTAL	407	415.4	426.6	424.5	479.6

Note: table excludes action relating to debt

Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*

In the past five years, the Government of Liberia (GOL) has prioritized economic infrastructure and services (energy and transportation) over health, education and water

supply and sanitation (social infrastructure). The 14 years of civil war destroyed much Liberia's economic and social infrastructure, and one would expect significant upticks in investments in both areas following the end of the conflicts in 2003. Of note is the decline in investment in social infrastructure (see figures 3 and 6).



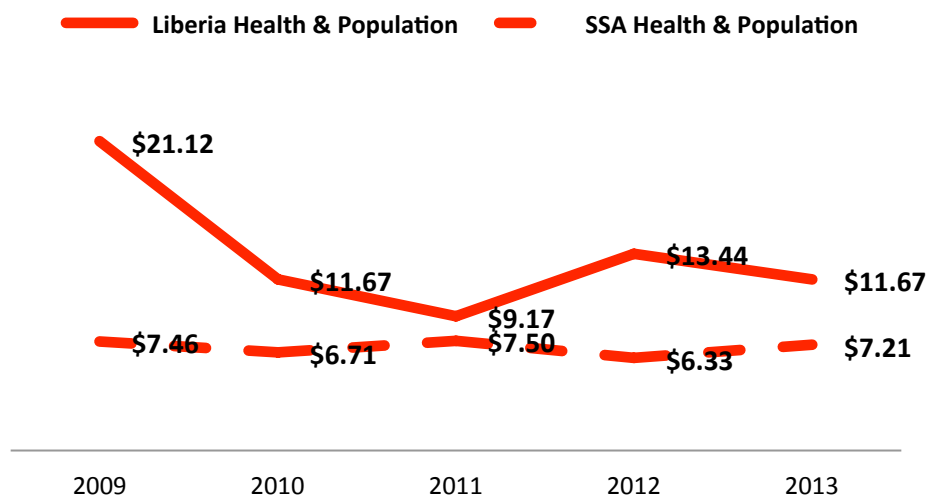
Data Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*

Figure 3. ODA by Sector, Liberia 2009–2013

Figure 3 shows the increase in economic and infrastructure funds (energy and transportation) alongside the decrease in social infrastructure and services. It also displays the relative stagnation at low levels of funding for the production sector (agriculture, forestry, fishing; industry, mining, construction; trade and tourism) and for multisector funding. Data from 2014 and 2015 will likely show marked increases in funding for food and humanitarian aid as a result of the Ebola epidemic.

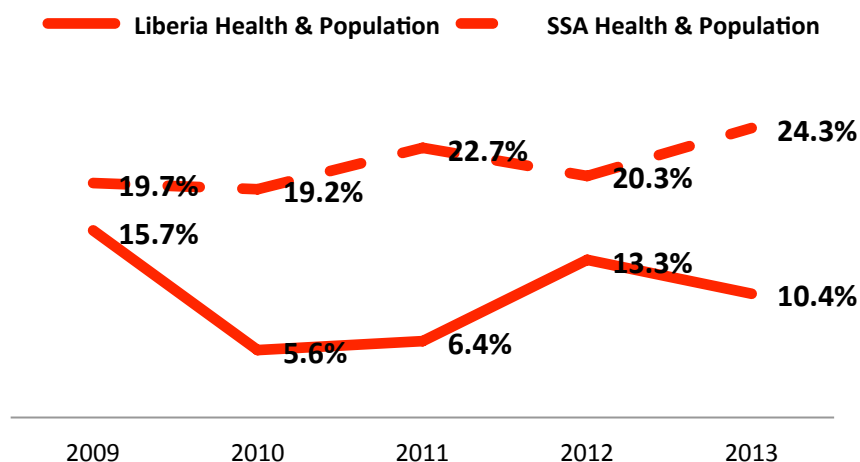
Looking just at health and population funding shows that while per capita funding

for health is slightly higher than in SSA overall (Figure 4), spending on health as a percent of total ODA is notably lower in Liberia; only 10% of ODA is allocated to health compared to about one-quarter in SSA (Figure 5).



Data Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*

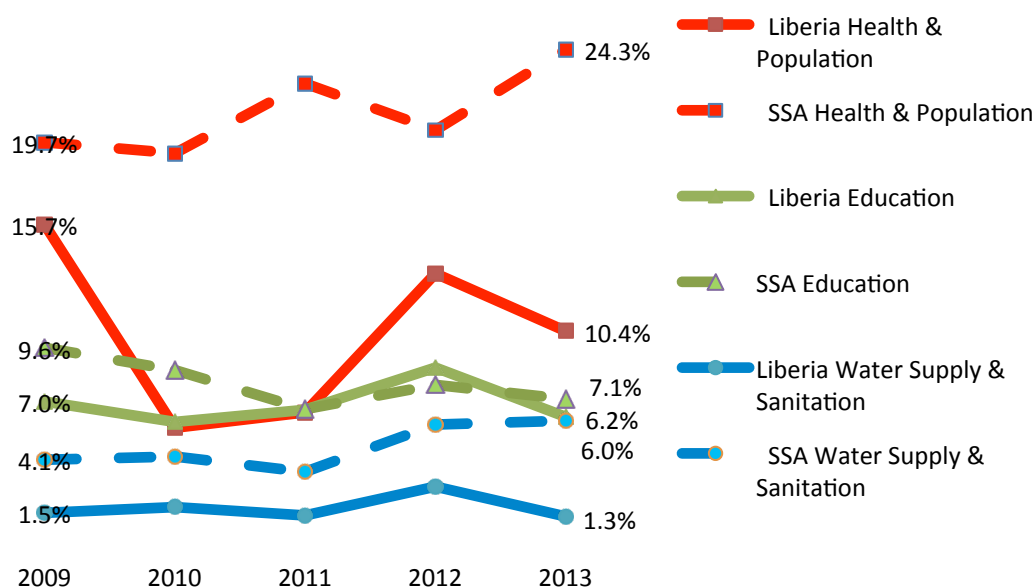
Figure 4. Per Capita Spending on Health, Liberia and Sub-Saharan Africa, 2009–2013 (USD)



Data Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*

Figure 5. Spending on Health as a Percent of Total ODA, Liberia and Sub-Saharan Africa, 2009–2013

Adding water supply and sanitation and education to the graph (Figure 6) illustrates how hugely underfunded each area of social infrastructure and services is in Liberia compared to SSA averages. In particular, the investment in water supply and sanitation is notably small. In 2013, the per capita ODA investment in Liberian water and sanitation was just \$1.42 per person.



Source: OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*

Figure 6. Spending on Health, Education and Water Supply and Sanitation as Percent of Total ODA, Liberia and Sub-Saharan Africa, 2009–2013

According to World Bank data, health expenditure in Liberia is vastly lower than in wealthier countries such as the United States and the UK than global and SSA averages, and second lowest among its neighboring countries (see Table 3).

Table 3. Health expenditure per capita (current US\$ 2013)

Country	Health expenditure per capita
Guinea	25
Liberia	44
Cote d'Ivoire	87
Sierra Leone	96
Sub-Saharan Africa	101
World	1,042
United Kingdom	3,598
Euro area	4,018
United States	9,146

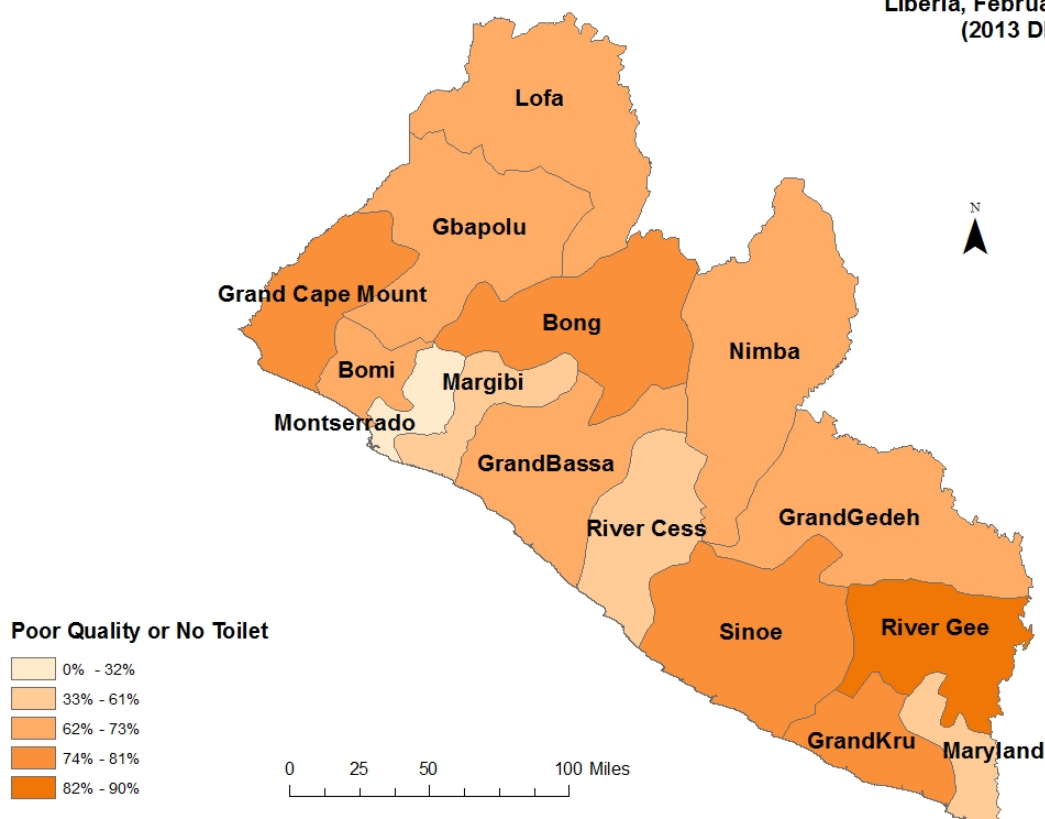
Source: <http://wdi.worldbank.org/table/2.15>

Factors Influencing Effective Use of DAH in Liberia

Factor: Lack of Investment in Water and Sanitation in Liberia

The 2013 Liberian Demographic and Health Survey (DHS) shows that there have been effectively no improvements in sanitation or access to safe water for over a decade. The 1999–2000 DHS showed national access to improved sanitation was only 11%. In 2007, it was 10%, and, in the 2013 DHS, increased only marginally to 17% (26% urban, 5% rural). This translates to millions of people, one-quarter of those living in urban areas and three-quarters of those in rural areas, with *no* toilet or latrine facility. Overall, close to half of the Liberian population, 45% of households, have no toilet facility. Figure 7 shows the proportion of households in each county with inadequate toilet facilities. According to the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, in 2013 almost half, or 48% of Liberians practice open defecation; in 2007 it was a similar 51%.^{xli}

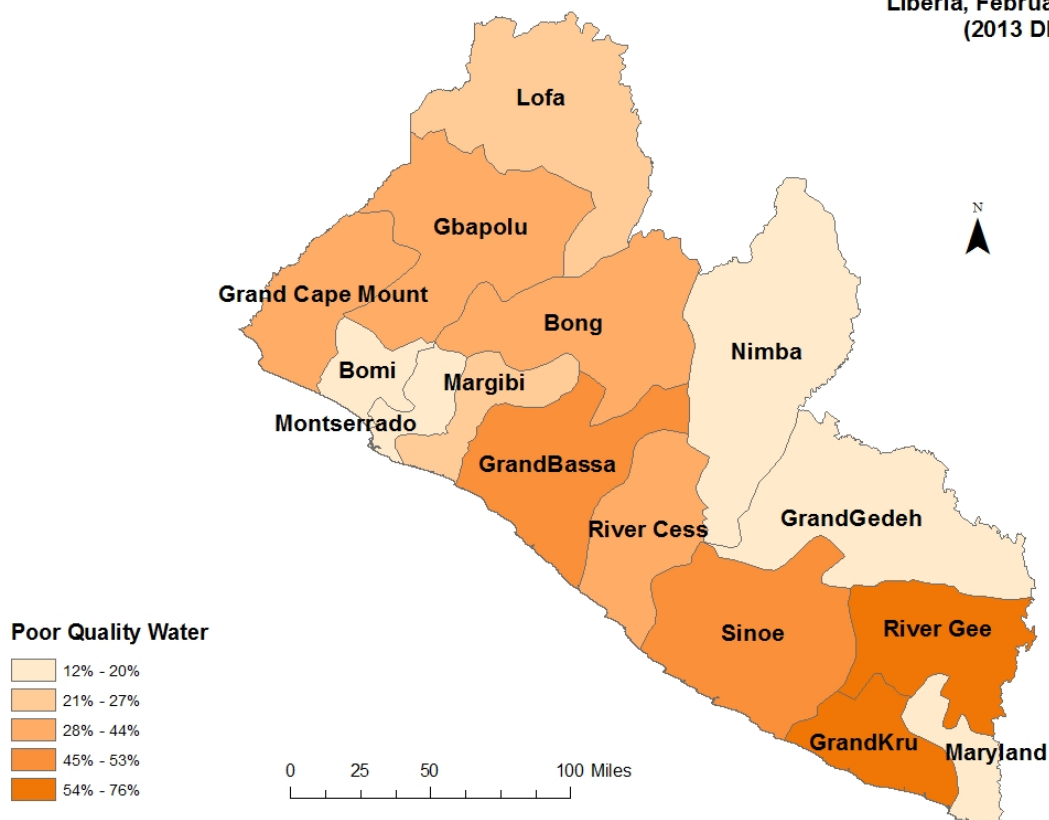
Figure 7. Proportion of Households with Poor Quality or No Toilet, Liberia, February 2015 (2013 DHS data)



The above map illustrates that the majority of Liberian households have limited access to adequate toilet facilities. Overall, close to half of the Liberian population, 45% of households, have no toilet facility, which translates to millions of people--one-quarter of those living in urban areas and three-quarters of those in rural areas--with *no* toilet or latrine facility. Household access to no or poor quality toilet was mapped using natural breaks.

Over a quarter of Liberians do not have access to an improved source of drinking water. Of the approximately 6,370 “fully functional” water points, about one in six households report a perceived water quality problem. One in five rural households get their drinking water from lakes and ponds, and 82% of households do not treat water before drinking. Finally, the 2013 DHS found that only 2% of households had a hand washing place, and of them, 27% had no water, soap, or any other cleansing agent at the hand washing place.^{xlii xliii} See Figure 8.

**Figure 8. Proportion of Households with Poor Quality Water
Liberia, February 2015
(2013 DHS data)**



The above map shows the proportion of Liberian households with poor quality water. Unimproved water is one of the leading health risk factors in Liberia. Household access to poor quality toilet was mapped using natural breaks.

Factor: Lack of Funding for Prevention

Liberia's first National Health Accounts (NHA) estimation was conducted in 2007/2008. The purpose of the NHA is to detail the flow of funding from financial sources (e.g., donors, Ministry of Finance [MOF]), to financing agents (i.e., those who manage the funds, such as the MOH or NGOs), to providers (e.g., public and private facilities) and finally to end uses (e.g., inpatient and outpatient care, pharmaceuticals). The NHA is intended to facilitate an assessment of how well resources are targeted to

health system goals and priority areas. In 2007/2008, half (45%) of health funds were spent on curative (inpatient and outpatient) health care, but only 34% on prevention and public health programs.^{xliv} In 2009/2010, the proportion spent on curative care increased to 49% and that spent on prevention decreased to 28%.^{11xlv} The first 2007/2008 NHA disaggregated donor funds by health priority area showing that: 44% of the total health expenditure was spent on malaria and of that 69% was for curative services; 14% was spent on child health, again with the majority, 64%, on curative care. Subsequent NHAs have not disaggregated by health focus area.

As a comparison, the United States allocated even less than Liberia, with only 9% of the US national health expenditure for prevention. However, there were 798,398 active physicians in the US in 2010 for 309.3 million people, or 1 doctor for every 387 people, with the majority of doctors being specialists (less than one-third being primary care providers).^{xlvi} In contrast, when Ebola struck in 2014, Liberia only had 50 trained doctors providing services for 4,602,514 people, or 1 doctor for every 92,050 people.^{xlvii}

Priority services are listed in the Liberian Essential Package of Health Services; the vast majority being preventive services that are provided by cadres other than physicians (nurses, registered midwives, trained traditional midwives, etc.). The relative lack of allocation toward prevention is notable considering 11 of the top 25 diseases in Liberia are communicable diseases for which effective preventive and therapeutic options exist. These include, in order of severity: malaria, diarrheal diseases, lower respiratory infections, neonatal sepsis, protein-energy malnutrition, HIV/AIDS, preterm birth

¹¹ According to the WHO Global Health Expenditure database online, in 2010 Liberia allocated even less, or 22% to prevention services (<http://apps.who.int/nha/database>)

complications, meningitis, tuberculosis, neonatal encephalopathy, maternal disorders.

These 11 diseases accounted for 73% of years of life lost in Liberia in 2010.^{xlvi}

Factor: Lack of General Budget Support

Donors finance a significant amount of total health expenditure in Liberia, 82%, making the Liberia's health system vulnerable to donor funding fluctuations.^{xlix} However, general budget support—that allows a country to allocate funds to self-identified versus donor priorities—has only been provided to Liberia since FY2009/10 by the World Bank, the African Development Bank, and the European Union (primarily UK). In FY2010/11, budget support amounted to only about 14% of ODA, while program and project aid represented approximately 86%.^l

In 2009–2010, the largest source of DAH disbursements in Liberia was the USG (providing over one-third, 35%), followed by the UK and the Global Fund, (each accounting for another 13%).^{li} Of the \$89.2 million for health in 2010, Millennium Development Goal 6 (MDG6) (control of HIV/AIDS, TB, and Malaria) accounted for 47% of all disbursements, largely funded by the USG. Health policy and administrative management accounted for 17% of all health disbursements, predominantly funded by the UK.^{lii}

In addition to supporting MDG6, a large portion of DAH in Liberia goes to fund reproductive health and family planning. To some extent, these global funding priorities have paralleled Liberian MOH priorities, which include malaria, reproductive health and child health; representing the majority of disease burden in the country.^{liii liv} However, little budget support has been provided to Liberia that the country could use to address

other health, or sector-wide, resilience-related priorities.

Factor: Lack of Financial Accountability and MOH Budgetary Control

According to the IMF's Public Expenditure and Financial Accountability Assessment between 2007 and 2013, donor practices in Liberia have failed to build capacity in financial accountability, which in turn leads to delays in actual disbursements. Further, annual deviations between estimated direct budget support and actual provision of funds have been substantial; in FY2010/11 it was 33% below, and in FY2011/12, 36% below estimates.^{lv} Such discrepancies between estimated and actual make it challenging to plan and implement activities, and have implications for building the sustainable capacity, or resilience, of the health system.

The central MOH has limited control of its own budget. JSI's 2014 capacity assessment of the MOH at central and county levels, conducted as part of the RBHS project, found that while capacities improved at both the systems level (e.g., monitoring and evaluation, human resources, pre- and in-service training practices), and individual levels (e.g., County Health Teams (CHTs) able to strategically plan based on need and local epidemiology), the funding allocated and stipulated from the Ministry of Finance has specific allocations established down to the county level. Thus, while CHTs may be able to forecast and budget in order to meet their needs, and while the central MOH may compile and submit these requests up the chain to the MOF and Congress, once they receive their allocation it is not only consistently less than requested (often by two-thirds), but also earmarked for distribution regardless of need or local epidemiology.^{lvi} Certain rural areas have a very high prevalence of poverty, whereas others have a very

high absolute number of impoverished persons (e.g., Bong, Lofa, and Nimba). See Figure 9. The allocation of the health budget from the central to county levels is typically not only inadequate, but also inequitably distributed across counties.

Area	Number of Poor	Poverty Headcount (2007 LISGIS)	Share of Population
Greater Monrovia	288,695	49%	22%
Bong, Nimba, Lofa	660,129	68%	36%
Gbarpolu, Bomi, Grand Cape Mount	206,547	76%	10%
Montserrado (outside Monrovia), Margibi	262,678	59%	17%
Grand Gedeh, Sinoe, River Cess	181,713	77%	9%
Grand Kru, Maryland, River Gee	126,044	68%	7%
National	1,725,806	64%	100%

Figure 9. Liberia's Poverty Profile, 2007^{lvii}

And while vertical programs and interventions may ensure their specific activities are carried out, it handicaps the CHTs to implement other, non-vertically-funded activities as needed. Thus, effective capacity to translate inputs (DAH) and outputs (increased worker skills and improved systems) into health outcomes is constrained. The health sector does not operate independent from the rest of the GOL. As such, these challenges, at all levels and across sectors, must be addressed for Liberia to develop a truly transformative and resilient health system.

Disease-Specific Funding and Fragmentation

Money flows (Global Fund, PEPFAR, Gates, etc.) to address priority infectious diseases (HIV/AIDS, TB, malaria, etc.) have brought many benefits including reductions in HIV/AIDS related morbidity and mortality, yet have also shifted attention away from integrated, systems-thinking toward maximizing disease-specific outcomes and regular

donor reporting. Due to weak health information systems, disease-specific interventions have necessitated the establishment of parallel management systems (for HR, supply chain, service delivery, and health information).

Fragmentation leads to inefficient, non-integrated service delivery systems and impacts the sustainability of health outcomes due to, in part, inefficient allocation of resources (time, budget, human resources) and excessive burden on clinical staff. A co-coverage study of eight essential interventions (DTP, BCG, measles, TT, vitamin A, ANC, skilled delivery, safe water supply) in eight countries showed that less than 1% of households had access to all these interventions at the same time.^{lviii} Though integration of services (e.g., HIV and family planning) is often indicated as a priority in donor solicitations, the funding rarely supports substantial, comprehensive integration. Ensuring coverage of the eight essential interventions noted in the study above would not only require integrated services within the health sector, but also multisector approaches that are historically vastly under-funded (multisector programs accounted for just 4% of total ODA in Liberia in 2013).^{lix}

However, fragmentation is not the only influential factor. Developing country health systems, such as that in Liberia, often have limited absorptive (financial) capacity (or ability to translate available resources into effective public investments), inadequate supply of skilled human resources, issues with poorly designed systems, protocols and procedures (i.e., “bureaucratic sclerosis”, or marked system inefficiencies¹²), and corruption.

¹² Dr. Theo Lippeveld described inefficient health system operations as typified by “bureaucratic sclerosis.”

Health System Strengthening

According to WHO, a health system consists of all the actors, institutions and resources that undertake actions (e.g., removing barriers to delivery, use, and quality of care), where the primary intent is to promote, restore or maintain population health. This is done through interrelated inputs, processes, outputs and outcomes (e.g., ensuring that the financial burden of paying for health is fairly distributed across households; that services are responsive to client needs and culture), ultimately improving or maintaining health. According to WHO's Alliance for Health Policy and Systems Research, the four vital functions of health systems are:

- (1) *Stewardship*: government oversight inclusive of defining the vision and direction of health policy, exerting influence through regulation, and collecting and using key data.
- (2) *Resource generation*: encompassing critical inputs such as human resources, physical capital, and drugs and medical supplies;
- (3) *Service provision*: including formal and informal, public and private, and includes management of service delivery; and
- (4) *Financing*: including the volume and sources of financial resources available for the health system, including mechanisms for pooling resources and transferring them to service providers.^{lx}

How a Health System Influences Population Health: the Determinants of Health

In order to maintain or improve population health, a health system must influence one or more of the five major determinants of health: genetics, behavior, social (including

economic) circumstances, environmental and physical influences, and medical care.^{lxi lxii}

While no consensus has been established for the relative contribution of various health factors on health outcomes, recent studies have reliably estimated that access to clinical care accounts for no more than one-fifth of health outcomes.^{lxiii lxiv} Figure 10 shows the results from three studies on the estimated relative contribution of health determinants on health outcomes. While each study measured a slightly different set of variables, it is clear across all three that health behaviors is a leading determinant, whereas the clinical care accounts for not more than 10–20% of health outcomes.

While clinical care itself has a smaller impact on health than individual behaviors or social and economic factors, the larger health care sector can also influence these other factors; in particular health behavior. Further, it is possible that in Liberia the physical environment may make up a somewhat higher proportion than the 5–20% estimates presented in Figure 10.

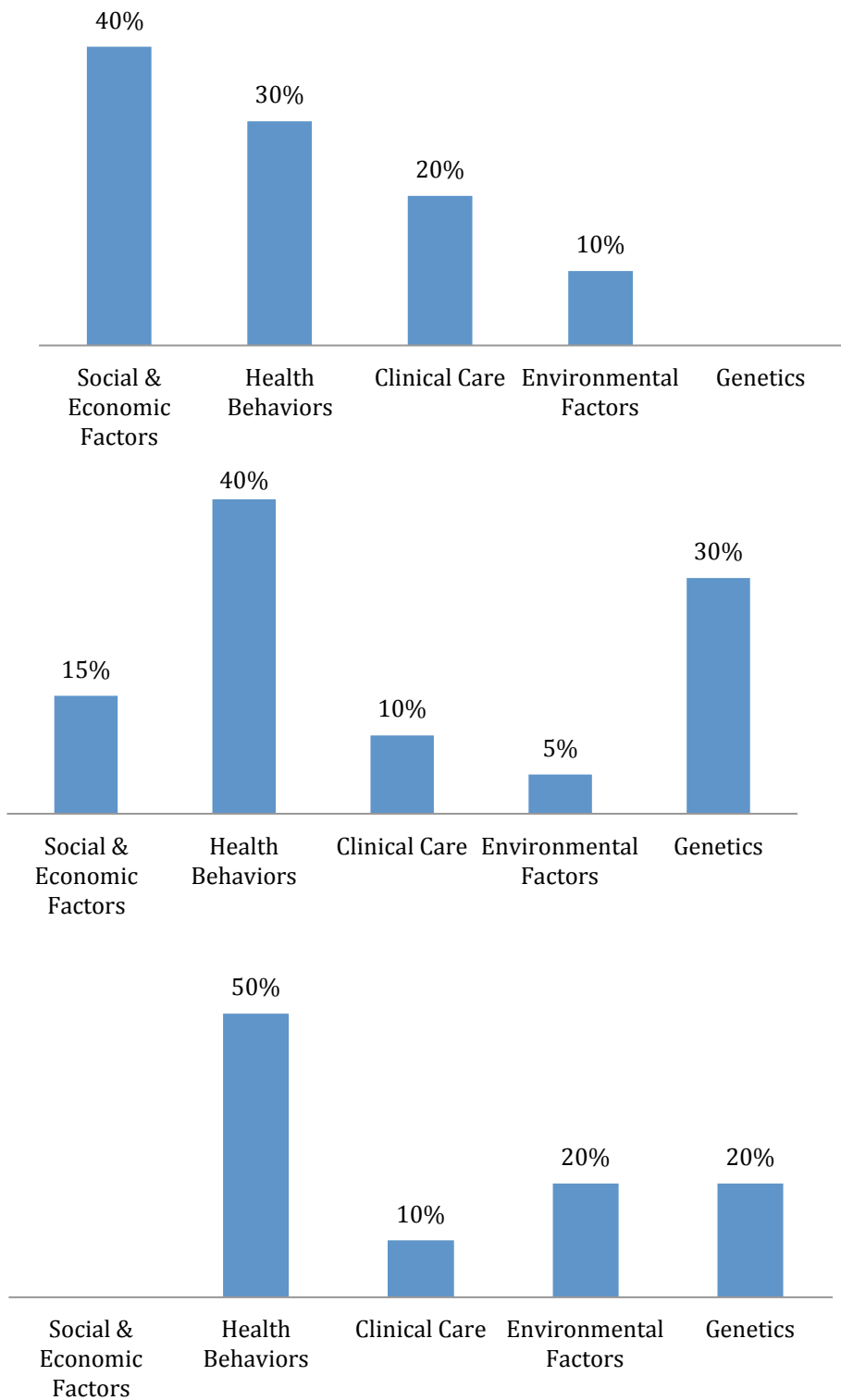


Figure 10. Contribution of Health Determinants on Health Outcomes: Results from Three Studies

Sources, from top to bottom:

- (1) Bridget Booske et al., “County Health Rankings Working Paper Different Perspectives for Assigning Weights to Determinants of Health,” February 2010.
- (2) J. Michael McGinnis, Pamela Williams-Russo, and James R. Knickman, “The Case For More Active Policy Attention To Health Promotion,” *Health Affairs* 21, no. 2 (March 1, 2002): 78–93, doi:10.1377/hlthaff.21.2.78.
- (3) Center for Prevention Services (U.S.) and Health Analysis and Planning for Prevention, *Ten Leading Causes of Death in the United States, 1977*. (Atlanta, Ga.: U.S. Dept. of Health and Human Services, Public Health Service, Center for Disease Control, Bureau of State Services, Health Analysis and Planning for Preventive Services, 1980).

The 2010 Global Burden of Disease study found that of the top 15 risk factors in Liberia, many are directly influenced by the physical environment. Water, sanitation and indoor air pollution account for the majority of diarrheal and lower respiratory infections in Liberia. The risk of diarrheal disease from sub-optimal breastfeeding (e.g., supplementing with bottle feeding in areas with poor water quality) is also strongly associated with environmental factors.^{lxv}

There is vast literature on the significant impact on health outcomes resulting from targeting specific, mostly behavioral health determinants such as smoking cessation or diet and physical exercise.^{lxvi lxxvii lxxviii lxxix} On the other hand, it is widely acknowledged that health behaviors take place within and are heavily influenced by larger social and economic contexts.^{lxx lxxi lxxii} Thus, health behaviors, or any one of the five major determinants, should therefore not be thought to be the sole drivers of health outcomes. Acknowledging this, many studies recommend increased focus on linking HSS activities to health outcomes.^{lxxiii lxxiv lxxv lxxvi lxxvii}

To maximally influence health outcomes, actions must address multiple determinants (quality medical care, health behaviors, social and physical environments),

but also simultaneously address these determinants through all sectors (health, education, government, private/business and NGO). And while it is ideal that all projects would link their actions to impacts beyond the specific disease and sector of interest, it is unrealistic to think that any one project or organization would be able to take on all health determinants and work through all sectors simultaneously. Thus, part of the role of a MOH is to ensure that the largest drivers of health, the primary determinants in a country, are adequately being addressed through the myriad of health-related interventions and programs in the country. As of now Liberia, like many other countries, does not possess this capacity. Similarly, the role of WHO should in part be to encourage holistic, systems-wide approaches to assessing the key health determinants in a country, and to provide tested models for local adaption and implementation.

Management of a Health System

While the government is responsible for all four of the main functions of a health system (stewardship, resource generation, service provision and financing), there are other essential actors. The main actors in a health system include: (1) the government as steward, financing body, health service provider, and for health promotion; (2) NGO sector as health service provider and/or health promotion; (3) in some countries, parastatal health services, such as those operated by corporations solely for the benefit of their employees (e.g., Liberia Firestone), (4) traditional health care providers (e.g., traditional healers, traditional birth attendants); (5) private sector; and (6) patients/clients and the community at large.

According to Theo Lippeveld, Vice President JSI's International Division, a

national health system has specific management functions related to (1) individual care management, (2) health unit management, and (3) health system management.^{lxxviii lxxix}

At the individual care/client management level, the health system:

- Makes curative/preventive case management decisions based on evidence-based standardized guidelines (quality of care);
- Ensures follow-up with patients with chronic disease or risk episodes (continuity of care); and
- Reduces missed opportunities by checking immunization and nutritional status (integrated care)

At the health facility level, the health system has service delivery and administrative functions:

- Provides a standard package of services to target groups in the facility catchment area;
- Ensures quality of care of the services provided;
- Ensures sufficient supplies of essential drugs;
- Ensures financial management of the health facility (adapted to financing mechanisms of the health services); and
- Improves client satisfaction (e.g., reduce waiting times).

At the health system level (e.g., county/district and central levels), the health system is responsible for coordination and management support for delivery of health care services and for public health functions:

- Health legislation and regulation;

- Resource allocation decisions;
- Prevention and control of disease, including emergency response to disease outbreaks;
- Improving access to and utilization of health services and commodities;
- Health promotion and education;
- Providing supportive supervision to the health facilities;
- Managing the health information systems (facility/services, human resources, supply chain, financial, ad hoc studies and population-based surveys, census, etc.); and
- Other public health services such as school health, occupational health, veterinary health services, and public health laboratories.^{lxxx lxxxi}

Collectively, a national health system oversees the four main functions of stewardship, resource generation, financing, and service provision, which includes and necessitates long-term planning and day-to-day management.

Health Systems Constraints to Promoting, Maintaining and Improving Population Health

Global experience shows that while lack of funding is often a major constraint, one cannot expect progress by just pouring money into an ineffective health system. A number of analogies have been made between a functioning health system and a functioning plumbing system.^{lxxxii lxxxiii} Equating water to funding, WHO described a viable health system as follows: “[W]ater cannot be provided to a building simply by filling storage tanks. There must be pipes through which the water can flow and these must not be too narrow, or clogged, or full of holes; there must be valves that direct it to where it is needed; and the system of pipes and valves must extend throughout the

building.”^{xxxiv}

According to WHO, the key constraints to scaling up health services in order to achieve the ultimate objective of a health system—population health—can be categorized into five areas. These areas, along with specific constraints in each, are listed in Table 4.

Table 4. Constraints to Scaling up Health Services

Level of Constraint	Types of Constraint
I. Community and household level	<ul style="list-style-type: none"> ■ Lack of demand for effective interventions ■ Barriers to use of effective interventions: physical, financial, social
II. Health services delivery level	<ul style="list-style-type: none"> ■ Shortage and distribution of appropriately qualified staff ■ Weak technical guidance, program management, and supervision ■ Inadequate drugs and medical supplies ■ Lack of equipment and infrastructure, including labs and communications) and poor accessibility of health services
III. Health sector policy and strategic management level	<ul style="list-style-type: none"> ■ Weak and overly centralized systems for planning and management ■ Weak drug policies and supply system ■ Inadequate regulation of pharmaceutical and private sectors and improper industry practices ■ Lack of inter-sectoral action and partnership for health between government and civil society ■ Weak incentives to use inputs efficiently and respond to user needs and preferences ■ Reliance on donor funding that reduces flexibility and ownership ■ Donor practices that damage country policies
IV. Public policies cutting across sectors	<ul style="list-style-type: none"> ■ Government bureaucracy ■ Poor availability of communication and transport infrastructure
V. Environmental characteristics	<p>A. Governance and overall policy framework</p> <ul style="list-style-type: none"> ■ Corruption, weak government, weak rule of law and enforceability of contracts ■ Political instability and insecurity ■ Low priority attached to social sectors ■ Weak structure for public accountability ■ Lack of free press <p>B. Physical environment</p> <ul style="list-style-type: none"> ■ Climatic and geographic predisposition to disease ■ Physical environment unfavorable to service delivery

Source: Alliance for Health Policy and Systems Research, *Strengthening Health Systems: The Role and Promise of Policy and Systems Research*. (Geneva: Alliance for Health Policy and Systems Research, 2004).

While some countries may face a few of the constraints listed in the above table, Liberia’s National Health and Social Welfare Policy and Plan 2010–2021 outlines health system constraints at each of the five levels.^{lxxxv lxxxvi} In order to sustainably scale up health services in Liberia, health systems strengthening is needed at each level.

What is Health Systems Strengthening?

In June 2009, the Global Fund defined health systems strengthening as “building capacity in critical components of [the] health system to achieve more equitable and sustained improvements across health services and health outcomes.”^{lxxxvii}

WHO lists two definitions of health systems strengthening in their HSS Glossary:^{lxxxviii}

- 1) the process of identifying and implementing the changes in policy and practice in a country’s health system, so that the country can respond better to its health and health system challenges;^{lxxxix} and
- 2) any array of initiatives and strategies that improves one or more of the functions of the health system and that leads to better health through improvements in access, coverage, quality, or efficiency.^{xc}

Frameworks for Assessing the Health System

Over the years, researchers have developed a number of frameworks in an attempt to describe and summarize complex health systems. According to Van Olmen et al., health system frameworks typically attempt to: (1) conceptualize and describe,¹³ (2)

¹³ E.g., health system *functions* (financing, governance, service provision, human resources, medicines and technologies, information), *participants* (households, governments, political leaders

analyze processes and outcomes,¹⁴ or (3) analyze specific aspects of the health system.¹⁵

xcii

As summarized by Shakarishvili, some of the most common health system frameworks include:

- Actors framework (Evans R, 1981)
- Fund flows and payment framework (Hurst J 1991)
- Demand-supply framework (Cassels, 1995)
- Performance framework (WHO, 2000)
- Control knobs framework (Hsiao, 2003)
- Reforms framework (Roberts M, Hsiao W, Berman P, Reich M 2004)
- Public management framework (Khaleghian, Das Gupta, 2004)
- Capacity framework (Mills A, Rasheed F, Tollman S, 2006)
- Building blocks framework (WHO, 2007)
- Essential public health functions framework (PAHO, 2008)
- Systems framework (Atun, 2008)
- Primary Health Care (WHO, 2008).^{xciii}

Hsiao and Siadat further classified major health systems frameworks into descriptive, analytical, and deterministic and predictive categories (see Table 5).

and constituents, private sector, donors, global initiatives, providers), *attributes* (fairness, responsiveness, effectiveness, choice)

¹⁴ E.g., *inputs and processes* (information, drugs, finance, human resources, infrastructure, technology, incentives), *outputs* (volume and distribution of services delivered), *outcomes* (health status improvements)

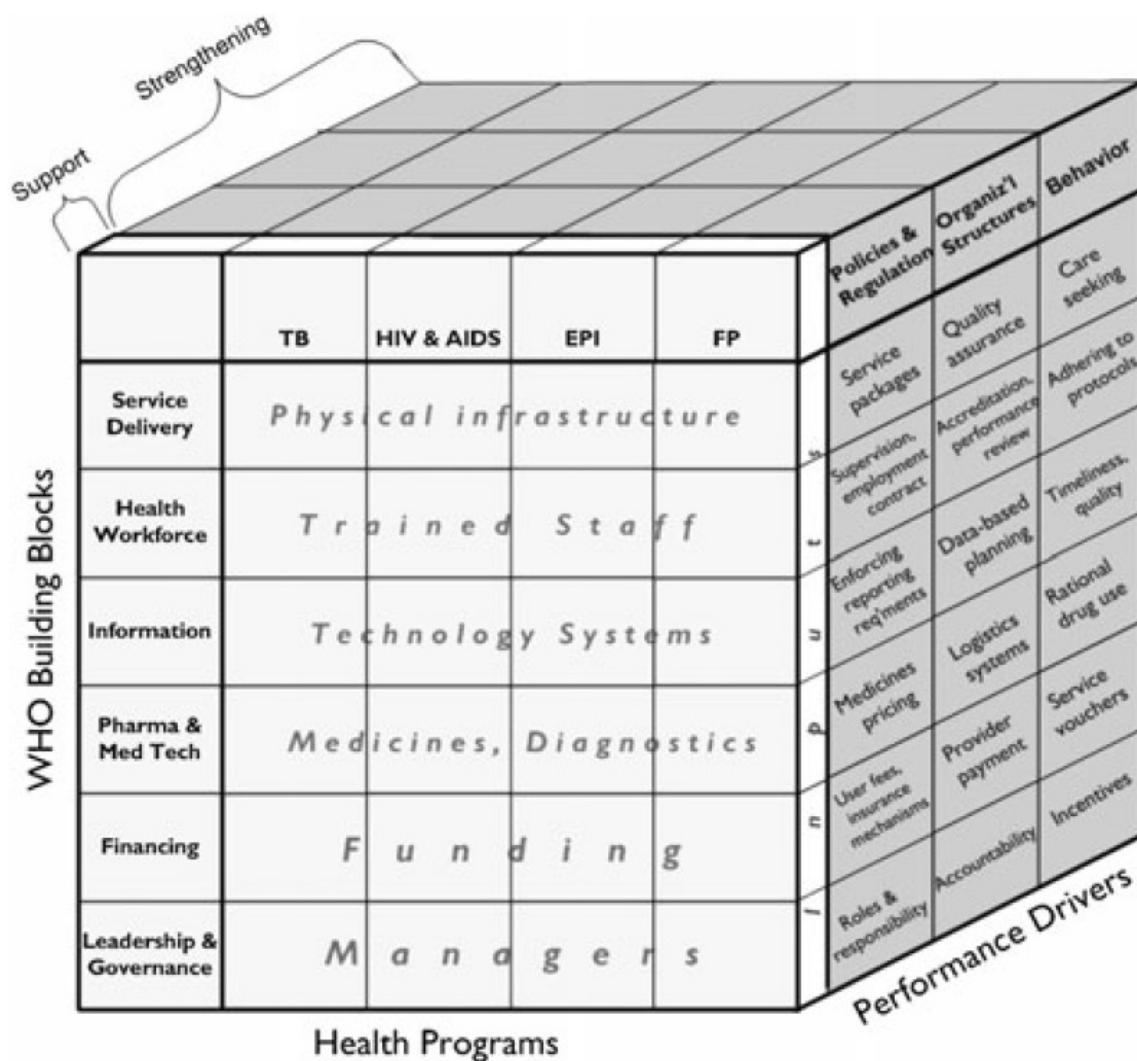
¹⁵ E.g., *levels* (community, local, national, regional, global), *health problems* (TB, HIV, malaria, pneumonia, diarrhea), *beneficiaries* (poor, women, rural, children, sick, chronic patients)

Table 5. Classification of Health Systems Frameworks

Type	Perspective	Researchers / Organizations
Descriptive	Sub-systems	Various
	National	Roemer (1991, 1993) European Observatory (HiTS)
Analytical	Funds Flow	OECD, Hurst (1992) Anell and Willis (2000) Docteur and Oxley (2003)
	Functional	Londono and Frenk (1997) WHO (2000) Mills and Ranson (2001, 2006) The World Bank (2007) The Global Fund (2008)
	Statistical Correlation	Nixon and Ulmann (2006) Anand and Bärnighausen (2004)
Deterministic and predictive	Actuarial models	Office of the Actuary, CMS
	Economic models	Yett, Drabak, Intriligator, et al. (1972) Feldstein-Friedman (1976)
	Macro-policy model	Hsiao (1997) Roberts, et. al. (2003)

Source: George Shakarishvili et al., “Converging Health Systems Frameworks: Towards a Concepts-to-Actions Roadmap for Health Systems Strengthening in Low and Middle Income Countries,” *Global Health Governance* 3, no. 2 (2010), http://www.ghgj.org/Shakarishvili_Converging%20Health%20Systems%20Frameworks.pdf.

Chee et al.’s HSS cube is one attempt at summarizing the array of initiatives and strategies that improves one or more of the functions of the health system. Based on the WHO Building Blocks framework, Chee et al. differentiate between activities that simply support a health system, and those that strengthen the health system in their HSS cube in Figure 11.



Source: Grace Chee et al., “Why Differentiating between Health System Support and Health System Strengthening Is Needed,” *The International Journal of Health Planning and Management* 28, no. 1 (January 2013): 85–94, doi:10.1002/hpm.2122.

Figure 11. Health Systems Support versus Health Systems Strengthening

For each of the six WHO health system building blocks, Chee’s cube identifies performance drivers at the individual/behavioral level, the organizational/health unit level and at the systems level/policies and regulation. The cube is useful in that by linking the WHO building block framework with WHO’s health system management level framework, it identifies specific areas of potential intervention that drive performance at

each management level, thus facilitating both long-term planning and day-to-day management. Examples include actions in each of the six building blocks:

- Strengthened clinical quality assurance and quality improvement;
- Increase the availability and deployment of providers, including community workers;
- Improve the availability and use of high-quality information;
- Reduce stock-outs of essential commodities;
- Reduce financial barriers to essential services; and
- Increase accountability for resources and results.

The history and evolution of health systems frameworks was described by Van Olmen et al., notes that the development of new frameworks “does not reflect a progressive accumulation of insights” but rather is a reflection of the political and economic environments and the paradigms of their authors.^{xciii}

Established frameworks vary from linear (e.g., building blocks) to more interdependent and complex (e.g., systems). What most have in common is an attempt to understand and simplify the complexity of health systems, and to help guide both design of HSS interventions and monitoring and evaluation of those interventions.

WHO Health Systems Building Blocks: From Disease Silos to Building Block Silos

In 2007, WHO published their landmark article on health systems strengthening, *Everybody’s Business: Strengthening Health Systems to Improve Health Outcomes: WHO’s Framework for Action*. Subsequently, like the RBHS project, the majority of HSS program interventions and evaluations reviewed were based on the WHO Health Systems Building Blocks framework, or some modification thereof.^{xciv xcv xcvi} The framework, in

Figure 12, outlines six key building blocks that make up health systems, four functions the health system aims to fulfill related to health services (center), and four overall goals/outcomes.

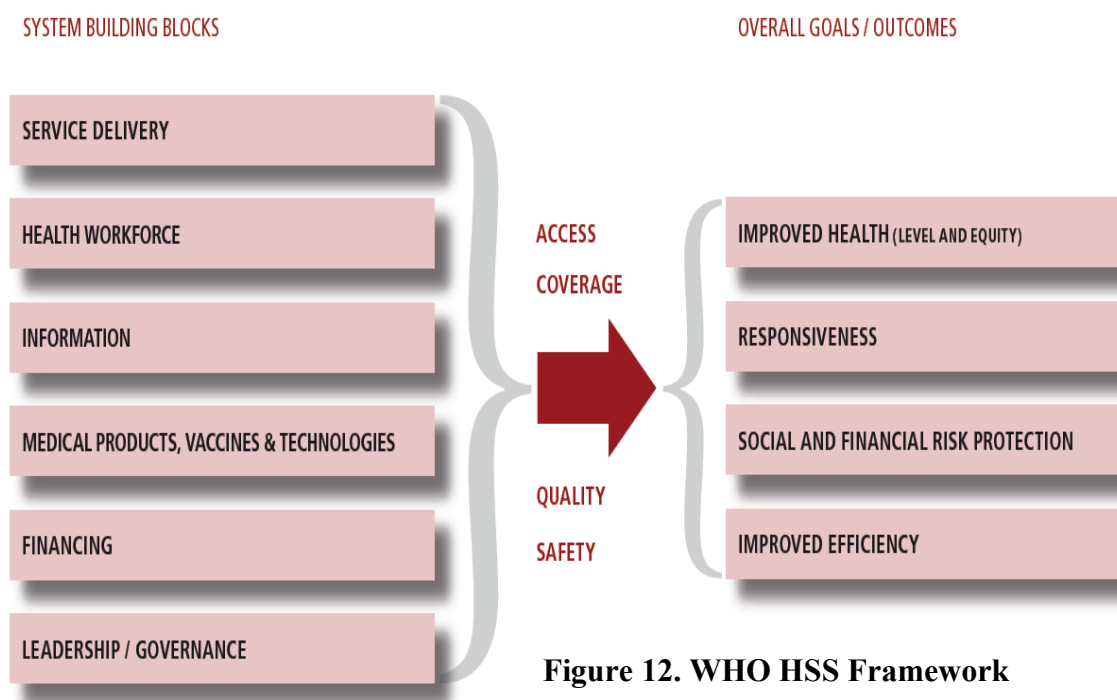


Figure 12. WHO HSS Framework

The widespread use of the building blocks framework may be in part attributable to the adoption of the framework by the USG. Figure 13 shows the USG Global Health Initiative HSS Results Framework that has been agreed on by all USG partners within the Obama administration (e.g., CDC, USAID, DOD, Peace Corps). The framework is based on the WHO building blocks framework, and includes key processes and outputs, four outcomes (financial protection, essential package of health services, population coverage, and responsiveness), leading to sustained system performance and health outcomes.

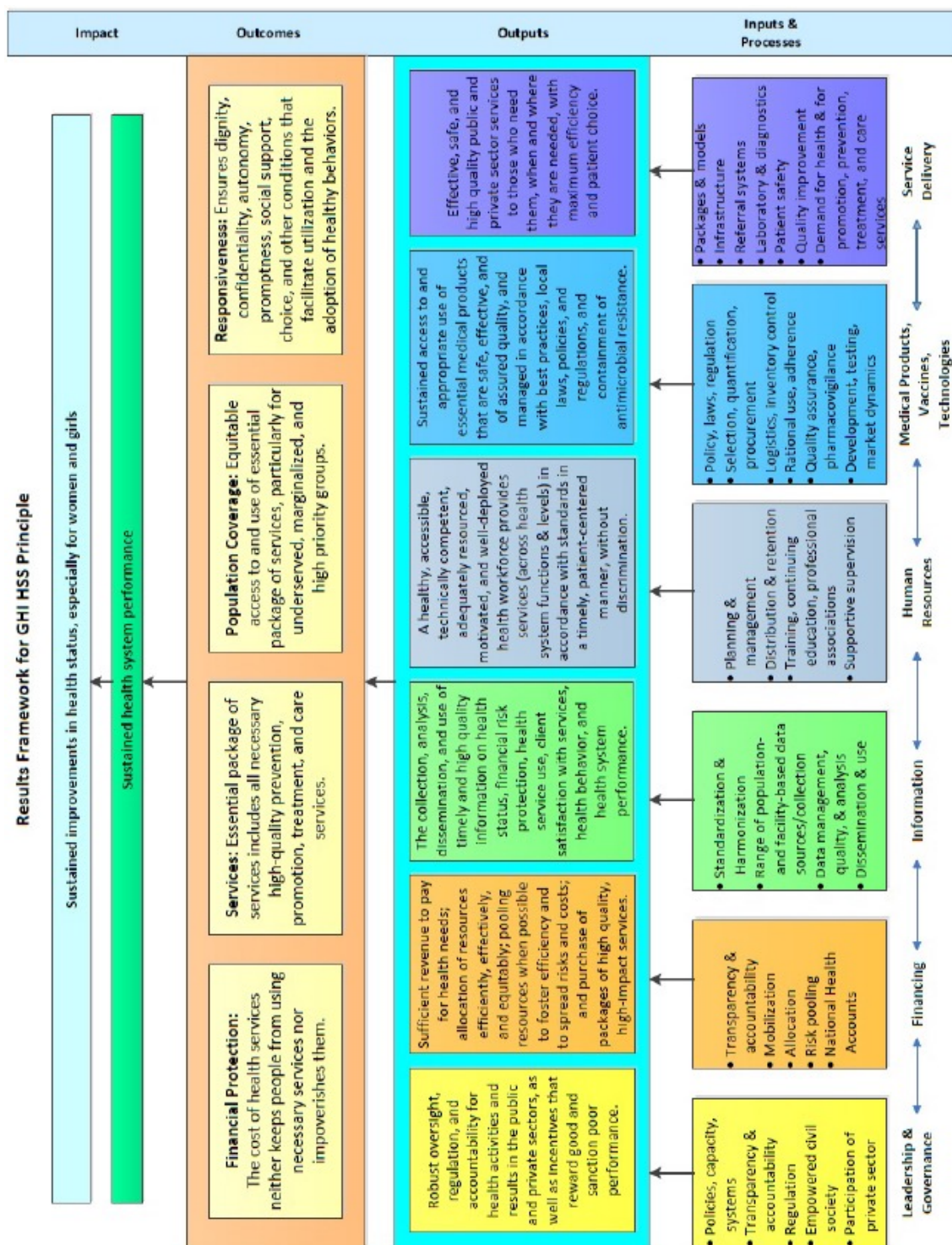


Figure 13. Global Health Initiative HSS Results Framework

Source: “United States Government Global Health Principles Monitoring and Evaluation Resource Guide — MEASURE Evaluation,” Publication, accessed August 18, 2015, <http://www.cpc.unc.edu/measure/publications/ms-14-85>.

“The building blocks approach is a useful means for locating, describing and classifying health system constraints, for identifying where and why investments are needed, what will happen as a result, and by what means the change can be monitored.”

--George Shakarishvili et al., “Converging Health Systems Frameworks: Towards a Concepts-to-Actions Roadmap for Health Systems Strengthening in Low and Middle Income Countries,” *Global Health Governance* 3, no. 2 (2010)

Despite its widespread use, the building blocks framework has been criticized for being too linear, ignoring the complexity and causal loops inherent in a health system. In 2007, WHO defined HSS as “improving these six health system building blocks and managing their interactions in ways that achieve more equitable and sustained improvements across health services and health outcomes. It requires both technical and political knowledge and action.”^{xcvii} At the time, *managing the interactions between and among building blocks* was an explicit objective in the WHO building blocks framework. However, in practice, the systems-wide focus on assessing and managing interactions among building blocks was lost.

The common focus by donors and implementing partners on only one or a few building blocks at a time, and the general lack of addressing the interactions between and among them, is not in line with the original intent of the framework as outlined in WHO’s landmark document.^{xcviii} Nonetheless, the misapplication of the framework is prevalent even within WHO itself.

In 2010, three years after the development of the building block framework, WHO’s *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and their Measurement Strategies*, noted that the building block framework:

“does not address the underlying social and economic determinants of health, such as gender inequities or education, and also does not deal with the substantial and dynamic links and interactions that exist across each component. On the other hand, focusing on these separate components helps put boundaries around this complex construct and permits the identification of indicators and measurement strategies for monitoring progress.”^{xcix}

Thus, it is not surprising that a majority of HSS program interventions and their respective evaluations neglected to measure multiple building blocks nor the interactions among them.

One study found that “out of 106 evaluations, less than half (43%) asked broad research questions to allow for comprehensive assessment...across multiple HS building blocks.” In this same study, only seven of the 106 evaluations reviewed explored impact across multiple building blocks, illustrating the limitations to date of HSS programs, and evaluations of HSS interventions.^c

According to Chee et al., we are now siloing building blocks whereas before it was siloing diseases. Financing is linked to information, and the information being prioritized and collected is linked to commodities or specific sub-components.^{ci}

Resilience

Measuring complexity of health systems includes measuring capacities (at individual, organizational and systems levels), sustainability of capacities, and, as of late, resilience (incorporating the concepts of emergency preparedness). These three related and often elusive terms have each gained in popularity in the health and development

field over the past few decades.

In addition to each being described as both processes and outcomes, they each have multiple (often overlapping) definitions, and a multitude of (often similar) approaches undertaken to increase capacity, sustainability, and resilience at each of the health system levels.^{cii ciii civ} Capacity, sustainability and resilience are all part of a complex-adaptive health system. Each relies on the other, and on consideration of the larger, complex, influential contexts in which they are promoted.^{cv} Further, capacity, sustainability and resilience are each required at each level of the health system: individual, organizational, and systems.

For the purpose of this dissertation, I will primarily focus on the system level, and define capacity as an outcome, sustainability as an attribute of capacity, and resilience as a process that supports sustainable health outcomes and capacities.

Sustainability vs. Resilience

Capacity is defined simply as: “the ability to carry out stated objectives.”^{cvii} According to Dr. Christopher Gill at BUSPH, “capacity is not a fixed construct, but a relative quality whose adequacy depends on one’s objectives.”

At the system level, **sustainable capacity** is achievable through adequate “personnel and economic management, planning systems, logistics, decision-making systems, flow of information, institutional development, creativity and external relations”.^{cvii} In other words, a health system is sustainable when there is adequate capacity in each of the WHO health system building blocks so that they are effectively functioning and interacting. Sustainability is a desired attribute of improved capacities.

While the concept of resilience as applied to health systems has its roots in the crisis and disaster management fields, both sustainability and resilience refer to a system's ability to adapt to shocks (e.g., Ebola) while maintaining basic functioning (e.g., basic health services). However, *sustainability is an attribute; something is either sustainable or it is not. Resilience, on the other hand, is a process; it can increase (or decrease) over time.* Thus, as resilience is enhanced, an entity is better able to mitigate identifiable stresses and shocks, and better able to respond to those that cannot be predicted or avoided. Building resilience in a health system requires: (1) collaboration across disciplines, sectors and organizations; (2) ongoing, iterative learning; and (3) transformational leadership.

Defining Resilience

Resilience is not a new topic. Like systems thinking, resilience research has historically been applied in diverse fields such as biology, engineering, economics and ecology, though has been gaining increased momentum in public health over the past five years.^{cviii} This is evidenced by the fact that USAID, a major international development donor, has incorporated the concept into their most recent mission statement: “We partner to end extreme poverty and promote resilient, democratic societies while advancing our security and prosperity.”^{cix}

There are a multitude of specific resilience definitions corresponding to all the sectors in which the term has been applied. In health, resilience has largely been part of the vernacular in crisis and disaster management, which is reflected in the definitions. Castelden et al. conducted a systematic review of 61 research papers on concepts of

resilience. In doing so, they summarized the main types of resilience relevant to public health protection (see Table 6).

Table 6. Types of Resilience

Type of Resilience	Definition
Disaster resilience	Capability of a community or society to resist and recover from a disaster
Community resilience	Capability (or process) of a community adapting and functioning in the face of disturbance
Ecosystem or social–ecological resilience	Capacity of natural and social systems to absorb disturbance while remaining within the same functional state
Infrastructure resilience	Capacity of built infrastructure to continue functioning during disasters. This might include roads, buildings and bridges
Individual or psychological resilience	Capacity of individuals or groups of people to cope with adversity and continue functioning.
Network resilience	Fault tolerance in a physical network (e.g., communications, water, power systems)
Urban resilience	Capacity of a city/urban area to resist and recover from disturbances
Organizational resilience	Capacity of an organization to resist and recover from disturbances

Source: Matthew Castleden et al., “Resilience Thinking in Health Protection,” *Journal of Public Health (Oxford, England)* 33, no. 3 (September 2011): 369–77, doi:10.1093/pubmed/fdr027.

According to Castleden et al., the relevance of the resilience concept to public health protection is that it focuses on the capacity of public health systems to “cope with broad societal and environmental changes; links between biodiversity and health, and climate change and health.”^{cx}

Common themes emerged from Castleden et al.’s review of definitions of resilience across very different disciplines. These include:

- Communication (including physical telecommunication, organizational communication, and via social networks that promote community cohesion)

- Adaptive capacity
- Risk awareness
- Trust and social cohesion (or social capital)
- Good governance
- Adequate planning and preparation
- Redundancy of critical systems
- Regional economic capacity and economic diversification
- Population's underlying physical and mental health.^{cx1}

For use in social sciences, the above themes have been repackaged by numerous researchers. For example, Speranza et al. define resilience in the context of social-ecological dynamics, simplifying the above aspects into three elements:

- *Buffer capacity*: including understanding of assets (human, natural, financial, social and physical capital) and vulnerabilities;
- *Self-organization*: including institutions, cooperation and networks, network structure, opportunity for self-organization, and reliance on own resources; and
- *Capacity for learning*: knowledge of threats and opportunities, shared societal (collective) vision, commitment to learning, knowledge identification capability, knowledge sharing capability, knowledge transfer capability, and functioning feedback mechanisms.^{cxii}

Grouping many of the above elements into five categories, Kruk et al. define a resilient health system as being:

- *Aware*: possessing an up-to-date asset map highlighting strengths and vulnerabilities;

- *Diverse*: addressing multiple health needs in times of calm (ideally universal health coverage) resulting in enhanced public trust;
- *Self-regulating*: ability to quickly identify threat and target resources to it while minimizing disruption to essential health services, and redundant capacity;
- *Integrated*: including pre-existing legislation that can facilitate rapid reassignment of resources (funds, personnel, etc.) as needed (i.e., adequate planning and preparation, good governance); and
- Having *adaptive capacity*.^{cxiii}

In her book, *The Resilience Dividend: Being Strong in a World Where Things Go Wrong*, Rodin lists the same five elements but explicitly adds ‘*redundant capacities*’, (which Kruk et al. incorporate into the ‘self-regulation’ category). Rodin defines redundant capacity as having explicit lines of command for managing unexpected shocks, and thus being able to target and reassign resources as needed (which Kruk puts into the ‘integration’ category).^{cxiv}

Acquiring knowledge of, communicating information on, and effectively responding to and learning from threats and disruptions is a common theme across all frameworks.

Resilient Health Systems vs. Health Systems with Effective Emergency Preparedness

In addition to there being considerable overlap among the different resilience frameworks, there is also a profound similarity between the definition of resilience and of emergency preparedness.

Public health *emergency preparedness* is: “the capability of the public health and health-care systems, communities, and individuals to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities.”^{cxv}

Similarly, *resilience* is defined as “the capacity of any entity—an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience.”^{cxvi}

Emergency preparedness and resilience are both processes. They both include the notion of a system being able to prepare for, respond to and recover from disruptions. The main difference is in the explicit addition of the concept of adaptability in the resilience definition. While one may argue adaptability is implicit in the emergency preparedness definition; it is explicit in the resilience definition.

It is important to note that in addition to there being significant overlap in definitions of increased resilience and emergency preparedness, there is also overlap in the specific activities that constitute resilience building and emergency preparedness, as well as routine public health practice and system strengthening activities. For example, routine public health activities such as promoting safety and health, reducing the burden of disease, and building social capital can also be viewed as building community resilience. Similarly, public health emergency preparedness, such as strengthening communities to resist health hazards through regular public health communication can be viewed as general community health or systems strengthening activities.^{cxvii}

Core Concepts:

Capacity: the ability to carry out stated objectives. *Capacity is not a fixed construct*, but a relative quality whose adequacy depends on one's objectives.

Sustainability: the ability to adapt to changes and shocks (e.g., Ebola) while maintaining basic functioning (e.g., basic health services). *Sustainability is a desired attribute*; something is either sustainable or it is not.

Emergency preparedness: the capacity to prevent, protect against, quickly respond to, and recover from emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities. *Emergency preparedness is a process*; there can be different levels of emergency preparedness.

Resilience: the capacity to prepare for disruptions, to recover from shocks and stresses, *and to adapt and grow* from a disruptive experience. *Resilience is a process*; there can be different levels of resilience. Resilience incorporates the concept of emergency preparedness. For an overall health system to be sustainable, to maintain basic functioning in times of shock, it must have high resilience.

METHODS

Aim and Objectives

This dissertation aims to provide evidence to the GOL that will help them build a more resilient health system in the post-Ebola period. To achieve this aim, there are three objectives.

Objective 1: Using the WHO Health System Building Blocks framework, identify the post-war capacity gains in the Liberian health system across each of the six building blocks from 2009–2014.

Objective 2: Document the impact of the 2014–2015 Ebola epidemic on the Liberian health system across each of the six WHO Health System Building Blocks.

Objective 3: Using the WHO-defined key emergency-preparedness components and attributes, assess the extent to which each WHO Health System Building Block incorporated resilience to threats into its structure and function as of 2015, and into current recovery and resilience plans through 2021.

The presence or absence of key WHO-defined emergency-preparedness components and attributes in the Liberian system in 2015, organized according to the six WHO Health System Building Blocks, was compared to current government priorities outlined in the Liberian Investment Plan for Building a Resilient Health System 2015–2021, and the April 2016 draft National Epidemic Preparedness and Response Plan. Identified gaps in necessary resilience components form the basis for recommendations to the Liberian MOH aimed at ensuring a more resilient health system with an increased ability to prepare for, respond to, and adapt from future epidemics and other shocks.

Theoretical Framework

The dissertation is guided by the WHO health systems strengthening framework and the WHO essential health system emergency preparedness components and attributes.

WHO health systems strengthening framework

An underlying premise on which the WHO health systems strengthening framework was built is that all system building block gaps should be addressed simultaneously (see Figure 12 above). This framework was applied to: (1) measure the capacity changes in the health system during the time frame in which the USAID-funded Rebuilding Basic Health Services project was implemented, from 2009–2014; (2) organize the impact of the Ebola epidemic on the health system; and (3) structure the assessment of resilience using the WHO emergency preparedness components and attributes.

WHO Components of Effective Emergency Preparedness Programs

Improving the six WHO health system building blocks theoretically strengthens the internal function of routine health care service provision and management. The building blocks framework does not however incorporate components and attributes within each building block that address emergency preparedness or crisis management in times of non-routine situations. Thus, in addition to applying the WHO building blocks framework, an emergency preparedness framework was applied to assess resilience, allowing for a deeper analysis of the six WHO building block components in light of

health system resiliency.

To do this, the WHO-defined 16 elements and 51 attributes of effective emergency-preparedness programs was used to assess the current resiliency of the Liberian health system (as of 2015), as well as to guide a review of the Liberian Investment Plan for Building a Resilient Health System 2015–2021 and April 2016 draft National Epidemic Preparedness and Response Plan, thus identifying whether current government priorities address each of the necessary resilience components.^{cxviii cxix cxx cxxi}

Table 7 outlines the WHO-defined key components and essential attributes of strengthened health system emergency preparedness, organized according to the six WHO Health System Building Blocks.

Table 7. WHO Key Components and Essential Attributes of Strengthened Health System Emergency Preparedness*

6 WHO Building Blocks	16 Key components	51 Essential attributes
1. Leadership and governance (BB6) *	1.1 Legal framework for national multi-sectoral emergency management	1. Laws, policies, plans and procedures relevant to national multi-sectoral emergency management 2. National structure for multi-sectoral emergency management and coordination
	1.2 Legal framework for health-sector emergency management	3. Laws, policies, plans and procedures relevant to health-sector emergency management 4. Structure for health-sector emergency management and coordination 5. Regulation of external health-related emergency assistance
	1.3 National institutional framework for multi-sectoral emergency management	6. National committee for multi-sectoral emergency management 7. National operational entity for multi-sectoral emergency management
	1.4 National institutional	8. National committee for health-sector emergency management

	framework for health-sector emergency management	9. National operational entity for health-sector emergency management 10. Mechanisms of coordination and partnership-building
	1.5 Components of national programme on health-sector emergency management	11. National health-sector program on risk reduction 12. Multi-sectoral and health-sector programs on emergency preparedness 13. National health-sector plan for emergency response and recovery 14. Research and evidence base
2. Health workforce	2.1 Human resources for health-sector emergency management	15. Development of human resources 16. Training and education
3. Medical products, vaccines and technology	3.1 Medical supplies and equipment for emergency-response operations	17. Medical equipment and supplies for prehospital and hospital (including temporary health facilities) activities and other public health interventions 18. Pharmaceutical services 19. Laboratory services 20. Blood services
4. Health information	4.1 Information-management systems for risk-reduction and emergency preparedness programs	21. Information system for risk assessment and emergency preparedness planning 22. National health information system 23. National and international information-sharing 24. Surveillance systems
	4.2 Information-management systems for emergency response and recovery	25. Rapid health-needs assessment 26. Multi-sectoral initial rapid assessment (IRA) 27. Emergency reporting system
	4.3 Risk communication	28. Strategies for risk communication with the public and the media 29. Strategies for risk communication with staff involved in emergency operations
5. Health financing	5.1 National and subnational strategies for financing health-sector emergency management	30. Multi-sectoral mechanisms of financing emergency preparedness and management 31. Health-sector financing mechanisms

6. Service delivery (BB1) *	6.1 Response capacity and capability	32. Subnational health-sector emergency-response plans 33. Surge capacity for subnational health-sector response 34. Management of prehospital medical operations 35. Management of situations involving mass-fatality and missing persons
	6.2 EMS system and mass-casualty management	36. Capacity for mass-casualty management
	6.3 Management of hospitals in mass casualty incidents	37. Hospital emergency-preparedness program 38. Hospital plans for emergency response and recovery
	6.4 Continuity of essential health programs and services	39. Continuous delivery of essential health and hospital services 40. Prevention and control of communicable diseases and immunization 41. Mother-and-child health care and reproductive health 42. Mental health and psychosocial support 43. Environmental health 44. Chronic and non-communicable diseases 45. Nutrition and food safety 46. Primary health care 47. Health services for displaced populations
	6.5 Logistics and operational support functions in emergencies	48. Emergency telecommunications 49. Temporary health facilities 50. Logistics 51. Service-delivery support function

*Note: The WHO Emergency Preparedness Framework swaps the number of the building blocks so that Leadership and Governance is Building Block 1 and Health Services is Building Block 6; this is opposite in the WHO Building Block framework. In this dissertation, I use the WHO Building Block Framework designations: Building Block 1 always refers to Health Services provision and Building Block 6 always refers to Governance and Leadership

Source: Strengthening Health-System Emergency Preparedness (Copenhagen: World Health Organization, Regional Office for Europe, 2012).

Study Design

The dissertation uses an intrinsic case study methodology that is explanatory in nature, with the primary intent to better understand the Liberian health system (i.e., the case), while seeking to explain how it could fail after years of noted health systems

improvements. According to Stake, case studies can be intrinsic (to better understand the case), instrumental (to understand some abstract construct or build theory), or collective (to explore differences within or between cases).^{cxix} Yin further delineates case studies as exploratory (when intervention being evaluated has no clear set of outcomes), or explanatory (seeking to explain presumed causal links in real-life interventions that are too complex for experimental strategies).^{cxix} The methodology allows for an in-depth assessment of how HSS (using the WHO health system building blocks) and resilience factors (using the WHO-defined key aspects of emergency preparedness) exist (or could exist) within the Liberian institutional and cultural context, and for tentative conclusions to be drawn about the importance of system factors to building specific health system capacities and overall health system resilience.

Data Methods

Methods applied as part of the case study include document and literature review, review of health facility statistics, and key informant and group interviews at the county and national levels.

The literature review above provides an overview of historic donor funding priorities, commonly accepted and promoted HSS interventions, and a summary of research on resilience. This is followed by: (Objective 1) an analysis of the process and associated outcomes of Liberian HSS activities between 2009 and 2014 according to the WHO HSS framework (using RBHS project, DHS, and Liberian HMIS data); (Objective 2) documentation of the impact of Ebola on the health system according to the WHO HSS framework (via literature review and using Liberian HMIS data and WHO and

MOH Ebola Situation Reports); and (Objective 3) a re-analysis of health system capacities through a resilience lens using WHO-defined critical components of emergency preparedness.

Corresponding descriptive health statistics and indicators of health system functioning over time were produced and mapped. Mapping was used to help visualize basic health, social and economic aspects of Liberia, and relationships, patterns and trends in data related to the three objectives. Using ArcGIS 10.3, spatial data was manipulated and analyzed to develop maps using DHS, HMIS and GOL data, and WHO and MOH Ebola Situation Report data.

Objective 1: Using the WHO Health System Building Blocks framework, identify the post-war capacity gains in the Liberian health system across each of the six building blocks from 2009–2014

The findings for Objective 1 were derived from data obtained for the RBHS project, DHS data, and Liberian health facility statistics (HMIS data). A detailed qualitative description of health system capacities according to each WHO HSS building block was completed. All qualitative data on the health system capacity were collected prior to the rapid escalation of the Ebola epidemic in July 2014.

Using quantitative HMIS data from 2009–2015, counties with over 100 Ebola cases throughout the epidemic were grouped and included in the analysis. This consisted of six of Liberia's 15 counties: Bomi, Bong, Lofa, Margibi, Montserrado, and Nimba. Data from the same three months (August, September, October) for each of the seven years was compared. This allowed for a comparison of health and system indicators over

the course of the two phases of the RBHS project (when it oversaw direct service provision 2009–2012, and when MOH took over direct service provision in 2013), during the Ebola epidemic in 2014, and into the post-Ebola period in 2015.

Indicators that were graphed as part of the analysis for Objective 1 and Objective 2 include:

(1) Health outcomes:

- Maternal health: skilled deliveries, ANC4, IPT2, couple-years of protection (CYP)
- Child health: penta3, measles
- Malaria: Artemisinin-based combination therapy (ACT) usage <5 years of age, RDT usage <5 years of age

(2) Health system indicators:

- Health services provision: HCT, OPD services

(3) Ebola cases.

A detailed description of the data sources, as well as of the RBHS project from which the qualitative data for this objective are derived, are described in the following section.

Objective 2: Document the impact of the 2014–2015 Ebola epidemic on the Liberian health system across each of the six WHO Health System Building Blocks

The analysis of the impact of the Ebola epidemic on the health system begins with an overview of the 2014–2015 West Africa Ebola outbreak, summarized in the Findings Overview section. The specific impact of Ebola on each health system component is included in the detailed findings for each WHO building block in order to document

which capacities identified under Objective 1 withstood the public health emergency, and which did not. Liberian HMIS data and WHO and MOH Ebola Situation Report data were used to produce maps and time-series graphs (described above) showing changes in key health service provision and health system indicators before, during, and after the peak in the Ebola epidemic. Maps of Ebola case fatality rates and population density were overlaid with cumulative Ebola cases, visually showing correlation between the variables. Additional maps showing key social and economic conditions were produced and included in Annex 1.

Objective 3: Using the WHO-defined key emergency-preparedness components and attributes, assess the extent to which each WHO Health System Building Block incorporated resilience to threats into its structure and function as of 2015, and into current recovery and resilience plans through 2021.

Using the WHO Health System Building Blocks to organize the analysis of the health system as of 2015, the presence or absence of 16 WHO-defined emergency-preparedness key components and 51 key attributes was assessed. This was done by ranking each attribute as existing/functioning, partly existing/planned, or non-existent. To fill gaps in existing data and confirm scores, additional data were collected from Liberian MOH and international NGO key informants who are members of the Epidemic Preparedness and Response (EPR) Consortium. The EPR Consortium is currently funded by OFDA, and will be absorbed into the MOH Division of Disease Prevention and Control once the current Incident Management System (IMS) is deactivated in December 2016.

Findings were then compared to current government priorities outlined in the Liberian Investment Plan for Building a Resilient Health System 2015–2021, and in the April 2016 draft Epidemic Preparedness and Response Plan. Identified shortcomings in necessary resilience components form the basis for recommendations to the Liberian MOH aimed at ensuring a more resilient health system with an increased ability to prepare for, respond to, and adapt from future epidemics and other shocks.

Table 8 summarizes for each of the three objectives the data sources, analysis methods, timeframe, geographical scope, software used and guiding framework.

Table 8. Data Analysis Summary

Objective	Data Sources	Method ¹	Timing of Collection	Geographic Scope	Analytic Software	Guiding Framework
Objective 1 Using the WHO HSS Building Blocks framework, identify the post-war capacity gains in the Liberian health system	DHS	Re-analysis	2007, 2013	All 15 counties; 5 regions	Microsoft Excel	WHO Building Blocks
	DHIS2 (HMIS) data	Re-analysis	2009–2013	All 15 counties	Microsoft Excel, ArcGIS 10.3	
	RBHS Mid-term evaluation and Performance Based Contractor (PBC) data	KII, group interview, document review	2011	Central MOH; Bomi, Bong, Grand Cape Mount, Lofa, Montserrado, Nimba, River Gee	Microsoft Excel, Word	
	Capacity assessments	KII, group interview, scoring and ranking, document review	2012, 2014	Central MOH; Bong, Lofa, Nimba counties	Microsoft Excel, Word	
	PRISM	KII, group interview, document review	2012, 2014	Central MOH; Bong, Lofa, Nimba	Microsoft Excel, Word	

Objective 2 Document the impact of the Ebola epidemic on the Liberian health system	Literature review; MOH documents	Document review	n/a	National	Microsoft Word	
	DHIS2 (HMIS) data	Re-analysis	2014–2015	All 15 counties	Microsoft Excel, ArcGIS 10.3	WHO Building Blocks
	WHO / MOH Ebola Situation Reports	Document review	May 29, 2014 –Nov 2015	All 15 counties	Microsoft Excel, ArcGIS 10.3	
Objective 3: Liberian resilience gaps and government priorities	MOH Investment Plan 2015–2021; Epidemic Preparedness & Response Plan April 2016	Document review	2014–2015	National	Microsoft Word	WHO Building Blocks, WHO Emergency Preparedness Key Concepts and Attributes

¹ KII=key informant interviews

Data Sources

The dissertation draws upon vast qualitative and quantitative data from the following sources: RBHS project data and assessments (2011 RBHS mid-term review, 2012 and 2014 Performance of Routine Information Systems Management (PRISM) assessments, 2012 and 2014 MOH capacity assessments); routine service statistics obtained through Liberia’s HMIS; Liberia (MOH and WHO) Ebola situation reports; Liberia Investment Plan for Building a Resilient Health System 2015–2021; April 2016 draft Epidemic Preparedness and Response Plan; 2007 and 2013 DHS reports and datasets; and publicly available geographic information system (GIS) data.

This section begins with an overview of the RBHS project, geographical scope, capacity development process, and evaluation tools and methods to help document the

context from which qualitative health system capacity data used for this dissertation were obtained. This is followed by a detailed description of each project and non-project data source that was used as part of this thesis.

Rebuilding Basic Health Services (RBHS) Project

The RBHS Project was the USG's key project in support of the Liberian MOH's National Health Plan and Policy, implemented between November 2008 and February 2015. JSI Research and Training Institute, Inc. implemented the project in partnership with three US-based organizations: Jhpiego, Johns Hopkins University Center for Communication Programs (JHU/CCP), and Management Sciences for Health (MSH).

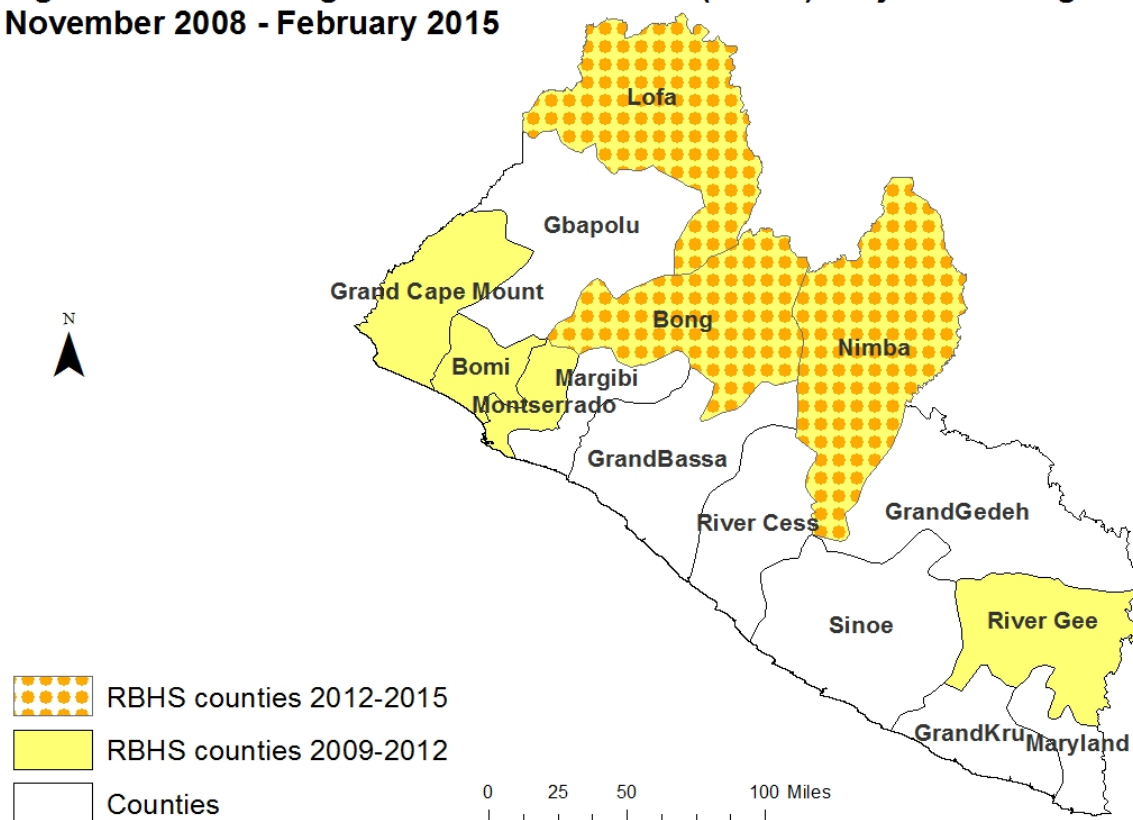
The first three years of RBHS focused on making sure Liberian citizens had increased access to health care services. The MOH had introduced performance-based contracting as a component of its five-year transitional National Health Plan in 2007. To support this, RBHS entered into five performance-based contracts with four international NGOs (and one performance-based grant with a local organization), requiring them to provide a core package of basic health services, covering seven of Liberia's 15 counties. The focus was on shifting the mindset and operating practices of existing health implementing partners (i.e., traditional humanitarian organizations) from relief to development.

In response to USAID's new Global Health Initiative, USAID FORWARD, in September 2011, USAID began providing direct government to government assistance to the MOH through a four-year fixed amount reimbursement agreement (FARA) for up to \$42 million to support the implementation of Liberia's National Health and Social

Welfare Policy and Plan 2011–2021 (NHSWPP). The FARA mechanism replaced the previous arrangement in which USAID funds for service delivery were provided through RBHS. The FARA shifted the focus of RBHS from managing service delivery to strengthening the MOH's capacity and contributing to sustainability by increasing the use of country systems and institutions to implement development assistance programs. The preparation for FARA highlighted capacity-building needs at the central and county levels to enable the MOH to carry out required activities and meet deliverables.

As a result, though the project was measuring clear improvements in project indicators, at about the project half way point, RBHS was reconfigured by USAID to move from direct management of service delivery in seven counties to MOH capacity building and HSS focused on the central MOH and the three USG focus counties: Bong, Lofa and Nimba. RBHS turned over management of the PBCs to the MOH, repackaged as performance based financing (PBF) which created an internal PBF unit in charge of managing the PBC with NGOs. Figure 14 shows the map of RBHS focus counties from 2009–2012, and then from 2012–2015.

Figure 14. Rebuilding Basic Health Services (RBHS) Project Coverage November 2008 - February 2015



This map illustrates RBHS project coverage in the first half of the project, from 2009-2012 and in second half of the project, from mid 2012-2015.

The NSWPP highlighted decentralization as a key policy in which Liberia's CHTs would incrementally increase their responsibility for managing all aspects of county health service delivery. Recognizing the complexity of decentralization challenges and the multi-level solutions necessary to address them, MOH, donors, and partners—including RBHS—expanded their strategies to include county- and central-level capacity-building. RBHS efforts focused on efficient use of investments, HSS according to the WHO six health system building blocks, and performance improvement, thereby leading to better processes and health outcomes. The project focused on simultaneous capacity-

building at three levels: individual, organizational, and system.

The capacity-development process, developed jointly by the MOH and RBHS, was structured to identify causes of performance gaps, address those gaps through a wide array of performance solutions, and enable cyclical processes of continuous performance improvement through the establishment of performance monitoring systems.

The capacity-development process in the second half of the project involved assessing baseline capacity and using findings to create capacity-building strategic and operational plans addressing each of the three levels. In 2012, RBHS conducted a baseline capacity assessment at the central MOH and in Bong, Lofa, and Nimba counties. The baseline assessment identified and prioritized capacity strengths and weaknesses at both the central and county levels according to the six WHO building blocks of a health system.

Based on the assessment results, the MOH prioritized areas to build capacity with technical assistance from RBHS. Following prioritization, a strategic plan was developed to address capacity-building in the priority areas. The strategic plan was implemented with the help of an operational plan, whereby MOH and RBHS jointly identified interventions to build capacity in the priority areas. Figure 15 shows the MOH capacity building framework, around which the second half of RBHS was designed.

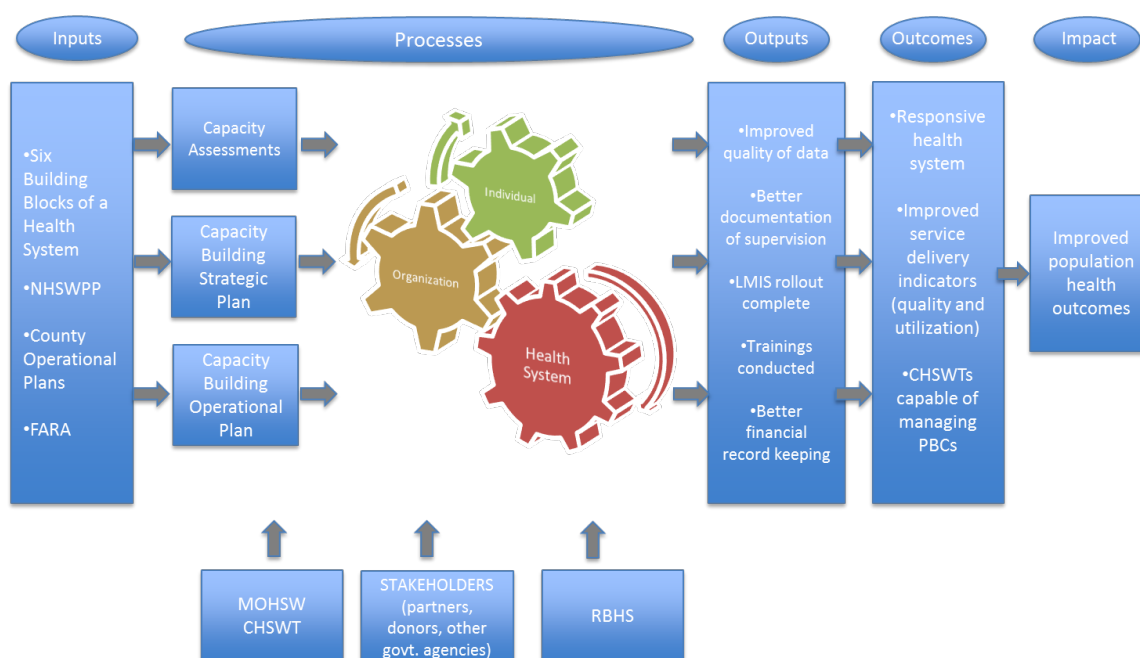


Figure 15. Liberian MOH Capacity Building Framework

I. RBHS Project Data Sources Documenting Health System Capacity

JSI implemented an internal project assessment in mid-2011 that documented changes in health outcomes and health system capacities during the first phase of the project when it was responsible for direct service provision. In 2012, a baseline assessment of the central and county health sector capacities, and a detailed PRISM assessment of the health information system were implemented. In 2014, using the same assessment tools, RBHS conducted end of project capacity assessments. The same mixed methods approach was used for all assessments including review of RBHS project, MOH and USAID documents and key informant and group interviews at the national and county levels with the central and county MOH, pre-service training institutions, and professional boards.

RBHS project data are used in this document to identify capacity changes according to the WHO health system building blocks. These data were supplemented with health service utilization and outcome data based on 2007 and 2013 DHS, and data obtained from Liberia's HMIS from 2009–2015, each described below.

RBHS Project Data: 2011 Mid-term Assessment and PBC Data from 2009–2012

The RBHS project mid-term evaluation, conducted in May 2011, documented system capacity and health outcomes as of project mid-term, following which the scope and focus shifted away from direct health service management to MOH capacity building (see Annex 2 for a list of individuals interviewed in the RBHS mid-term evaluation). This included the collection of data from the performance based contracts with five NGOs providing direct services in seven counties from 2009–2012. Though many of the WHO HSS building blocks were addressed in the first half of the RBHS project, it was not designed specifically to address the building blocks, and thus the mid-term evaluation was organized by USAID intermediate results.

RBHS Project Data: Central and County MOH Capacity Assessments, 2012 and 2014

Corresponding to the RBHS project change in scope, in 2012, a 'baseline' capacity assessment was conducted with the central MOH and CHTs using the WHO's HSS building blocks framework. The initial assessment led to the establishment of a baseline to develop a capacity development action plan across each of the WHO building blocks. In May–June 2014, a follow-up capacity assessment was implemented using the same tools and framework as the one in 2012 (see Annex 3 for a list of individuals

interviewed in the 2012 and 2014 capacity assessments). The tool consisted of a quantitative self-assessment and an interview-administered qualitative component, addressing each of the six HSS building blocks.

RBHS Project Data: PRISM Assessments, 2012 and 2014

Under the RBHS revised project description, the aim of capacity building under *Building Block 3: Health Information Systems* was to improve HMIS performance, defined as: 1) the production of quality data; and 2) use of the information generated for improved decision-making. To measure HMIS performance, RBHS used the Performance of Routine Information System Management (PRISM) tools that are based on the PRISM framework. This framework promotes strengthening HMIS performance through better data quality and improved information use. It looks into not only technical issues related to data generation, but also organizational and behavioral factors that hinder the effective use of information. An initial assessment undertaken in May 2012 led to the establishment of a baseline to develop an HMIS strengthening action plan. A second assessment was undertaken in May 2014.

II. Demographic and Health Survey (DHS) data, 2007 and 2013

DHS data was reviewed for key health outcomes associated with Liberia's essential package of health services for which the RBHS project was responsible. While DHS data in 2013 was collected to be representative at the county level, it was only sampled at the regional level in 2007. Thus, DHS data are only presented at the national level in this thesis.

III. HMIS (DHIS2) data, 2009–2015

The national HMIS collects data from public, and to a very limited extent, private/mission health facilities throughout Liberia. Data include health services provided and outcomes seen and measurable at the facility level. Liberia's HMIS is built upon District Health Information System 2 (DHIS2) software.¹⁶ DHIS2 data are used to document and map health outcomes, service provision and utilization by county over time. HMIS data on health service provision and health outcomes are assessed from 2009–2013 prior to the Ebola outbreak, during the epidemic in 2014, and following the Ebola outbreak in 2015.

IV. Liberia (MOH and WHO) Ebola situation reports, 2014–2015

WHO Ebola Situation Reports (<http://apps.who.int/ebola/en/ebola-situation-reports-archive>) summarize current and cumulative data and information on all of the effected countries in the current West African Ebola outbreak. Data contained in these Situation Reports were derived from the affected country's Ministries of Health. During active transmission, case detection and laboratory confirmation of suspected cases, the statistics between what was reported in the MOH and WHO Situation Reports varied slightly as suspected and probable cases were reclassified as confirmed or not. Over time, however, the two data sources should be equivalent. Both WHO Ebola Situation Reports and Liberian MOH Situation Reports are used as a cross reference.

¹⁶ DHSI2 was developed by HISP, a global south-south-north collaborative network, and is supported by the University of Oslo.

V. *Open Source GIS data*

Data on GPS coordinates for Liberian health facilities and geographic boundaries were obtained from the following sources:

- USAID-funded DHS Spatial Repository (<http://spatialdata.dhsprogram.com/data/#/>)
- Tech4Relief: Pushing Humanitarian Relief Head-First into the Tech Age (<http://www.tech4relief.com/gis>)
- Humanitarian Data Exchange (https://data.hdx.rwlab.org/dataset?q=ebola&sort=metadata_modified+desc&page=2)
- Open Humanitarian Data Repository (http://ohdr.nethope.opendata.arcgis.com/datasets?q=Liberia&page=5&sort_by=relevance)

Figure 16 shows the timeline of key events and data collection of sources used for this dissertation.

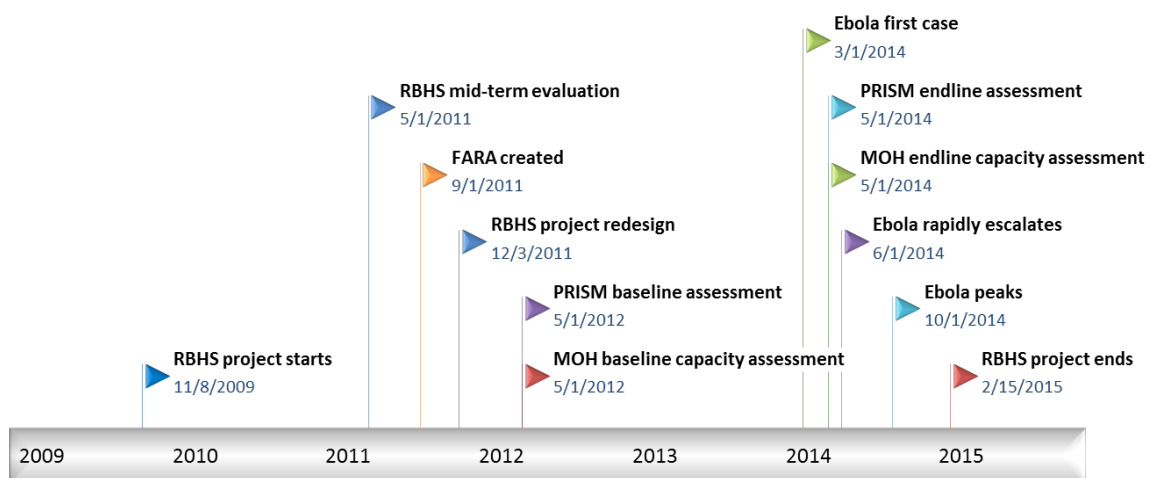


Figure 16. Timeline of key events

The researcher and author, Ms. Deirdre Rogers, was directly involved in the design and implementation of the RBHS mid-term review and MOH capacity assessments, collected as part of the RBHS project evaluation through key informant interviews and stakeholder group interviews. The available data and the author's existing familiarity with the RBHS project and Liberia provide a unique opportunity to address poorly understood questions about the intersection between activities designed to strengthen health systems and those that build resilience.

FINDINGS OVERVIEW

2008 Mindset Shift:

From Humanitarian Assistance to Development, RBHS 2008–2012

Following the prolonged civil war, the country was entrenched in a humanitarian response with international organizations implementing all basic health services and reporting directly to their organizational headquarters, totally independent of the weak MOH. Paralleling this were significant disease-specific funding streams into Liberia. This resulted in a myriad of vertical programming and associated fragmented systems intended to increase the likelihood of short-term outcomes but at the expense of building sustainable capacity within the national health system. In late 2008, the GOL and donors were transitioning from a humanitarian to a development model, and the RBHS project commenced in part with the goal of helping with this transition.

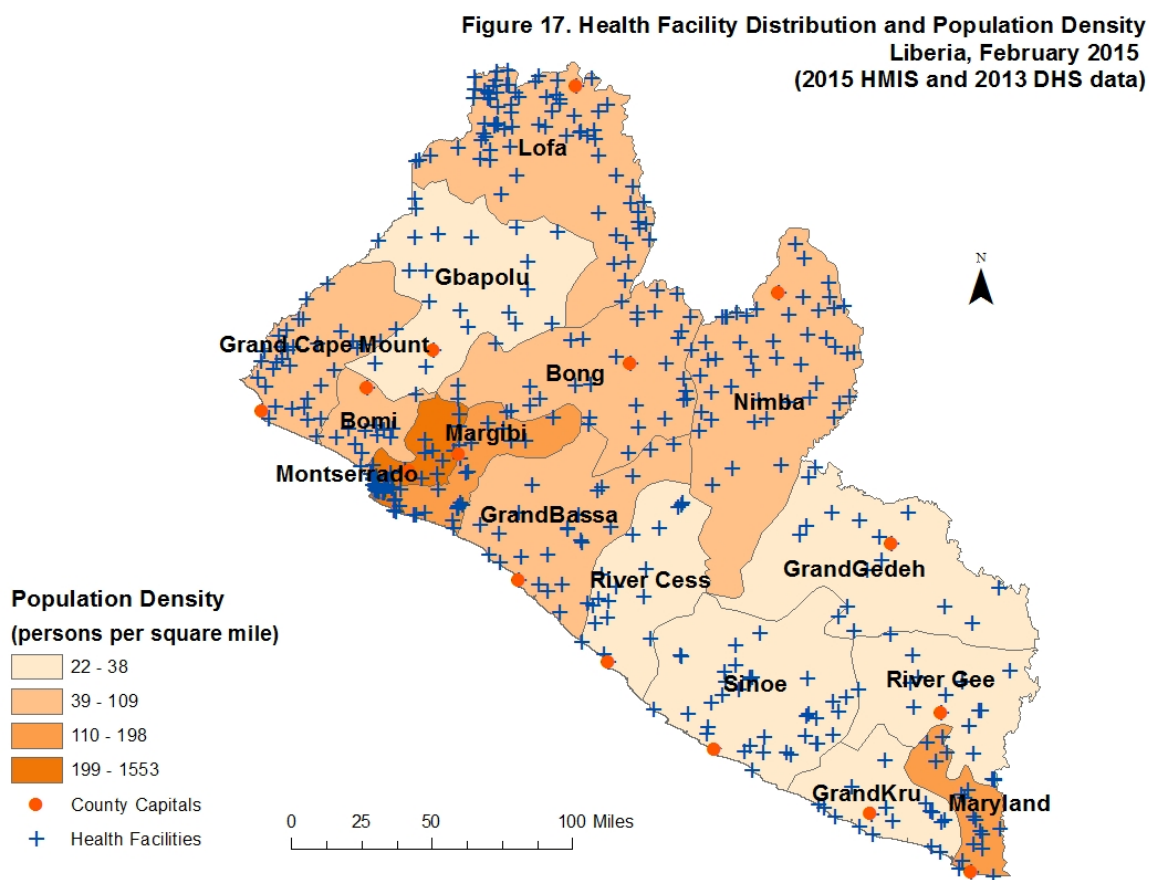
RBHS took a health systems strengthening approach to deliver capacity-building services based on the WHO six health system building blocks. The theory was that building capacity—at the individual, organizational, and system levels—within each of these six building blocks would contribute to strengthening the entire health system. The design acknowledged the dynamic linkages between the building blocks as well as the three levels, and that changes in one area influence other areas. The intent was thus to address each level and building block simultaneously—either directly through RBHS project activities or through other complementary activities undertaken by other implementing partners and projects. In addition to the six building blocks, the capacity-building framework (see figure 15) was in alignment with the National Health Policy and

Plan, and driven by the county operational plans and the USG's FARA funding mechanism.

The interventions and technical areas listed at the beginning of each building block section below were designed to address capacity gaps and their root causes agreed upon between RBHS staff and Central and County-level MOH staff. RBHS project interventions provided extensive training and mentorship of MOH staff at both the national and county levels with the aim of promoting sustainability by also strengthening systems and processes, i.e., ensuring gains were not personnel dependent.

In the first half of the project, between 2009 and 2012, RBHS: (1) directly managed NGO contracts to provide a basic package of health services in 118 health facilities in seven counties or Bong, Lofa, Nimba, River Gee, Grand Cape Mount, Bomi and Montserrado (see Figure 17 for a map of Liberian health facilities by county); (2) conducted BCC campaigns on malaria prevention, early diagnosis and treatment, and on maternal and child health topics; (3) implemented community mobilization efforts through general Community Health Volunteers (gCHVs) and trained traditional midwives; and (4) completed facility infrastructure improvements—all related to *building block 1, delivering health services*. RBHS also (5) built the capacity of pre-service health training institutions, updating and standardizing curricula of existing and new cadres of staff (*building block 2, health workforce*); and (6) supported the MOH to design and operationalize the country's HMIS using open-source DHIS2 software (*building block 3, health information systems*). While RBHS procures drugs and commodities for the RBHS-supported facilities under the PBCs from 2009–2012, another JSI project,

USAID|DELIVER was responsible for capacity strengthening of Liberia's national supply chain (*building block 4, access to essential medicines*).



The above map shows the distribution of health facilities in Liberia against population density. Due to a lack of available data, the map does not show variances in capacity and service availability at each facility. Further, during Ebola, an estimated 50% of all health facilities closed, though obtaining reliable data on specific facility closures was not possible. Population density was mapped using natural breaks.

As will be discussed in more detail under the findings for building block 1 below, performance-based contractor data and findings from the 2011 RBHS project mid-term review showed that during the first half of the project there was increased access to and use of health services, and significant associated health outcome improvements in the seven RBHS-focus counties.

General Health System Capacity Findings from 2009–2014

Following the restructuring of the project in 2012, RBHS shifted its focus from primarily a direct service management project in five counties (plus additional services in two more) to primarily a capacity development project working with the central MOH and three target counties. The project handed over direct management of PBCs to the MOH and supported them in this effort at the Central level to create and operationalize a PBF Unit through an embedded staff member (*building block 6, governance and leadership*). Other support was given at the policy level related to human workforce management and support for pre-service education (*building block 2, health workforce*), identifying tailored health financing options (*building block 5, health financing*), health information strengthening (*building block 3*), and BCC. Thus the focus on various health system building blocks, and the activities to address each, varied over time. Consistent activities throughout the project included pre-service education efforts, support of the health information system, infrastructure, and BCC activities at the national level.

The same capacity assessment tools that measured the new project baseline in 2012 (both building blocks and PRISM assessments) were used to assess capacity improvements in the endline assessment in 2014. The assessments employed a mix of quantitative and qualitative measures, and assessed utilization rates; quality of care; supervision health workforce motivation; supply management; quality of health information data; facility infrastructure; and community involvement.

Each of the project evaluation tools—sub-contractor data, the mid-term review, and capacity and PRISM assessments—show that the MOH recognized RBHS’

contributions in improving capacity at three levels: at the systems level through the development of policies and operationalization of an HMIS, at the institutional level through the placement of staff in key positions and through training opportunities, and at the individual level through both in-country and international training opportunities.

Endline capacity assessment data from 2014 suggest that systems strengthening and decentralization has resulted in greater accountability among health sector workforce, at all levels, who have shown increased commitment to realizing “the efficient and effective delivery of comprehensive, quality health and social welfare services that are equitable, accessible and sustainable for all people in Liberia.”^{cxix} In spite of the constraints facing the health sector (e.g., over-reliance on donors, budgets well below needs), capacity gains were noteworthy across all six building blocks between 2012 and 2014; though capacity remained uneven within the divisions and units of the MOH, and across the three CHTs that RBHS shifted to focus attention on in the second half of the project.^{cxx}

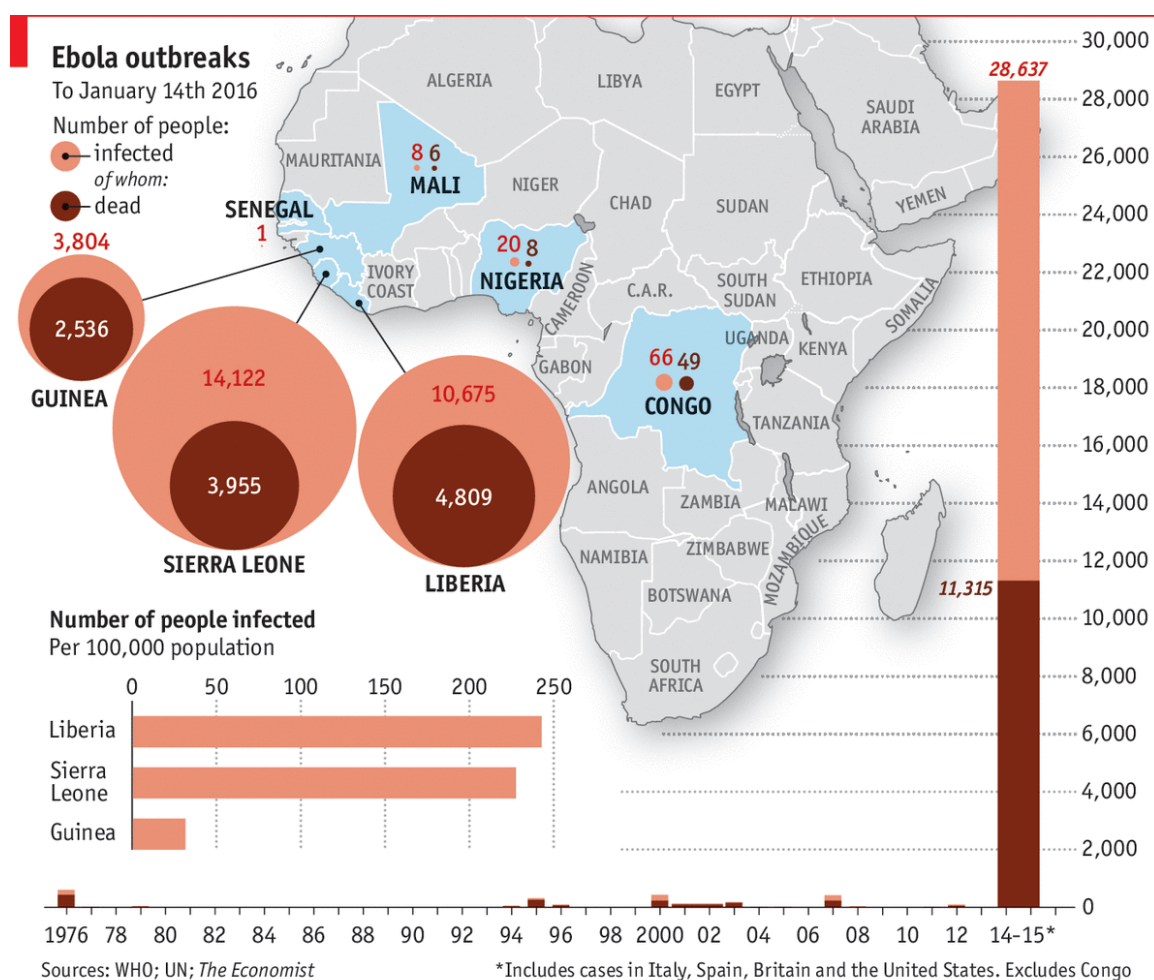
2014–2015 Ebola Virus Disease (EVD) Epidemic

Ebola virus is among a class of filoviruses that are among the most feared pathogens in the world, with mortality rates as high as 90% and newsworthy morbidity including rapid decline and massive hemorrhaging. In countries where major outbreaks have occurred, Ebola has had devastating consequences in terms of social human cost and economic cost resulting from reduced trade and global travel.^{cxxi}

However, Ebola is not airborne and has an incubation period from 2 to as long as 21 days during which infected persons are not a source of infection, and thus the

magnitude of the 2014 outbreak was not anticipated by public health professionals in West Africa or elsewhere. The twenty previous Ebola outbreaks in other African countries, also with inadequate human, financial and material resources were each managed effectively and contained.^{cxxvii}

The following graphic from the Economist shows the relative impact of the 2014 West African Ebola outbreak compared to all previous outbreaks.

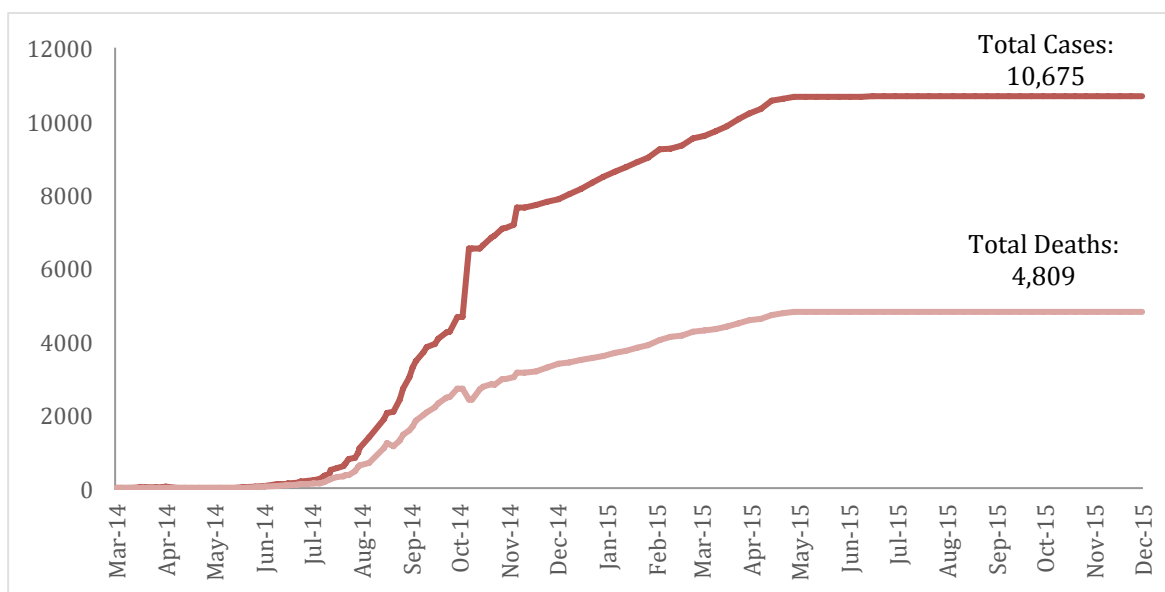


Economist.com

Figure 18. Relative impact of the 2014–2015 West African Ebola Outbreak

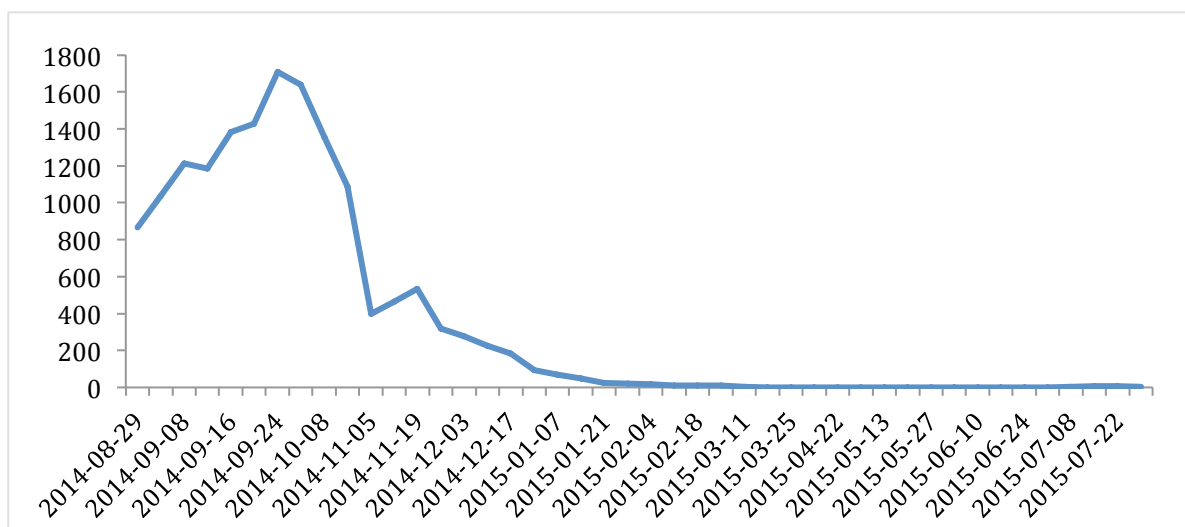
Source: “Ebola in Africa: The End of a Tragedy?,” *The Economist*, January 14, 2016, <http://www.economist.com/blogs/graphicdetail/2016/01/daily-chart-12>.^{cxxviii}

The 2014–2015 outbreak of Ebola disease in West African nations began with a suspected natural reservoir (bat)-to-human spillover of the Zaire Ebola virus in Guinea in February 2014. The first case in Liberia was the following month in March 2014, but was largely ignored within Liberia until mid to late June. A long six months after the first case was confirmed in Guinea, WHO declared the outbreak a “public health emergency of international concern.” By its peak in October, the epidemic was already at least thirty times larger than the largest Ebola virus disease outbreak in recorded history.^{cxxix} Since the first case in Guinea, 28,642 cases of Ebola virus disease, and 11,319 deaths, have been reported in eight of the affected nations.^{cxxx}



Data Source: WHO and Liberia MOH Ebola Situation Reports, 2014–2015

Figure 19. Cumulative Ebola Cases and Deaths, Liberia, March 2014–2015



Data Source: WHO and Liberia MOH Ebola Situation Reports, 2014–2015

Figure 20. Number of confirmed, probable and suspected Ebola cases in the last 21 days, Liberia, Aug 2014–Jul 2015

Figures 19 and 20 above show the cumulative cases and deaths from Ebola in Liberia and Ebola incidence over the course of the epidemic. Figures 21 and 22 below show the cumulative number of Ebola cases and deaths worldwide resulting from the 2014 West African Ebola outbreak.

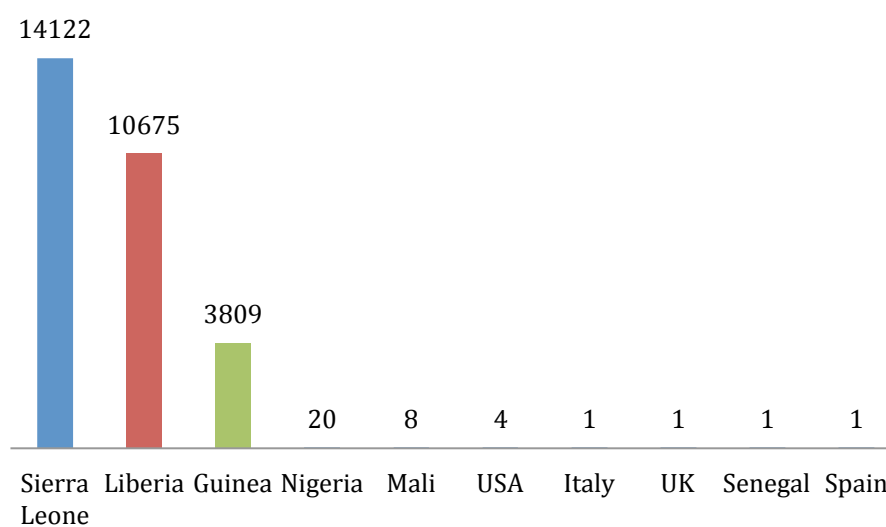
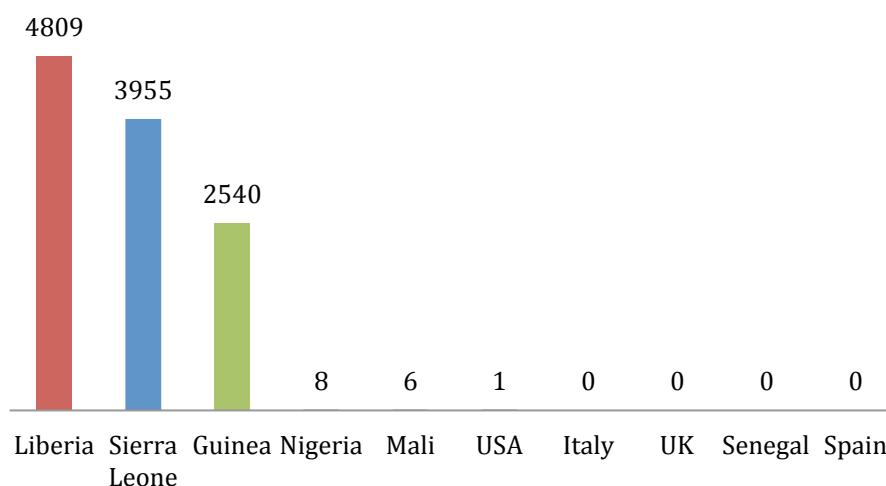


Figure 21. Cumulative number of confirmed, probable and suspected Ebola cases, March 2016



Source: WHO Ebola Situation Report, March 2016

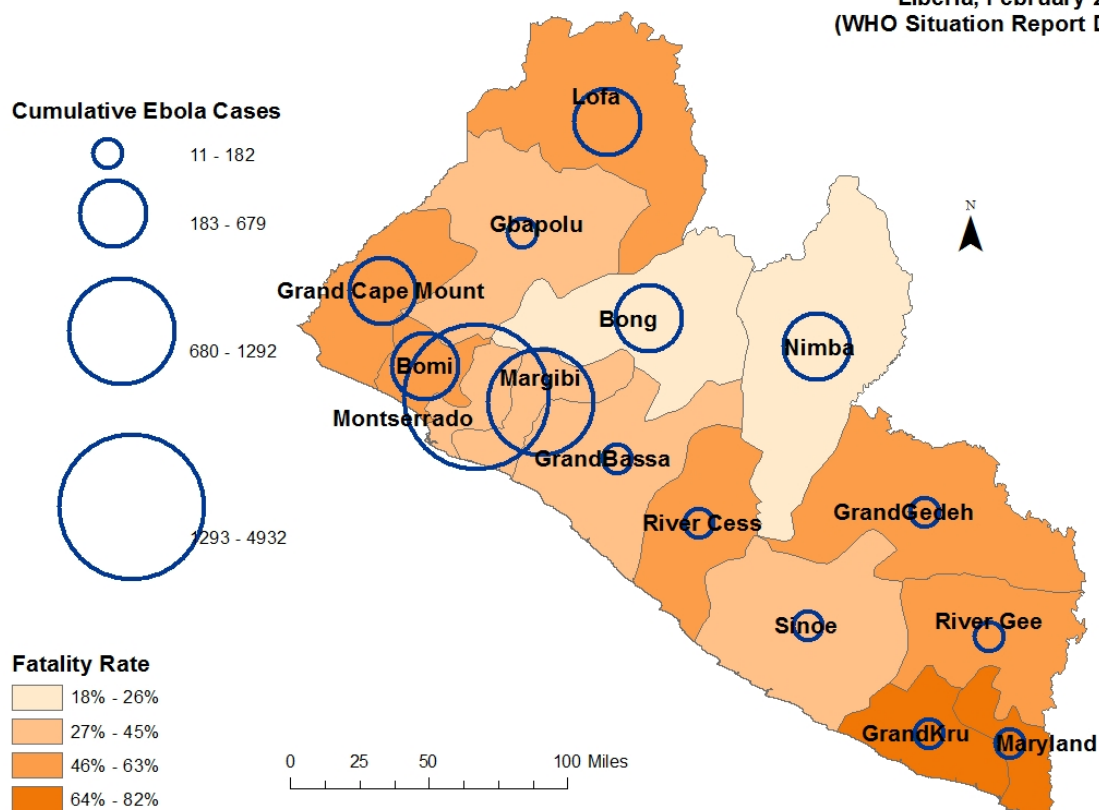
Figure 22. Cumulative number of confirmed, probable and suspected Ebola deaths, March 2016

In West Africa, country-specific case fatality rates ranged from 28% in Sierra Leone to 67% in Guinea. The overall case fatality rate was 40%, with Liberia having the highest number of deaths during the epidemic, and a 45% case fatality rate. Figure 23 shows case fatality rates from Ebola in each county with actual numbers of cases (blue circles overlaid over each county to allow for a visual representation of the regional impact of Ebola.

What was different in Liberia that allowed the exponential spread of Ebola?

The health system was experienced in dealing with intermittent cases of Lassa virus, another hemorrhagic fever virus endemic in the West African region. While Lassa has a much lower overall case fatality rate (~1%) and upwards of 80% are asymptomatic, it too can be transmitted person-to-person where poor infection control practices are

Figure 23. Cumulative Ebola Cases and Case Fatality Rate
Liberia, February 2015
(WHO Situation Report Data)



While counties in the South East saw higher case fatality rates, there were relatively few cases compared to Lofa and Grand Cape Mount that were most severely impacted facing both high numbers of cases and high case fatality rates. Fatality rates and cases were mapped using natural breaks, and cases include totals for probable, suspected and confirmed.

present, and can have particularly deadly consequences for pregnant women.

Like Ebola, Lassa is spread through direct contact with the blood, urine, feces, or other bodily secretions of a person infected with the virus.^{cxvxi} Nonetheless, when Ebola hit Liberia in March 2014, the health system proved to be almost totally unprepared to cope despite experience with Lassa and despite massive recent international support for health systems strengthening and associated targeted capacity development interventions, including those of JSI's RBHS project.

In 2014, the health system remained fragile with significant deficits in human, financial and material resources, including basic infrastructure, resulting in compromised ability to mount an adequate Ebola outbreak control response. Further, due to a chronic delay in receiving pay, government health worker strikes took place in November 2013 and then again in February, March and April 2014, just as the first cases of Ebola were being seen in Liberia. At the peak of the epidemic, Ebola cases were being turned away at the door of both health facilities and Ebola Treatment Units with insufficient beds and capacity to meet the need.^{cxxxii} The failure to mount a timely response on the part of the government, NGOs and international agencies was in part due to the lack of timely and accurate information, as well as the demands of addressing significant competing priorities within the fragile health system.

Due to misunderstandings related to Ebola (mode of transmission, incubation period, symptoms confused with malaria) and rapid unnoticed transmission due to frequent cross-border travel between the three West African countries and then onto each of the populated capital cities—Conakry, Guinea; Monrovia, Liberia; and Freetown, Sierra Leone—information on Ebola infections was incomplete and under-valued, and the community response slow due to it being an unknown disease. Ultimately, the high number of infections identified among health-care workers—highlighting inadequate infection control practices and a dire lack of basic infrastructure such as access to water and gloves—served to increase fears among the community that the health system was a major source of infection, thus to be avoided, and that clearly there was nothing that could be done once infected.^{cxxxiii cxxxiv}

Religious leaders reinforced misperceptions by denying the existence of Ebola and calling people to come close together to pray, while promoting the continued burial practice of thoroughly washing the body, and placing hands on the deceased, at which point the levels of virus were at their peak. Burial teams were ill-equipped to cope, and resembling witches in their PPEs, reinforced a belief that Ebola was witchcraft, further limiting their success in carrying out their jobs.^{cxxxv} In the height of the epidemic in Liberia, family members refused to allow burial teams wearing PPEs to remove corpses, and many corpses were left in the open on the densely populated urban streets.

By way of comparison, when faced with Ebola patients arriving from Liberia, Nigeria demonstrated significantly stronger capacity to respond to and contain a threatened epidemic in their country; from individual health care worker competencies to government systems.^{cxxxvi} In 2012, in response to a spike in polio cases, Nigeria developed an emergency command center to assess and document infections and guide response activities. This same system was immediately called up after notification of the first cases of Ebola two years later in 2014. Having developed clear emergency operations, despite 20 confirmed and proposal cases of Ebola, Nigeria was nonetheless able to contain the spread of Ebola. Within a few days, Nigerian officials had identified 894 contacts with those cases and conducted 18,500 visits with contacts to monitor for Ebola symptom.^{cxxxvii}

According to McKenzie et al.:

“[T]he health system [in Nigeria] was not overwhelmed by Ebola. Disease surveillance worked well: index cases were identified, contacts traced and

assessed for symptoms and signs of Ebola and, where appropriate, quarantined.

Political capital was mobilised and significant financial resources were released.

The government communicated regularly and repeatedly with media and the public at large, updating all on the state of play.^{”cxxxviii}

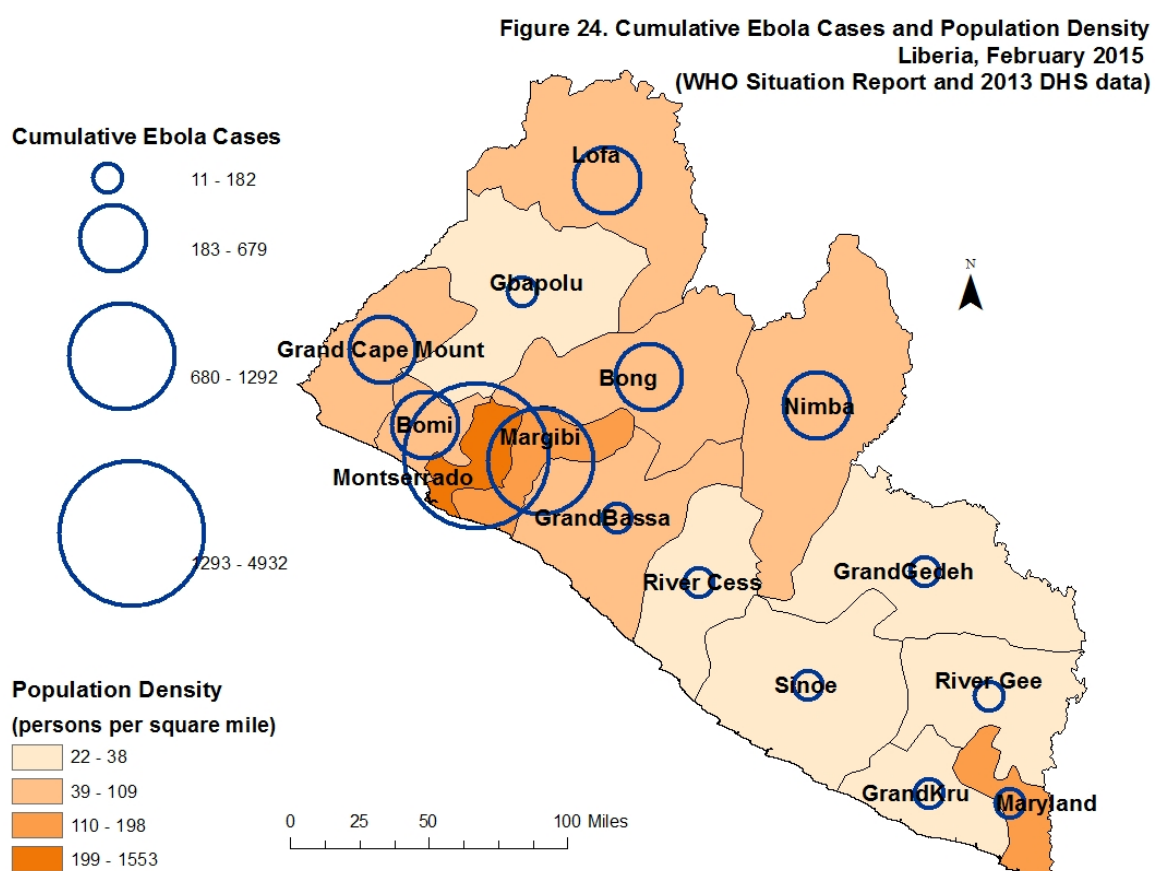
Unlike in Liberia, the Nigerian health system was resilient enough to fend off any escalation of Ebola once it entered the country.

The impact of Ebola on the health system in Liberia raised questions among the international public health community about current Liberian health system capacities, as well as about the nature and design of international public health priorities and associated interventions—were the wrong things being prioritized in public health programs and/or were there gaps in how they were being designed and implemented?

But again, the 20 previous Ebola outbreaks were contained with only small fraction of the devastation caused in Liberia and neighboring Guinea and Sierra Leone. The countries in these other outbreaks also faced severe poverty and major health facility and road infrastructure constraints. But the combination of these, along with other factors tipped the health system beyond its ability to cope. Other factors include: sorely insufficient skilled human resources; inconsistent availability of basic supplies such as access to water and sanitation at health facilities; irregular supply of health commodities and laboratory reagents; lack of laboratories and adequate triage and isolation areas; high mobility across national borders and limited expertise in contact tracing and effective isolation; community misunderstanding and fear of the disease, and distrust of the health system.^{cxxxix cxl cxli} Rapid spread to more densely populated urban centers, however, was

somewhat unique in the West African Ebola outbreak; prior outbreaks were often contained within rural communities.

The map in Figure 24 below shows Ebola cases (confirmed, probable and suspected) overlaid on population density of Liberian counties. Population density data are from 2008 GOL Census estimates.



The map shows that cases roughly correlate with population density other than in Maryland in the South East. Ebola first entered Liberia via Lofa County that shares a porous border with Guinea; the spread of the virus to the South East occurred somewhat later in the epidemic after control efforts were more established. Population density and cases were mapped using natural breaks, and cases include totals for probable, suspected and confirmed.

One additional factor may be the relatively greater levels of asymptomatic transmission compared to previous outbreaks. While the existence of asymptomatic EVD

cases has been shown to occur in previous outbreaks, research is now showing potentially very high levels of asymptomatic transmission during the 2014 Ebola outbreak.^{cxlii} On the other hand, a recent meta-analysis of Ebola secondary attack data by Dean et al. estimated that 27% of Ebola cases are asymptomatic, though only about 1% of secondary infections not due to direct contact with a symptomatic person.^{cxliii} If high levels of symptomatic transmission in the West African epidemic were substantiated, this fact would also help explain the difficulties in initially understanding the magnitude and rapidly responding, as well as some of the challenges in contact tracing.

While dealing with myriad other public health priorities, public health preparedness went largely unaddressed in pre-Ebola Liberia. The government, donors and implementing partners were focusing on strengthening basic health services through a rapidly decentralizing system. The lack of integration of public health preparedness into HSS interventions left the country vulnerable to public health emergencies.

Ranking Priorities According to WHO Emergency Preparedness Components

Prior to Ebola, effectively none of the 16 key components or their 51 essential attributes listed in the WHO table of emergency preparedness were in place. For this thesis, the existence of the 16 key components and 51 essential attributes was analyzed as of July 2016, over a year since the last Ebola case in Liberia. This was done in a two-step process.

Step 1: Priority Ranking of Attributes and Components

The WHO Building Block framework was developed with the underlying premise that each of the six components is equally essential to the functioning of the health

system. In the WHO list of essential attributes and components for emergency preparedness, it was also assumed that each of the 16 components was equally critical to their respective building block (e.g., BB6: Leadership and Governance has 5 components, thus each component contributed to one-fifth, or 20% of the total function of BB6). Following the same logic, it was assumed that each of the component attributes was equally critical to its respective component (e.g., BB6 Component 1.1 has two associated attributes, thus each was equal to one-half, or 50% of the score for that component).

In conjunction with the JSI/Liberia HSS and Ebola response staff, as well as with input by the EPR consortium and members of the current Incident Management System in Liberia, the 51 essential attributes were then classified as: absent (receiving a score of 0), plan in place but not yet implemented (receiving a score of 1), or actively being implemented (receiving a score of 2).

The average score for each component was calculated, resulting in the following ranking in Table 9 of identified priority areas, with the lowest scores representing the largest health system emergency preparedness unmet needs.

Table 9. WHO Emergency Preparedness Component and Building Block Priority Scores*

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
1. Leadership and governance (BB6) *	1.1 Legal framework for national multi-sectoral emergency management SCORE=0.00	1. Laws, policies, plans and procedures relevant to national multi-sectoral emergency management	0
		2. National structure for multi-sectoral emergency management and coordination	0
	1.2 Legal framework for health-sector emergency management SCORE=1.33	3. Laws, policies, plans and procedures relevant to health-sector emergency management	1
		4. Structure for health-sector emergency management and coordination	2
		5. Regulation of external health-related emergency assistance	1
	1.3 National institutional framework for multi-sectoral emergency management SCORE=1.00	6. National committee for multi-sectoral emergency management	1
		7. National operational entity for multi-sectoral emergency management	1
	1.4 National institutional framework for health-sector emergency management SCORE=0.33	8. National committee for health-sector emergency management	0
		9. National operational entity for health-sector emergency management	1
		10. Mechanisms of coordination and partnership-building	0
	1.5 Components of national programme on health-sector emergency management SCORE=0.75	11. National health-sector program on risk reduction	1
		12. Multi-sectoral and health-sector programs on emergency preparedness	0
		13. National health-sector plan for emergency response and recovery	1
		14. Research and evidence base	1
2. Health workforce	2.1 Human resources for health-sector emergency management SCORE=1.00	15. Development of human resources	1
		16. Training and education	1

3. Medical products, vaccines and technology	3.1 Medical supplies and equipment for emergency-response operations SCORE=0.00	17. Medical equipment and supplies for prehospital and hospital (including temporary health facilities) activities and other public health interventions	0
		18. Pharmaceutical services	0
		19. Laboratory services	0
		20. Blood services	0
4. Health information	4.1 Information-management systems for risk-reduction and emergency preparedness programs SCORE=0.63	21. Information system for risk assessment and emergency preparedness planning	0
		22. National health information system	1
		23. National and international information-sharing	1
		24. Surveillance systems	0.5
	4.2 Information-management systems for emergency response and recovery SCORE=0.00	25. Rapid health-needs assessment	0
		26. Multi-sectoral initial rapid assessment (IRA)	0
		27. Emergency reporting system	0
	4.3 Risk communication SCORE=1.00	28. Strategies for risk communication with the public and the media	1
29. Strategies for risk communication with staff involved in emergency operations		1	
5. Health financing	5.1 National and subnational strategies for financing health-sector emergency management SCORE=1.00	30. Multi-sectoral mechanisms of financing emergency preparedness and management	0
		31 Health-sector financing mechanisms	2
6. Service delivery (BB1) *	6.1 Response capacity and capability SCORE=0.00	32. Subnational health-sector emergency-response plans	0
		33. Surge capacity for subnational health-sector response	0
		34. Management of prehospital medical operations	0
		35. Management of situations involving mass-fatality and missing persons	0
	6.2 EMS system and mass-casualty management	36. Capacity for mass-casualty management	0

	SCORE=0.00		
6.3 Management of hospitals in mass casualty incidents SCORE=0.00		37. Hospital emergency-preparedness program	0
		38. Hospital plans for emergency response and recovery	0
6.4 Continuity of essential health programs and services SCORE=0.78		39. Continuous delivery of essential health and hospital services	1
		40. Prevention and control of communicable diseases and immunization	1
		41. Mother-and-child health care and reproductive health	1
		42. Mental health and psychosocial support	1
		43. Environmental health	1
		44. Chronic and non-communicable diseases	0
		45. Nutrition and food safety	1
		46. Primary health care	1
6.5 Logistics and operational support functions in emergencies SCORE=0.25		47. Health services for displaced populations	0
		48. Emergency telecommunications	0
		49. Temporary health facilities	1
		50. Logistics	0
		51. Service-delivery support function	0

*Note: The WHO Emergency Preparedness Framework swaps the number of the building blocks so that Leadership and Governance is Building Block 1 and Health Services is Building Block 6; this is opposite in the WHO Building Block framework. In this dissertation, I use the WHO Building Block Framework designations: Building Block 1 always refers to Health Services provision and Building Block 6 always refers to Governance and Leadership

Step 2: Gap Identification:

Matching Priorities against Current Response, Resiliency and Recovery Plans

In order to identify gaps, identified priorities from the above table were compared to those outlined in the National Epidemic Preparedness and Response Plan (April 2016 draft), and the Investment Plan for Building a Resilient Health System, Liberia 2015–

2021, which is meant to be an addendum to the National Health Plan 2011–2021. A summary ranking of the GOL post-Ebola health sector priorities, as listed in the Investment Plan for Building a Resilient Health System, Liberia 2015–2021, is summarized in Table 10.

Table 10. GOL Post-Ebola Investment Plan Priorities

Priority	Building Block
1	BB2 Human resources
2	Infrastructure and technology
3	Epidemic preparedness and response*
4	BB4 Medical products, vaccines and technology
5 (tie)	BB1 Health services
5 (tie)	BB3 Health information
5 (tie)	BB6 Governance and leadership
5 (tie)	Community engagement
6	BB5 Health financing

*Including surveillance and early warning and alert response network (EWARN) structures at all levels.

The two post-Ebola government plans continue to prioritize the six WHO building blocks, however they add three additional components to the list: (1) infrastructure and technology, (2) epidemic preparedness and response, and (3) community engagement.

In the WHO emergency preparedness framework, infrastructure and technology, and epidemic preparedness and response activities are specifically integrated into the existing six building blocks. Similarly, community engagement is a cross-cutting feature of building blocks 1 Health Services, 2 Human Resources, 3 Health Information, and 6 Governance and Leadership (e.g., formally incorporating community health workers, gCHVs, into the public sector workforce, placing them on payroll and routinely supporting and supervising them, tapping into their ability to collect community level data for capture in a newly developed C-HMIS). Comparisons of WHO Emergency

Preparedness framework findings with those from the two post-Ebola government plans are further discussed in detail under Objective 3 within each building block section below.

FINDINGS BY WHO HEALTH SYSTEM BUILDING BLOCK

This section documents findings for each of the three objectives organized by the six WHO health system building blocks. Under each building block there is an assessment of the health system capacity changes from 2009–2014 (Objective 1), the impact the Ebola epidemic had on the health system in 2014 (Objective 2), and an assessment of health system resilience using WHO-defined emergency preparedness components and attributes (Objective 3).

Building Block 1: Delivering Essential Health Services

Objective 1: Liberian Health System Capacities, 2009–2014

Table 11 illustrates interventions that occurred at the central and county levels, the level that the intervention was intended to impact, and the areas assessed as part of the RBHS baseline and endline capacity assessment, conducted in 2012 and 2014, respectively.

Table 11. RBHS activities in support of provision of health services

	RBHS Intervention/Technical Support Areas	Capacity Building Level	Sub-component Evaluated in RBHS Capacity Assessment of MOH
BB1: delivering essential health services	Reorienting services provided by NGOs (e.g., PBCs)	Organizational, systems	
	Public-private partnerships (e.g., PBF MOH contracting with NGOs)	Organizational, systems	-Access, availability, timeliness, responsiveness, satisfaction
	Community involvement (e.g., Community Health Development Committees)	Organizational	-Quality and safety of care provided
	Community outreach (e.g., gCHV, trained traditional midwives)	Individual, organizational	-Public-private partnerships around service provision
	Quality improvement: clinical supportive supervision	Individual, organizational	

From 2009–2014, the RBHS project made significant contributions to improving the country’s health indices. Since the implementation of the Basic Package of Health Services in 2007—replaced by the Essential Package of Health Services in 2011—health outcomes and health practices in Liberia have shown significant improvement.

RBHS Activities

In the first half of the RBHS project, through the BPHS, the government prioritized maternal and child health services, rebuilding/building health facilities to expand physical access to care, and increasing human resources for health in order to fill identified gaps. PBF was also prioritized by the MOH in their National Health Plan as a promising approach to accelerate quality implementation of the EPHS, and thus became a core intervention in the first half of the project.¹⁷ cxliv

Between 2009 and 2012, RBHS **designed and implemented PBF contracts with five NGOs** in seven counties covering 118 facilities, and subsequently supported the MOH to directly manage PBCs from 2012–2014. Over 250 health facilities in 12 of Liberia’s 15 counties implemented PBF during the life of RBHS. At the same time, RBHS was actively supporting the MOH’s decentralization strategy through system strengthening at the central level, and particularly in the areas of human resources (see building block 2) and HMIS (see building block 3). RBHS **embedded staff in central units of the MOH** including PBF, health promotion/BCC, and mental health. Other project staff, while not officially embedded, worked closely with other Central MOH

¹⁷ PBF uses incentives to achieve desired health outcomes by rewarding facilities and providers contingent upon achieving targets.

units including County Health Services, Community Health Services, and the Infrastructure Unit.

In support of health service provision, RBHS **helped the MOH develop inpatient clinical standards**, and prioritize those to be rolled out in the first phase of EPHS implementation. The EPHS was designed to be rolled out in two phases, first focusing on higher-priority health services (largely those that comprised the earlier BPHS) and eventually scaling up to include mental health, school health and other services. High priority was given to standards for obstetrics/neonatal, pediatrics, and infection prevention, based on their proven effect on reducing maternal, neonatal, and child mortality.^{cxlv}

When RBHS began capacity building activities, the interaction between the central MOH and CHTs was limited to budget and health service planning activities. There was very little interaction when it came to maintaining the health facilities and assessing community health needs. Supervision at both central and county levels was inconsistent. RBHS worked to **standardize supervision tools and practices**, as well as **developing infrastructure building standards** for the health sector, and **completing the construction of new EmONCs, facility upgrades and national drug store (NDS) construction planning**.

Health Outcomes and Health System Changes

In interviews as part of the RBHS mid-term assessment, the MOH credited the project as being a significant contributor to realizing targeted health outcomes.^{cxlvi} This is substantiated by RBHS endline capacity assessment data, NGO performance data from

the PBCs, national HMIS data and DHS data.

In the 2012 baseline capacity assessment, the central MOH scored low on supervising the CHTs in their use of health service delivery standards. Likewise, the CHTs scored low on the extent of interaction with their health facilities in the use of these standards.^{cxlvii} The RBHS 2014 endline capacity assessment found that overall supervision had improved and been “institutionalized.” A standardized set of tools for supportive supervision was developed, and were being used at all supervisory visits. Supportive supervision visits from the county level to the health facilities were conducted on a monthly schedule and the findings from these visits were being used to improve performance. The central MOH was conducting quarterly supervision visits to all facilities and to communities on EPI activities.^{cxlviii}

The capacity to deliver essential health services was also positively influenced by improved health infrastructure, including the development of maternal waiting homes, drug storage facilities, and upgraded or newly constructed facilities.^{cxlix} Further, facilities funded and provided bonuses based on performance showed improved health services and outcomes. The mechanism also reinforced a culture of information and use of data for decision-making.^{cl cli} These improved capacities are also reflected in annual accreditation survey scores.

Population survey data also confirm health gains made during the life of the RBHS project. Between 2007 and 2013, Liberia saw: a lower infant mortality rate (IMR) from 71 to 54 deaths per 1,000 live birth; increases in antenatal visits from 79% to 96% (and four+ ANC visits from 66% to 78%); increased deliveries by skilled attendants and

in facilities from 37% to 51%; increased contraceptive prevalence rate (CPR) from 11% to 19%; full vaccination coverage rise from 39% to 55% (and penta3 from 50% to 68%); and HCT coverage rates increase from 87% to 92% among women and from 80% to 88% among men (see table 1). Due to facility improvements and upgrading, access to health services within 5 km or 1 hour walk from a health facility increased from 46% to 71%. In the three USAID focus counties – Bong, Lofa and Nimba – which are the most populous and generally perform below national averages, performance across all these parameters also showed significant improvement.^{clii cliii} These improvements are attributable, at least in part, to increased capacity of the MOH to deliver essential health services including increased levels of engagement between the central MOH and CHTs, and between the CHTs and health facilities.^{cliv}

Below is a summary of findings organized by health outcome indicators (maternal health, child health, malaria), and health system indicators (availability of HCT, OPD visits). HMIS data are presented in bar graphs from 2009–2015 showing changes over the first half of the RBHS project 2009–2012 when directly managing health services via PBCs, when MOH took over direct management in 2013, the impact of the Ebola epidemic in 2014, and the early post-Ebola recovery period in 2015. The HMIS data analysis looked at the same three months over seven years for the six counties most severely impacted by Ebola: Bomi, Bong, Lofa, Margibi, Montserrado and Nimba.¹⁸ RBHS actively worked in all the counties excluding Margibi. Across indicators, the graphs of HMIS data show a gradual improvement from 2009 to 2012; at times a slight

¹⁸ As noted in the Methods section, for the analysis, “most severely impacted by Ebola” was defined as having >100 cases in 2014.

stagnation corresponding to MOH first taking over direct management of PBCs in 2013; a marked drop in performance corresponding with Ebola in 2014; and then a post-Ebola recovery, though not always complete, in 2015.

Maternal Health Services, HMIS Data, 2009–2015

RBHS PBC data show the percent of pregnant women provided with a 2nd dose of IPT to prevent malaria increased by 22% in RBHS facilities, compared to 14% in non-RBHS facilities; ANC4 increased 10% in RBHS facilities, compared to 3% in non-RBHS facilities.^{clv}

In RBHS facilities, estimated protection provided by contraceptive methods increased over three-fold from 7,835 in program year one (July 2009–June 2010) to 26,872 in program year six (July 2013–June 2014).^{clvi}

Figure 25. IPT2 in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct 2009-2015

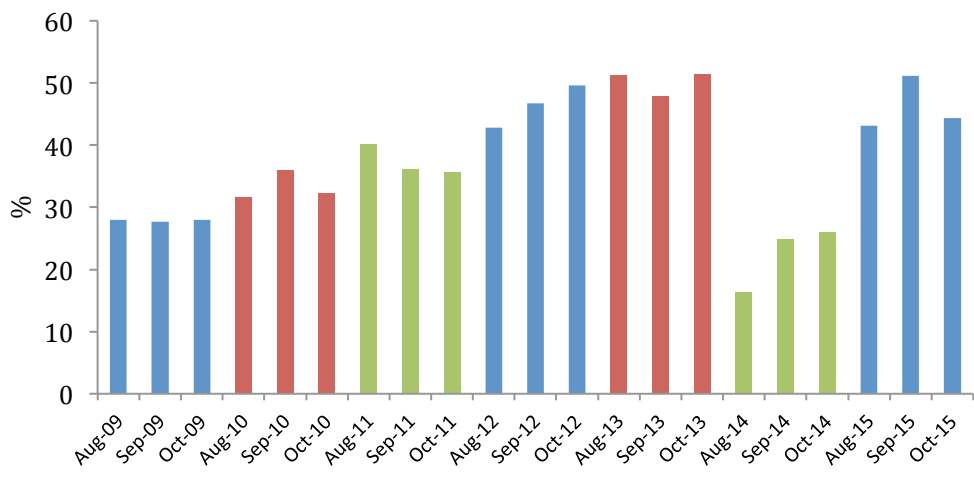


Figure 26. 4+ ANC Visits in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct 2009-2015

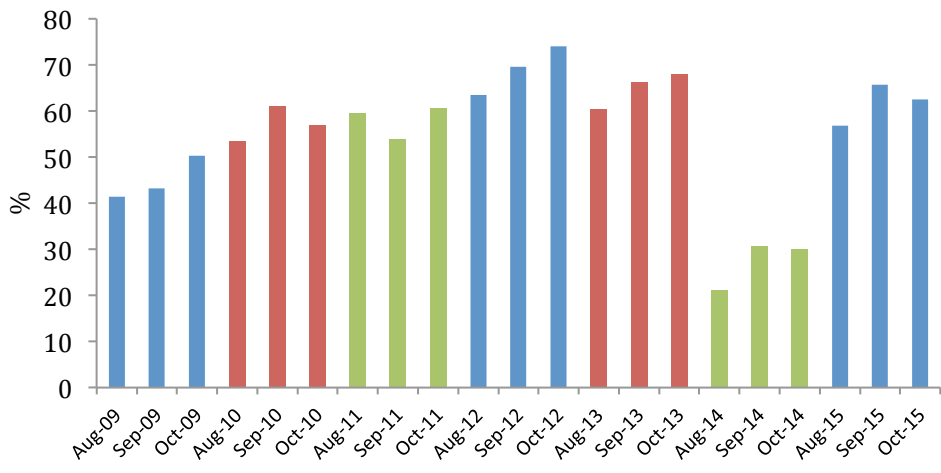


Figure 27. Skilled Deliveries in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct 2009-2015

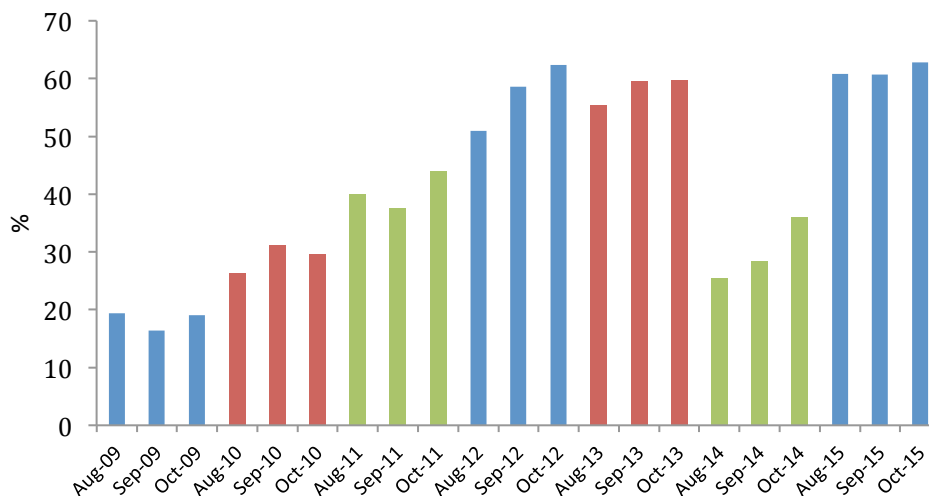
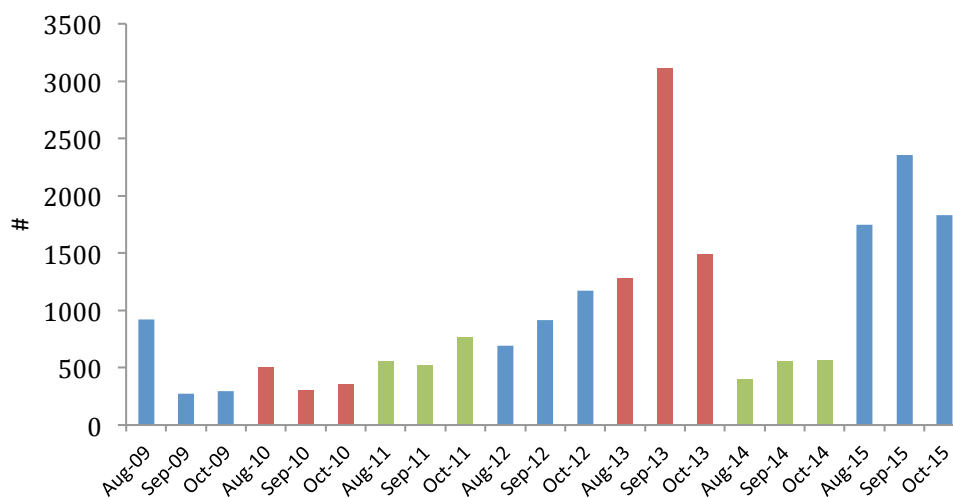


Figure 28. Total CYP in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015



Child Health, HMIS Data, 2009–2015

Childhood vaccinations are provided both at health facilities and via expanded program on immunizations (EPI) vaccination campaigns in the community. DHS data—which captures the effect of both facility-based and community campaign vaccination—

shows marked increased between 2007 and 2013 (see table 1). HMIS data in the graphs below show more steady coverage over time between 2009 and 2015, indicating the need for continued community-level vaccination through regular campaigns. The impact of Ebola on facility-based measles and pentavalent vaccine coverage is clear in the above graphs.

Figure 29. Measles Coverage (>1yr) in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015

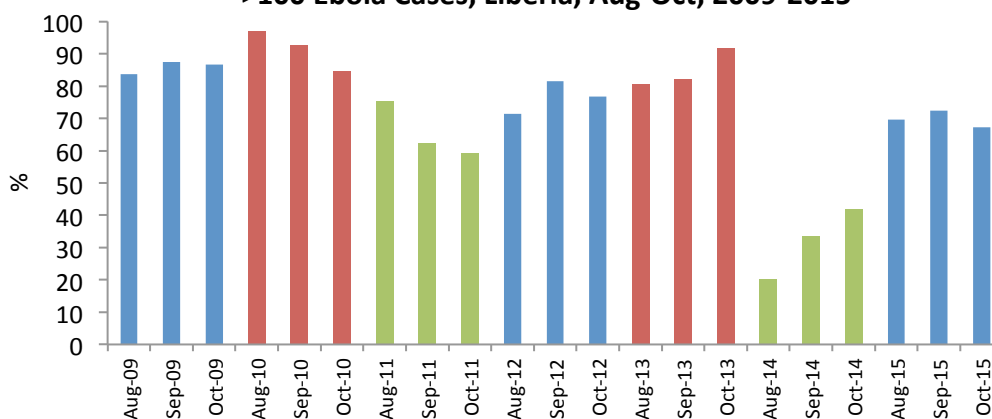
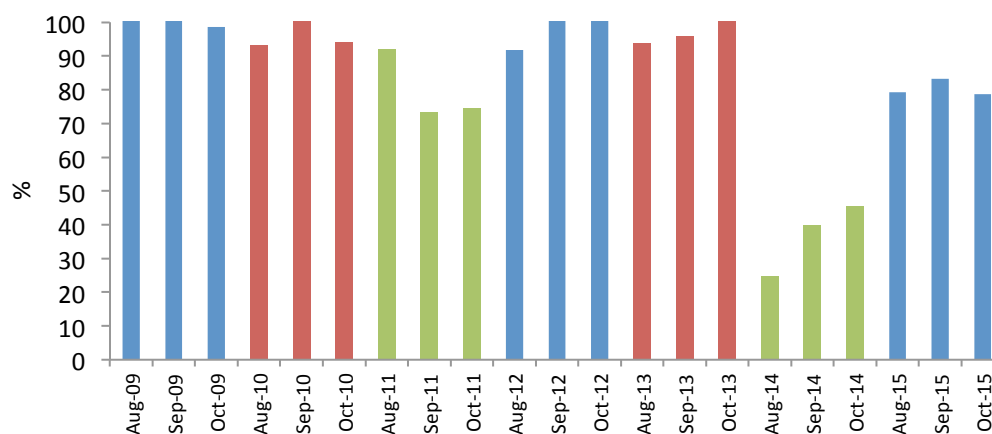


Figure 30. Penta3 Coverage (>1yr) in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015



Malaria, HMIS Data, 2009–2015

In RBHS-supported facilities, the percentage of malaria cases with a confirmed diagnosis increased by 15% between program year one (July 2009–June 2010) to 26,872 in program year six (July 2013–June 2014).^{clvii}

Figure 31. Malaria Diagnosed by RDT (<5yrs) in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015

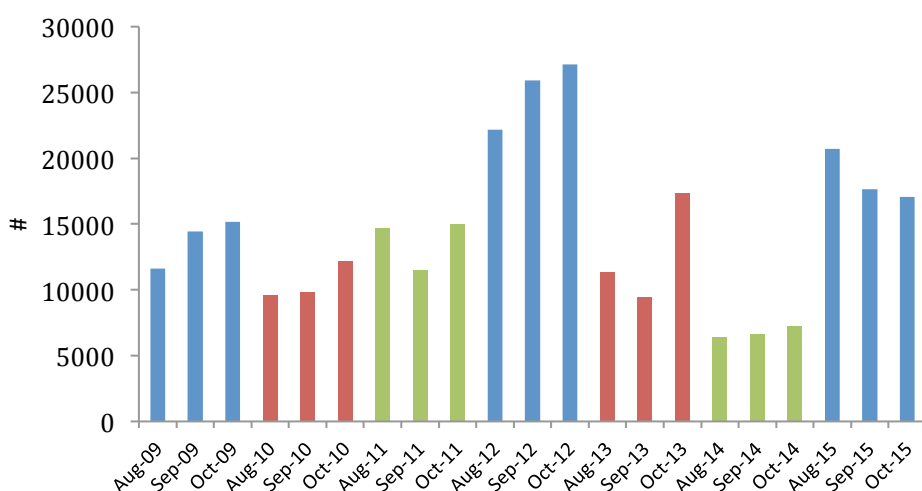
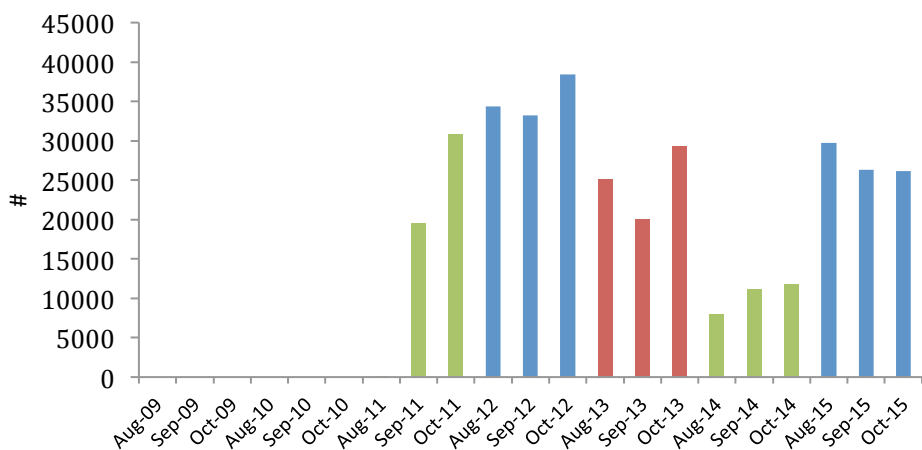


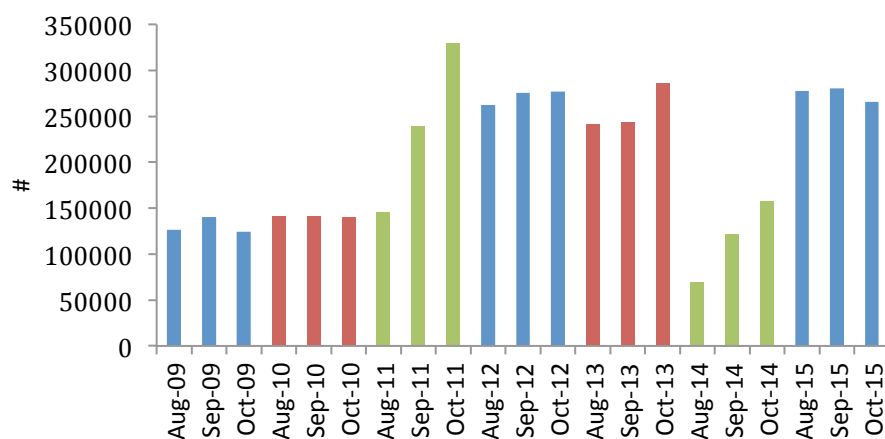
Figure 32. Malaria Cases Treated with ACT (<5yrs) in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015



Note: The national treatment guidelines changed in 2011 to include treatment of children under 5 years of age with ACT as the preferred first line treatment; as a result, there were no data on this indicator prior to 2011.

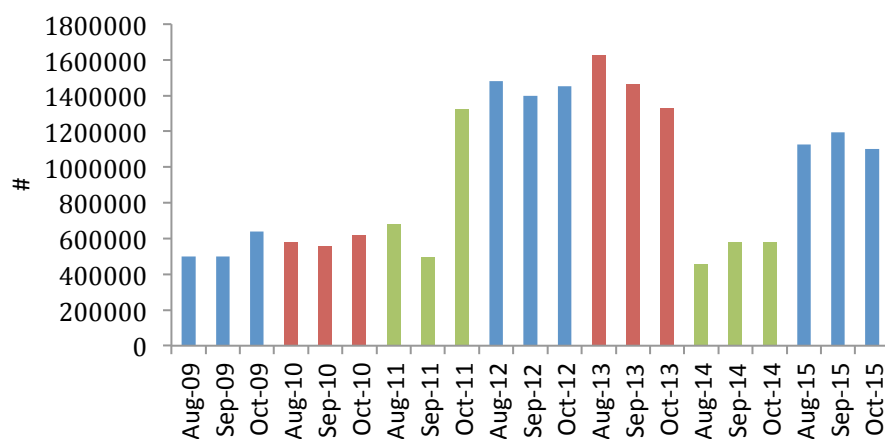
HIV Counseling and Testing Utilization, HMIS Data, 2009–2015

Figure 33. HCT Services in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015



Outpatient Department Visits, HMIS Data, 2009–2015

Figure 34. OPD Visits in the Six Counties with >100 Ebola Cases, Liberia, Aug-Oct, 2009-2015



Both out-patient department utilization and facilities providing HCT showed marked increases in 2011. This is likely in part due to increases in facility adherence to reporting requirements into the then relatively new HMIS system. Again, the impact of

Ebola is clearly seen in 2014.

From 2009–2010, RBHS was working with the MOH to institute DHIS2 as the new HMIS, and to operationalize the system at the central and county levels in the seven counties in which PBC were being managed. With international relief NGOs having been responsible for the majority of all health service provision for almost two decades, reporting into the government HMIS was not commonplace. As a condition of funding, RBHS required that NGOs report both into the new national HMIS as well as to the project directly. These data were routinely correlated to ensure complete, accurate and timely submission into the HMIS, thus helping institutionalize reporting from the facility level up. The above graphs reflect the gradual increase in reporting between 2009 and 2011, as well as increases in coverage.

By 2012, clear increases in service utilization and outcomes can be seen. The following year, 2013, marks the first year in which the MOH took over direct management of NGO PBCs, with JSI in a supportive, capacity-strengthening role. As the Ministry adapted to the new role, slight decreases in performance can be seen across some indicators. The above graphs clearly show the marked impact the Ebola epidemic had on these indicators in 2014, and the recovery, though not always complete, in the same period one year later, 2015, following the last cases of Ebola.

Prior to Ebola, the 2013 Health Facility Assessment Report found that gCHVs were significantly involved in the delivery of health services including: integrated community case management of diarrhea, pneumonia and malaria; health and hygiene promotion; social mobilization; directly observed therapy for tuberculosis; and also

providing support to vertical program activities (e.g., HIV/AIDS, TB, leprosy, malaria). However, most of the gCHV projects were partner-led with minimal support from or formal interaction with the county and district health teams. Further, the report highlighted inconsistent training levels, and lack of consistent availability of equipment and commodities.^{clviii} While often not formally on the government payroll, gCHVs play a critical role in strengthening community engagement and improving environmental and community health in underserved areas.^{clix} Their role in helping to ultimately curb the Ebola epidemic at the community level has yet to be fully documented.

Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System

Despite improvements in the provision of health services and health outcomes, the service delivery system was still relatively weak with many glaring shortcomings in the spring of 2014. Vertical donor funding streams continued to be apparent, fragmenting services at both the facility and community levels. Linkages between the community and health facilities were weak, with the community health roadmap just having been developed in 2014 outlining recommendations on a more formal and comprehensive engagement of community health workers into the existing health system. IPC was greatly inconsistent across facilities and staff. Laboratory and diagnostic services were limited with no national reference laboratory, resulting in significant delays in confirmation of epidemic diseases.^{clx} Infrastructure was inadequate to support comprehensive provision of essential health services.^{clxi} HMIS data shown in the above graphs clearly demonstrate setbacks that resulted in essentially every indicator following the onset of Ebola.

While the number health facilities increased from 618 in 2010 to 656 in 2014, one can see in Table 12 that facility density per 10,000 population remains extremely low. Facility density ranged from 1.0 per 10,000 population in Bong County to 2.9 in Sinoe County.

Table 12: Facilities by county and facility density (shaded cells are counties most severely impacted by Ebola; >100 cases)

County	2015 population projection	Health facility per county	Facility density per 10,000 pop
Bong	385,701	39	1.01
Grand Bassa	256,408	29	1.13
Nimba	534,376	62	1.20
Grand Gedeh	144,872	18	1.24
Margibi	242,795	33	1.36
Gbarpolu	96,446	14	1.45
Maryland	157,225	24	1.53
Lofa	320,218	56	1.75
Montserrado	1,293,349	240	1.86
Grand Cape Mount	146,975	32	2.18
River Gee	77,248	17	2.20
Rivercess	82,707	18	2.20
Bomi	97,291	24	2.50
Grand Kru	66,982	17	2.54
Sinoe	117,813	33	2.80
Total	4,020,406	656	1.63

Source: Investment Plan for Building a Resilient Health System, Liberia 2015–2021

In addition to an inadequate number of facilities per capita, there are glaring infrastructure issues throughout the health system. The 2010 accreditation report showed:

- 48 facilities (13%) do not have access to safe water
- 100 facilities (26%) do not have a sound structure
- 162 facilities (43%) do not have a functional incinerator

- 169 facilities (45%) do not have a primary power source for emergency lighting.^{clxii}

At the time, a suggested gap was the lack of standards for what constitutes appropriate space for the provision of health and social welfare services. A major accomplishment of RBHS was the development of building infrastructure standards.^{clxiii} Nonetheless, glaring inadequacies in basic infrastructure existed at the onset of the Ebola epidemic due to the lack of donor funds available to support infrastructure.

The Ebola outbreak resulted in significant declines in utilization of health services from August to October 2014 compared to the same period in 2012 and 2013, and then in 2015. Many facilities temporarily closed due to lack of supplies, health workers not reporting to work, and lack of utilization due to fear and mistrust of the health system. There were multiple incidents of people being turned away at the door of both health facilities and Ebola Treatment Units due to inadequate capacity.^{clxiv}

As seen in the graphs above, deliveries by skilled birth attendant declined by 7% from 2013 to 2014; ANC 4th visits dropped by 8%; measles coverage declined by 21% from 2013 to 2014; and health facility utilization dropped by 40% (5.5 visits in 2013 to 3.3 visits per inhabitant in 2014). In addition, all schools in Liberia closed for 10 months; setting all students in the country back a full school year.

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities

The analysis and priority ranking of the WHO Emergency Preparedness Components and Attributes shows that Building Block 1: Health Services, should be the government's second top priority to ensure emergency preparedness, after supply chain (BB4).

Table 13. Emergency Preparedness Assessment Results

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
6. Service delivery	6.1 Response capacity and capability SCORE=0.00	32. Subnational health-sector emergency-response plans	0
		33. Surge capacity for subnational health-sector response	0
		34. Management of prehospital medical operations	0
		35. Management of situations involving mass-fatality and missing persons	0
	6.2 EMS system and mass-casualty management SCORE=0.00	36. Capacity for mass-casualty management	0
	6.3 Management of hospitals in mass casualty incidents SCORE=0.00	37. Hospital emergency-preparedness program	0
		38. Hospital plans for emergency response and recovery	0
	6.4 Continuity of essential health programs and services SCORE=0.78	39. Continuous delivery of essential health and hospital services	1
		40. Prevention and control of communicable diseases and immunization	1
		41. Mother-and-child health care and reproductive health	1
		42. Mental health and psychosocial support	1
		43. Environmental health	1
		44. Chronic and non-communicable diseases	0
		45. Nutrition and food safety	1
		46. Primary health care	1
	6.5 Logistics and operational support functions in emergencies SCORE=0.25	47. Health services for displaced populations	0
		48. Emergency telecommunications	0
		49. Temporary health facilities	1
		50. Logistics	0
		51. Service-delivery support function	0

While some improvements were seen as a result of the Ebola epidemic in terms of the country's ability to source and build temporary isolation and triage facilities (attribute 49 under component 6.5), health services in times of emergency remain one of the most under-prepared areas in the WHO emergency preparedness framework.¹⁹

The attributes for components 6.1, 6.2 and 6.3 were not included in either the EPR plan or the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021. However, counties are commencing the process of developing their own EPR plans (attribute 32), with one county (Lofa) as of July 2016 having developed a draft. Unfortunately, emergency planning is being conducted in parallel to county operational planning. Further, it is strictly future epidemic preparedness rather than a broader all-hazards emergency planning.

Some attributes under component *6.4 Continuity of essential health programs and services*, received a score of 1 since the April 2016 draft Epidemic Preparedness and Response Plan specifically mentions them, although without clear guidelines for operationalization. The EPR plan indicates that once IMS is activated, pillar leads will address key areas (e.g., environmental health, psychosocial, nutrition and food safety, IPC).

6.5 Logistics and operational support functions in emergencies are somewhat addressed in the EPR plan by a proposed emergency dispatch and toll-free hotline

¹⁹ During the Ebola epidemic, a number of donors funded temporary and to some extent semi-permanent isolation and triage structures in select facilities in Liberia. However, many of these were coming unraveled just months after installation. (Personal correspondence with County Health Officers at a meeting to discuss temporary vs. semi-permanent triage unit design as part of JSI's OFDA-funded IPC Activity).

(attribute 48), but with no details on how to operationalize such a system in the Liberian context, with no formal first responders and inadequate equipment (i.e., fire engines, ambulances, paramedics).

None of the other components or sub-attributes are addressed in either the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021 or EPR plan.

Building Block 2: Health Workforce

Objective 1: Liberian Health System Capacities, 2009–2014

Table 14 illustrates interventions that occurred at the central and county levels, the level that the intervention was intended to impact, and the areas assessed as part of the RBHS baseline and endline capacity assessment, conducted in 2012 and 2014, respectively.

Table 14. RBHS Project Capacity Strengthening for MOH Health Workforce

	RBHS Intervention/Technical Support Areas	Capacity Building Level	Sub-component Evaluated in RBHS Capacity Assessment of MOH
BB2: health workforce	Workforce development (e.g., training to upgrade professional qualification of midwives)	Individual, organizational	-Supply and distribution -Personnel management and performance systems -Training (pre-service and in-service)
	Changes in the pre-service curriculum and teaching methods	Individual, organizational	
	Quality improvement: performance management/review	Individual, organizational	
	Incentives for retention or remote area deployment (via PBCs)	Individual, organizational	

Over the course of Liberia’s 14-year civil war, most of the health workforce left the country. Following the war, Liberian government capacity was severely damaged and

dominated by corruption, and thus very few top graduates sought public sector, civil service careers. Before the Ebola epidemic took its toll on an already weakened post-war system, the MOH had recognized in its national health plan the critical importance of being able to effectively manage a health workforce that is accessible, available, acceptable, and provides quality services.^{clxv}

During the post-conflict period, health training institutions were severely resource-limited, faculty and clinical preceptors were inadequately trained in pedagogical and clinical supervision skills, and curricula and on-site reference materials severely outdated. Governance and regulatory bodies were essentially non-functioning and toothless, lacking clear accreditation guidelines inclusive of quality standards.

RBHS Activities

RBHS project interventions broadly addressed areas impacting human resources, from pre-service education and in-service training, through supporting regulatory bodies responsible for accreditation, and promoting a culture of accountability among health workers.

Improvement Collaboratives were introduced, as was an electronic integrated human resource information system (iHRIS) (discussed under BB3 Health Information below). The pre-service education supported by the project contributed to increasing the number of providers across all levels (except doctors), and has strengthened the quality of training institutions and the accreditation process. Supportive supervision and performance based contracting (both discussed previously under BB1: Health Services) strengthened facility staff adherence to standards and HMIS reporting, and also helped

reactivate community health structures such as the Community Health Development Committees and the County Health and Social Welfare Boards (CHSWBs).

Government Institutionalization of the Improvement Collaborative Approach

RBHS introduced the concept of improvement collaboratives in three RBHS-supported hospitals to help roll-out inpatient clinical standards. An improvement collaborative is a quality improvement approach that organizes teams or health facilities to work together to rapidly achieve significant improvements in processes, quality, and efficiency of a specific area of care.^{clxvi} Following positive results, the MOH took responsibility for scaling up the initiative in non-RBHS facilities. As further evidence of the lasting effect of the intervention, on a 2015 World Bank funded Ebola-response project, the MOH instructed JSI to again implement the improvement collaborative approach, this time to increase adherence to IPC practices to prevent Ebola.

Updated Pre-Service Curricula and Standards

RBHS trained faculty and clinical preceptors in pedagogical and clinical supervision skills, reviewed and updated technical course content and curricula, procured on-site reference materials and tools, and supported management practices and skills in two major training institutions, Esther Bacon School of Nursing and Midwifery (EBSNM) and the Tubman National Institute of Medical Arts (TNIMA). The RBHS model was subsequently expanded nationally to include 16 additional health training institutions. These institutions train mid-level health professionals, including certified midwives, physician assistants (PAs), registered nurses (RNs), and environmental health technicians (EHTs). By the end of RBHS, more than 500 RNs, RMs, PAs, EHTs, and

MLTs had graduated using the new curricula. All training institutions are now using the revised curricula and the PSE performance standards to improve the training of mid-level health care providers.^{clxvii}

Strengthened Regulatory Bodies

RBHS undertook capacity development interventions with two Liberian regulatory bodies: (1) Liberia Medical and Dental Council (LMDC); and (2) Liberian Board of Nursing and Midwifery (LBNM). Their responsibilities include conducting monitoring, assessment, and accreditation of both training institutions and health facilities, as well as revising curricula and continued professional development (CPD) processes and licensure using up-to-date standards. RBHS activities were aimed at improving the capacity of the bodies to (1) assess facilities and (2) assess training institutions on adherence to standards. The RBHS project helped develop tools to assess 32 sets of standards, each addressing: administration, patient's care, service delivery, equipment and supplies, and waste management.

During the project, the regulatory bodies were supported to assess 36 major health facilities (hospitals, health centers and clinics) in the RBHS three supported counties (Nimba, Lofa, Bong) in the second half of the project. The LBNM now uses the tools to regularly monitor and evaluate adherence of nurses and midwives, and report the results to institutions and the government including the Commission on Higher Education. Progress with the LMDC was somewhat less successful than with the LBNM.^{clxviii}

RBHS also supported the development of standards for accreditation of training institutions and professional staff, which enabled the regulatory bodies to make

appropriate decisions on accreditation and licensing/re-licensing processes including continuing professional development. When baseline assessments of education standards were conducted at EBSNM and TNIMA in 2009 by RBHS, 39% of standards were met. After quality improvement plans were developed and implemented, a follow-up assessment in 2013, now conducted by the capacitated LBNM, revealed that 79% of standards had been met at the two schools. As a result, both schools were approved for accreditation by LBNM. Improvements were documented in the areas of classroom instruction, institutional clinical instruction, and institutional management. The processes for accreditation of existing and new schools, licensure and re-licensure, as well as continuing professional development, are now being utilized regularly by LBNM.^{clxix}

Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System

In 2015, the public health workforce included 117 physicians (0.03 per 1,000 population), 436 physician assistants (0.08 per 1,000 pop), 2,137 nurses in both RN and LPN categories (0.4 per 1,000 pop), and 659 midwives (0.12 per 1,000 pop). According to the MOH, this represents a 30% increase for physicians and a 50–60% increase for the other three groups since 2009. Between 2010 and 2015, there was a 37% increase in the density of health professionals in the public sector from 6.3 to 8.6 per 10,000 population. Nonetheless, the 2010 Workforce Optimization Analysis showed that maldistribution across levels of care, roles and counties was a major challenge.^{clxx}

According to the MOH, as of February 2015, only 59% (5,920/10,052) of government health workers have been included on the payroll and are receiving pay on a regular basis, thus precipitating the four health worker strikes that took place in the six

months prior to the first cases of Ebola in Liberia. Table 15 shows the proportion of staff not on payroll in each county. Those most severely impacted by Ebola are highlighted.

Table 15: County distribution of health workforce based on payroll status (February 2015)

County	Not on GOL payroll	On GOL payroll	Total	% of staff not on payroll
Bomi	217	311	528	41%
Bong	339	415	754	45%
Cape Mount	224	228	452	50%
Gbarpolu	121	140	261	46%
Grand Bassa	243	258	501	49%
Grand Gedeh	434	236	670	65%
Grand Kru	140	179	319	44%
Lofa	449	356	805	56%
Margibi	151	225	376	40%
Maryland	302	164	466	65%
Montserrado	595	2505	3100	19%
Nimba	204	448	652	31%
River Gee	257	128	385	67%
River Cess	198	142	340	58%
Sinoe	258	185	443	58%
Total	4132	5920	10052	41%

Source: Investment Plan for Building a Resilient Health System, Liberia 2015–2021

Despite some improvement in human resources in the five years preceding the onset of Ebola, according to the MOH, the workforce model is not fit for purpose with skills gaps, inequitable distribution, disincentives to performance (e.g., irregular receipt of salary), and weak regulation (e.g., insufficient supervision). The supply chain is inadequate, budget allocation remains based on historical amounts rather than actual needs, and many services remain fragmented according to donor priorities. As a result, there are high levels of attrition and inefficiencies at all levels.^{clxxi}

Onto this scene descended Ebola in March 2014 where almost one in two health workers who became infected died (a case fatality rate of 49%; 184 out of 372 cases).

According to the MOH, the total number of health workers in the iHRIS database is about 10,052. Therefore, 3.7% of health workers developed EVD and 1.7% died from Ebola.

^{clxxii} According to WHO, during the West African epidemic, health care workers were up to 32 times more likely to acquire Ebola than people in the general adult population.^{clxxiii}

As mentioned previously, many facility-based health care workers stopped reporting to work and approximately half of all health facilities shut down during the Ebola epidemic.

At the community level, gCHVs continued to operate throughout the Ebola epidemic.

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities

The analysis and priority ranking of the WHO Emergency Preparedness Components and Attributes indicates that Building Block 2: Human Resources, should be the government's lowest priority to ensure emergency preparedness. However, human resources for health is ranked the top priority by the MOH in the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021. This is the area of largest discrepancy from the findings in this report. Similar to these findings, in the EPR, health workforce is only mentioned in terms of the need to conduct full drills, table-top (conceptual) exercises, specific component exercises of the epidemic preparedness plan. Timing and specifics of health workforce improvements beyond that are not provided.

Table 16. Emergency Preparedness Assessment Results

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
2. Health workforce	2.1 Human resources for health-sector emergency management	15. Development of human resources	1
	SCORE=1.00	16. Training and education	1

Building Block 3: Health Information Systems

Objective 1: Liberian Health System Capacities, 2009–2014

Table 17 illustrates interventions that occurred at the central and county levels, the level that the intervention was intended to impact, and the areas assessed as part of the RBHS baseline and endline capacity assessment, conducted in 2012 and 2014, respectively.

Table 17. RBHS Project Capacity Strengthening for MOH Health Information Systems

	RBHS Intervention/Technical Support Areas	Capacity Building Level	Sub-component Evaluated in RBHS Capacity Assessment of MOH
BB3: health information systems	Analysis and visualization of data to improve use of information for decision-making	Individual, organizational, systems	-Health information systems -Other management information systems
	Scale-up of electronic DHIS2	Individual, organizational	
	Integrated data systems and enterprise architecture for HIS design	Systems	
	Coordination of national household surveys (e.g., timing of data collection and level of sampling)	Systems	

The Liberian National Health Policy and Plan, 2011–2021 gives high priority to the development of a decentralized HMIS as an integral part of the national health system. The aim of RBHS capacity building under BB3 was to improve HMIS performance, defined as the production of quality data, and use of the information generated for improved decision-making. This was done through: 1) improving the system components required for HMIS functionality; 2) improving individual staff

capacity at all levels; and 3) creating an organizational environment conducive to the use of information for decision making. RBHS also contributed to the development of HMIS policy and strategy documents, data recording and reporting instruments, and computer equipment.

To measure HMIS performance, RBHS used the Performance of Routine Information System Management (PRISM) tools that are based on the PRISM framework. This framework promotes strengthening HMIS performance through better data quality and improved information use. It assesses the technical issues related to data generation, and also organizational and behavioral factors that hinder the effective use of information. An initial assessment undertaken in Bong, Nimba, Lofa, and Grand Bassa counties in May 2012 led to the establishment of a baseline to develop an HMIS strengthening action plan. A second assessment was undertaken in May 2014.

RBHS Activities

A strategic and operational plan for strengthening the HMIS in Liberia was designed and implemented by RBHS based on these findings. Various interventions to strengthen the system components as well as the HMIS individual and organizational capacity were implemented from 2012 to 2014. These included:

- Reviewing the list of essential indicators in 2009 and again in 2014. The process was guided by national health priorities and involved stakeholders including data producers and users. RBHS assisted with the initial design of community-based indicators and data collection instruments for the planned community-level health management information system (C-HMIS). RBHS also developed human resource

- indicators and instruments and facilitated the introduction of integrated human resource information system (iHRIS).
- Replacing the DHIS1.4 with the DHIS2 application for HMIS data management and customizing it for use in Liberia. To further strengthen data management, RBHS assisted with the design of a C-HMIS data entry and management module as well as the introduction and customization of the iHRIS application for HR data management. RBHS also assisted with the development of a data warehouse linking DHIS2 and iHRIS4 using interoperability standards.
 - Developing and institutionalizing the new HMIS (based on DHIS2 software). NGOs contracted to provide the BPHS were required to report directly to RBHS and into the government's HMIS. RBHS triangulated NGO and HMIS data with regular, random spot check of registers in health facilities from every NGO to improve the quality of data, thus significantly strengthening and operationalizing the new HMIS. RBHS supported monthly data reviews with the NGOs and central MOH and CHT monitoring and evaluation staff, as well as quarterly data reporting; thus helping to build the capacity of the MOH at central and county levels to document health services provision and utilization.
 - Operationalizing and institutionalizing data quality assurance (QA) by setting up data verification and QA mechanisms based on desk reviews of data before entry at the facility and county levels, and regularly comparing data recorded with data reported.
 - Using information for decision making. RBHS assisted with increasing the functionality of DHIS2 for data analysis and visualization by creating program

- specific and county dashboards. RBHS also assisted with creating incentivized indicators for performance-based financing.
- Organizing various HMIS in-service training activities on a range of topics for staff at the central MOH, CHT and district-level staff in project counties.
 - Creating an “information culture” within the central MOH and the three counties in which it worked, meaning that it helped to create an environment in which information is valued for decision-making. Some examples include linking the use of HMIS information with operational planning at all levels, institutionalizing data review/coordination meetings at the central MOH and county levels, and linking the use of HMIS information with PBF in selected counties.^{clxxiv}

Changes in Health Information System Capacity

All four county health offices and a random sample of 76 health facilities (19 health facilities per county) were surveyed, and about 360 health managers and staff from these institutions were interviewed using the PRISM framework and tools.

Data quality varied from facility to facility, depending on the implementing partners with which they were associated. Data accuracy ranged from 38% in August 2011 to 46% in February 2012. While 91% of the health facilities submitted monthly reports to the county health offices, only 75% of these reports were submitted by the reporting period deadline. In general, use of HMIS information was low at both the county and facility levels. Less than 20% of health facilities received feedback on their monthly reports. Evidence of use of HMIS findings in the decision-making process was observed in only 38% of the facilities^{clxxv}.

The PRISM assessment was repeated in May 2014. Results showed a substantial improvement in HMIS performance. Data accuracy in health facilities increased from 46% in 2012 to 83% in 2014. At county level, it increased from 78% in 2012 to 88% in 2014. Data completeness in the facilities increased from 52% to 79%. Use of information was estimated at 58%, a substantial increase compared to the 38% of 2012. Also HMIS processes such as data analysis and feedback given to health facilities increased substantially.^{clxxvi clxxvii}

Table 18: Comparison of PRISM Assessments 2012 – 2014

HMIS INDICATORS – LEVEL:	Facilities		County	
	2012	2014	2012	2014
PERFORMANCE OF THE HMIS				
Quality of data				
Overall accuracy	46%	83%	78%	88%
Data completeness in facilities monthly reports	52%	79%		
Completeness of monthly reports at county level			91%	98%
Timeliness of reports of health facilities at county level			74%	88%
Use of information	38%	58%		75%
PROCESS				
Feedback to health facilities	20%	49%		50%
Data analysis: Performing at least two types	15%	51%		100%
Presentation of data	45%	68%		54%

Source: Improving HMIS Performance: Measurement and Interventions, RBHS project, JSI Research & Training Institute, Inc. 2014

As part of the transition plan, RBHS classified interventions into three categories:

(1) mature interventions; (2) developing interventions; and (3) initiated interventions.

Mature interventions were ready to be managed independently by the MOH without further technical support; however developing and initiated interventions would need

further support and resources from donors and partners.²⁰

Table 19: Status of RBHS-supported HMIS Interventions, July 2014

TRANSITION STATUS OF HMIS INTERVENTIONS		
Mature Interventions	Developing Interventions	Initiated Interventions
<ul style="list-style-type: none"> • DHIS2 data entry and management • PRISM assessment using Lot Quality Assurance Sampling • Use of information based on problem solving techniques 	<ul style="list-style-type: none"> • iHRIS data entry and management • HMIS review: training of staff • Quarterly health review meetings at county level • Scaling up of routine DQA 	<ul style="list-style-type: none"> • Scaling up of C-HMIS • Interoperability between DHIS2 and iHRIS • Use of information at health facility level • Sustainable management of HMIS printed supplies

Source: Improving HMIS Performance: Measurement and Interventions, RBHS project, JSI Research & Training Institute, Inc. 2014

Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System

As seen in Table 18 above, as of July 2014, the beginning of the Liberia Ebola epidemic, there was not yet a functioning system to collect community-level data (e.g., health services provided by gCHVs). Though the iHRIS was in place at the central level and interoperability programming with the existing HMIS (DHIS2) underway, human resource data was only just being captured and entered, and only for the FARA counties (i.e., number of staff, by cadre, at each facility). Due to resistance at multiple levels, capturing and correcting long-established double counting and ‘ghosts’ and other inaccuracies in the system (e.g., dead people receiving ongoing salaries, people receiving salaries for simultaneous posting in two counties), caused the data entry process to be

²⁰ Mature interventions: has an institutional home in the MOH (HMIS unit); clear procedures; knowledgeable staff at multiple levels of the system; may need more attention to quality; county implementation; roll out to additional counties.

Developing interventions: has an institutional home and/or point person in the MOH; needs additional technical assistance in the form of coaching, QA, ongoing scaling up.

Initiated interventions: started at a relatively small scale, with limited technical or geographic coverage; institutional home and/or point person in MOH is not yet formalized; likely to need substantial technical support, resources to move through developing and maturing stages.

slow and arduous.

The vital statistics system was also in its infancy in 2014, with low levels of birth and death registration, and the surveillance system had limited capacity to detect and respond appropriately to events.^{clxxviii} Though every county health team had a designated position on the books for one or more disease surveillance officers, they may not have been fully staffed.^{clxxix} Epidemiologic surveillance and reporting was and continues to be a parallel system, not linked with the HMIS. Due to this, county surveillance officers were not explicitly targeted by RBHS or implementing NGOs for inclusion in RBHS-associated activities.

On the other hand, the completeness of DHIS reporting rates was good prior to the Ebola epidemic. On average, 80% of monthly reports were received from health facilities, both public and private, during 2012–2013 (n=659 facilities). Excluding Montserrat County where the majority of private facilities are—with notoriously low reporting rates into the national HMIS—reporting rates then were well over 90%.^{clxxx}

The Ebola outbreak created additional interest in the iHRIS. RBHS and the MOH were approached by other implementing partners interested in building off of the iHRIS system to develop a mobile messaging system that would use telephone contacts of staff contained in iHRIS to broadcast various types of messages to health workers. This became an opportunity to accelerate and expand RBHS' support to data entry for iHRIS beyond the three FARA counties and Montserrat, and to potentially speed up communication with health workers in the crisis. RBHS supported clerks for an intensive data entry period that resulted in more than 7,000 records from all counties. This massive

effort has also provided the Personnel office with a list of unverified personnel; or those with missing information, and thus the opportunity to validate and cross-check payroll records, which was met with great resistance prior to Ebola.

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities

The analysis and priority ranking of the WHO Emergency Preparedness Components and Attributes shows that Building Block 3: Health Information, should be the government's third top priority to ensure emergency preparedness, after supply chain (BB4) and service provision (BB1).

Table 20. Emergency Preparedness Assessment Results

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
3. Health information	4.1 Information-management systems for risk-reduction and emergency preparedness programs SCORE=0.63	21. Information system for risk assessment and emergency preparedness planning	0
		22. National health information system	1
		23. National and international information-sharing	1
		24. Surveillance systems	0.5
	4.2 Information-management systems for emergency response and recovery SCORE=0.00	25. Rapid health-needs assessment	0
		26. Multi-sectoral initial rapid assessment (IRA)	0
		27. Emergency reporting system	0
	4.3 Risk communication SCORE=1.00	28. Strategies for risk communication with the public and the media	1
		29. Strategies for risk communication with staff involved in emergency operations	1

Component 4.1 Information management systems for risk-reduction and emergency preparedness programs

While Liberia now had a functioning HMIS, indicators of emergency preparedness are not captured (attributes 22 and 23). In terms of surveillance systems, the GOL is working with WHO and CDC to create an integrated disease surveillance and reporting and early warning systems (albeit, not integrated with other parts of the health system) (attribute 24 under component 4.1 as well as attribute 29 under component 4.3). The Investment Plan ranks surveillance and early warning and alert response (EWARN) as the third highest priority. However, the plan separates early warning and surveillance systems from other types of health information, which overall is assigned a lower rank of five out of the six priorities. The EPR Plan makes only cursory mention that ongoing risk assessment is needed at county and district levels so that early warning alerts can be issued.

Component 4.2 Information-management systems for emergency response and recovery

The EPR Plan proposes an emergency management dispatch and call center, but no suggestion of who would man the center, where it would be housed and supported, and how the associated suggested systems will be put in place and supported (e.g., the rapid response team membership is up to the County/District Health Officers to identify as needed, and without clear ‘first responders’ as in other countries, it may prove to be a time-consuming undertaking to identify and convene the team when needed in an

emergency).Further, there is a lack of clarity on the proposed call center—is only to be established during an emergency? How would it be advertised and promoted?

Component 4.3 Risk Communication

As a result of the Ebola epidemic, some strides have been made to improve risk communication. There is a newly proposed Press and Public Affairs Unit within the MOH, and the EPR Plan emphasizes that solid risk communication is needed both among staff and with the public and media. The plan noted that while engagement strategies will depend on the situation, they may include media (which would mean primarily radio in Liberia), social media (which is not widespread as smartphone ownership is very low), mass awareness campaigns and health promotion, social mobilization and community/stakeholder engagement. To disseminate risk information to the public during emergencies, the plan suggests collaboration between the proposed Press and Public Affairs unit at MOH and the Ministry of Information, Culture and Tourism in order to hold regular press conferences during emergencies. However, other than that, the plan provides no specificity on how to implement the other recommendations in the Liberian context. The EPR plan simply states under risk communication that “Coordination of responses requires effective use of tools including mobile telephone, radio, newspapers, television, etc.” During the Ebola outbreak, the MOH’s central National Health Promotion Unit was tasked with risk communication responsibilities. Effective plans for emergency risk communication and the newly proposed Press and Public Affairs Unit need to be reconciled with the mandates of existing central ministry divisions and units.

Building Block 4: Access to Essential Medicines

Objective 1: Liberian Health System Capacities, 2009–2014

Table 21 illustrates interventions that occurred at the central and county levels, the level that the intervention was intended to impact, and the areas assessed as part of the RBHS baseline and endline capacity assessment, conducted in 2012 and 2014, respectively.

Table 21. RBHS Project Capacity Strengthening for MOH Supply Chain System

	RBHS Intervention/Technical Support Areas	Capacity Building Level	Sub-component Evaluated in RBHS Capacity Assessment of MOH
BB4: access to essential medicines	Stakeholder consensus building in FARA counties on gradual transfer of supply chain management (SCM) functions from central level (SCMU-NDS) to the CHTs	Individual, organizational	-Access and rational use -Public-private partnerships around medicines and technologies
	New approaches to pharmacovigilance (e.g., Interim Approach)	Individual, organizational, systems	-Supply management -Quality and safety of medicines
	Supply chain management	Individual, organizational	

Efficient procurement and distributions systems are vital to the provision of the essential health services. And in fact, the supply chain has been a priority issue on the MOH's agenda for many years. The Supply Chain Master Plan (SCMP), developed in 2010 with support from JSI, continues to be the guiding document for supply chain improvements in Liberia. The supply chain outlined in the SCMP is a pull system in which lower levels (facilities to counties, counties to central) determine needs and place orders to higher levels based on the data derived from the current Logistics Management

Information System (LMIS). The central-level National Drug Store (NDS) and county capacities for warehousing were intended to be used, and deliveries were intended to be quarterly from central to county and monthly from county to health facilities.

However, the system was facing marked gaps, inefficiencies and theft of commodities. Factors such as limited road infrastructure, unsuitable storage, limited warehousing capacity, inventory and warehouse management practices, and limited information sharing have led to frequent stock-outs of commodities, uncertain drug quality, and a general lack of confidence.

As a stop-gap mechanism, CHTs have resorted to direct and local procurement in order to manage their own individual supply chains, with the unintended consequence of introducing counterfeit, expired, or damaged products into the system from private sellers with ill-equipped storage facilities and practices. In addition, the increased fragmentation adds to the burden on the national system by adding unnecessary, duplicative costs while also contributing to lack of visibility, misallocation of resources, misalignment of supply and demand and general underperformance.^{clxxxix}

To address significant transparency issues, the USAID | DELIVER Project (also led by JSI) implemented the “Interim Approach” (IA) in 2014; a system to deliver health commodities and conduct data verification, while simultaneously strengthening the NDS’s capacity. The IA only included select family planning and malaria commodities instead of the complete Essential Drug List of medicines and commodities. An evaluation of the IA system and subsequent update of the SCMP took place in 2015.

There is large variation in how the supply/distribution/storage of essential

medicines is handled in each county. Through the IA, malaria and FP commodities are handled from NDS to the county depots and out to the facilities in a top-up model (as opposed to the pull model outlined in the SCMP). The rest of the essential medicines are fragmented and handled by different NGO programs in each state (Africare, Merlin, etc.), who have their own reporting / quantification / storage processes. Further, the IA was funded through USAID (via the RBHS bi-lateral) for the three FARA counties (Bong, Lofa, Nimba) but via Global Fund for the other 12 counties (via centrally funded/vertical programs including HIV and TB commodities); both with separate reporting requirement to their respective donors.

In the FARA counties, the IA drugs were purchased by RBHS, and or managed by RBHS implementing partners Africare (Bong and Nimba) and IRC (Lofa), while the vertical program drugs were channeled through the central mechanism. The RBHS county staff assisted the Supply Chain Management Unit (SCMU), USAID|DELIVER, and the RBHS implementing partners to organize the quarterly distribution of drugs in the FARA counties. They also assisted facility staff in filling in the Stock Balance Reporting and Requisition (SBRR), the main LMIS report. RBHS provided support to the SCMU and CHTs to prepare for gradual decentralization of commodity management to the county level, and to ensure an uninterrupted delivery of essential drugs in Bong, Lofa and Nimba counties.^{clxxxii}

The 2015 IA assessment found overall availability of products improved during the IA, from approximately 28% at the start of the IA to over 70% during the last round. However, stock outs are still relatively common, and at the start of almost every

distribution round, 40–60% of facilities were stocked out of or had less than two months of malaria products while 20–60% of facilities were stocked out of or had less than two month of family planning products (rates varied by individual products and counties). Despite this, health facility personnel across all counties consistently feel that the program products have become much more available under the IA and that stock outs, when they occur, do not last as long as they did before the IA.^{clxxxiii}

However, the assessment found that the IA has not consistently been delivering products according to schedule. Figure 35 shows that even prior to Ebola was declared an emergency by the GOL in June 2014, the timing for delivery rounds was off-schedule, occurring closer to every four months rather than every three months as designed.

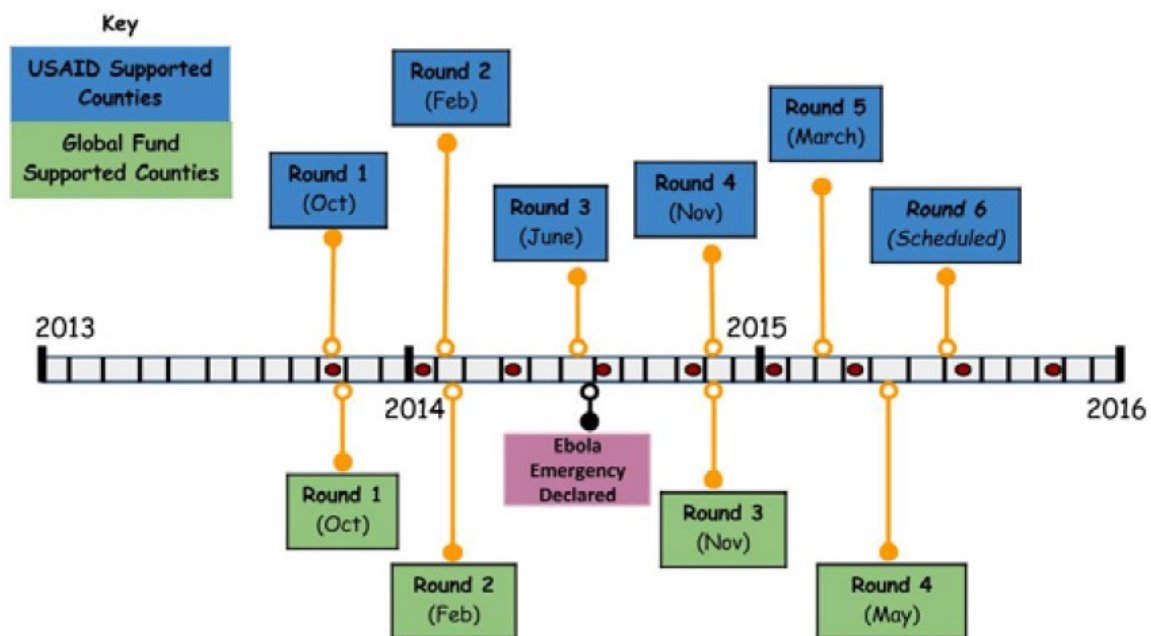


Figure 35. IA Delivery Schedules from Counties to Facilities^{clxxxiv}

In addition, most county delivery teams across rounds failed to follow order fulfillment guidelines across all products and consistently over or under supplied

facilities with products by more than five percent of the required amounts.

At the facility level, most staff are unaware as to the source or system by which drugs and commodities are received in the facility, which means they are not able to hold the delivery teams or counties accountable for how much product facilities received or when it would arrive. To address this with the IA system, as of Round 3 they instituted the IA data form, and in the subsequent round facility staff were able to produce signed copies of the IA data form (i.e. the delivery round waybill) showing signatures of the delivery team, the facility officer in charge, as well as a community representative confirming receipt of the products.^{clxxxv}

According to the 2015 assessment, CHTs also had limited information or involvement in NDS deliveries from central to county level, and thus limited ability to hold the higher level accountable. At the NDS, however, the IA showed significant NDS management improvements likely due to the secondment of a USAID | DELIVER PROJECT Warehouse Advisor to the NDS. IA commodities were well organized, managed and secured within the NDS compound. The records, both manual and electronic, indicate strong inventory control overall.^{clxxxvi}

Overall, the IA showed some improvements in stock availability, as well as notable improvements in data visibility and NDS management, and thus strengthened accountability at each level, though communication and coordination between levels is a clear gap. Also, both central level management and NDS warehouse management are run by external partners and donors, and thus the assessment findings may be masking ongoing capacity weaknesses.

Another issue with the IA is financial sustainability. The distribution rounds completed since late 2013 to June 2015 have cost approximately \$2 million. Not only is the IA a costly experiment, but in 2006, the post-war National Health Policy defined the Basic Package of Health Services containing clinical services, including pharmaceutical services, that could be delivered free of charge to the population.^{clxxxvii} The continued provision of free drugs and commodities to all Liberians is not in line with recent rethinking of sustainable health financing schemes currently under development.

Finally, in addition to central level deficits in the supply chain system and NDS, counties face understaffed and inadequate warehouse space with no continuous and uninterrupted power supply for most facilities. None of the counties has adequate cold chain facilities, requiring the use of county hospital facilities which are already overburdened. Last mile distribution is a big challenge due to poor road conditions (only about 10% of the roads to county headquarters are paved).^{clxxxviii clxxxix}

A more integrated approach is needed, with the SCMP as a backdrop. There are several key issues that continue to hinder supply chain performance: (1) limited supply chain staff capacity; (2) continued issues with transparency of supply chain data and products; (3) need to align and update supply chain processes and procedures (including ensuring funds for distribution rounds are available at least one month prior to the distribution date); (4) need for integrated / coordinated system inclusive of all products on the Essential Drug List; and (5) need for improved coordination, including between donors funding various supply chain activities.

Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System

Despite the achievements of the IA in increasing commodity availability and accountability for malaria and family planning commodities, at the time Ebola first hit Liberia in March 2014, there was still no comprehensive, integrated, functioning supply chain system under the control of the MOH for the provision of the complete list of essential medicines and commodities to all health facilities.

For Ebola-related supplies and commodities, WHO took over procurement to the central level; the World Food Program (WFP) was mandated with distribution of commodities from the central to county depots, and JSI was responsible for distribution to all functioning (~656) public and private health facilities in the country on a monthly basis.

However, for non-Ebola-related supplies and commodities, the system faltered. As can be seen in Figure 35 above, there was one national round of IA distribution during the active Ebola epidemic in November 2014—both by USAID | DELIVER and by Global Fund. Again, these included family planning and malaria commodities, and in Global Fund counties also included TB and HIV drugs. According to the MOH, during the Ebola epidemic health facilities experienced shortages and stock-outs of 12 tracer medicines and vaccines by the second half of 2014. Largely via unregulated donations—weak regulation by the Liberia Medicines and Health Products Regulatory Authority (LMHRA) unable to cope with the influx of product—the market was flooded with pharmaceutical products.^{cxc}

The sudden increase in parallel supply chain systems (importation, storage and

distribution) added increased burden on regulatory authorities, plus pressure on NDS and county depots to absorb the vast quantities of PPEs and other Ebola-related products. According to MOH, due to uncoordinated donations and the disruption of health services during the EVD outbreak, Liberia now has large volumes of expired drugs that need to be properly destroyed, and the weak regulation of pharmaceutical products and supplies has facilitated the importation of counterfeit medicines.^{cxci}

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities

The analysis and priority ranking of the WHO Emergency Preparedness Components and Attributes shows that Building Block 4: Medical products, vaccines and technology, is the least well performing component of the health system and should be the government's top priority in terms of emergency preparedness. Even following the Ebola epidemic—which facilitated some improvements in each of the other building blocks in terms of future emergency preparedness—the supply chain saw none.

Table 22. Emergency Preparedness Assessment Results

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
4. Medical products, vaccines and technology	3.1 Medical supplies and equipment for emergency-response operations SCORE=0.00	17. Medical equipment and supplies for prehospital and hospital (including temporary health facilities) activities and other public health interventions	0
		18. Pharmaceutical services	0
		19. Laboratory services	0
		20. Blood services	0

While international NGOs filled the gap in laboratory capacity during the epidemic (attribute 19), Liberia continues to have marked challenges in this area,

including no national Quality Assurance Laboratory to test all incoming and outgoing medicines that circulate in the Liberian market for their quality and safety for consumption; no in-house ability to conduct rapid and reliable laboratory confirmation; and chronic under-enrollment in lab training schools. The healthcare quality assurance assessment of the past three years showed laboratory services receiving the lowest scores. There was no evidence to suggest a sustainable increase in systems-level government laboratory capacity as a result of Ebola ^{excii}

Despite these low scores, the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021 ranks supply chain/medical products, vaccines and technology a relatively low priority four out of six priorities. ^{exciii} The plan proposes that in the event of an emergency, WHO/CDC will work with the MOH to develop a logistics management system and then WFP will be responsible for logistics. Similarly, the EPR Plan notes that in the event of a future epidemic, an emergency supply chain system will be initiated by MOH and WHO/CDC, with WFP responsible for logistics. During an emergency, WHO typically takes over procurement of emergency supplies and commodities to central stores, and WFP then transports goods to regional level (e.g., counties in Liberia; districts in other countries). Due to the large size of the WFP trucks, they typically do not do ‘last mile distribution’, i.e., distribute to health facilities, since the vehicles are often unable to navigate poor, rural roads.²¹ As a result, last mile distribution is reliant on the national supply chain management and routine distribution

²¹ In fact, due to challenges in getting up and running in Liberia, JSI took over distribution from the central stores to the county level for the first four months of the epidemic while WFP established operations. JSI also ensured that drug depots/storage facilities were available at the county level prior to the installation of temporary drug units.

system. In the case of Liberia, where the system is not functioning, international organizations, in this case JSI, needed to take over responsibility of last mile distribution to every health facility. The recommendation in the Investment and EPR plans is thus incomplete in the Liberian context.

Overall, the EPR Plan contains critical recommendations and proposed structures that would ideally be in place. However, it is clear that the plan is based on plans in countries with more robust and established health and emergency response systems and infrastructure in place (e.g., the presence of formal first responders such as fire and paramedical staff, vehicles and equipment, emergency information systems). As a result, many of the recommendations are not feasible to implement unless they are formally integrated into existing HSS activities and donor-funded programs.

Building Block 5: Health Systems Financing

Objective 1: Liberian Health System Capacities, 2009–2014

Table 23 illustrates interventions that occurred at the central and county levels, the level that the intervention was intended to impact, and the areas assessed as part of the RBHS baseline and endline capacity assessment, conducted in 2012 and 2014, respectively.

Table 23. RBHS Project Capacity Strengthening for MOH Health Financing

	RBHS Intervention/Technical Support Areas	Capacity Building Level	Sub-component Evaluated in RBHS Capacity Assessment of MOH
BB5: health systems financing	Support implementation of an electronic accounting system at county level	Organizational and systems	-Revenue collection and pooling
	Universal healthcare planning (e.g., LHEF)	Systems	-Payment mechanisms: provider
	Performance based financing	Organizational and systems	-Payment mechanisms: beneficiary
	Sector wide approaches and pool (basket) funding	Systems	-Resource allocation

The National Health and Social Welfare Financing Policy and Plan (NHSWFPP) 2011–2021 was developed with the goal of ensuring affordable health services and preventing catastrophic household costs. The NHSWFPP proposes a mix of health funding including sustainable government financing, predictable donor support, affordable user fees for selected services, mechanisms for risk pooling and appropriation from value-added tax. ^{cxciiv}

Performance based financing

The MOHSW introduced performance-based contracting as a component of its five-year transitional National Health Policy and Plan in 2007. The rationale for PBC in Liberia was to help build public sector systems and capacity while continuing to harness existing service delivery capacity of NGOs during the post-conflict period. From 2009–2012, RBHS contracted and managed five NGOs (IRC, EQUIP, Africare, MTI, and MERCI) to deliver the BPHS in seven counties (Bomi, Bong, Grand Cape Mount, Lofa, Montserrado, Nimba, and River Gee). A total of 118 health facilities with a catchment population of 770,000 were covered.

As noted above under Building Block 1: Health Services, Liberia saw notable improvements across a wide range of health services under the JSI-managed PBCs, as well as increased access to and utilization of services.^{cxcv}

Universal healthcare planning

RBHS was requested by the MOH to explore feasible mechanisms to provide health insurance to the Liberian population with the ultimate, eventual goal of sustainable universal health coverage (UHC). One of the central aims of UHC is to ensure that all people have access to health and health care without the risk of financial impoverishment. Health financing reform—specifically health insurance—has been widely recognized as a key intervention strategy to increase financial protection and access to health care.

In 2011, the Liberian government initiated discussions about potential financing mechanisms for health to move towards UHC. In 2011, Oxford Policy and Management conducted two studies on the pre-feasibility of community-based health insurance (CBHI) and social health insurance (SHI) and their potential roles in Liberia’s short- and medium-term health financing strategy. The conclusions were that the context in Liberia was not yet at a point where these mechanisms could be viable; the investigators argued that most of the factors contributing to the enabling environments of CBHI and SHI were only “weakly met.”^{cx cvi}

In 2013 there was renewed interest in health insurance at the MOH and RBHS subcontracted the Institute for Collaborative Development (ICD) to support the MOH to think through a transition from free care and put in place a health financing mechanism that would move Liberia on the road to UHC. With only one year left in the project, the

goal was to lay the groundwork for the eventual passing of legislation codifying a national health services purchaser. Planned activities were organized around eight domains: 1) oversight, policy, and legislation; 2) benefits package and provider payment; 3) financing; 4) enrollment; 5) purchasing agent and claims management; 6) service provision; 7) education / advocacy / marketing; and 8) knowledge acquisition. ^{cxvii}

In July 2013, RBHS conducted formative research for health financing reform and insurance design options, including a high-level meeting with President Ellen Johnson-Sirleaf. This was followed by capacity building including a Ghana study tour to witness a live, operational national health insurance system in action. The Liberian delegation consisted of senior officials from the MOH in health planning and health services, the Ministry of Finance, the Civil Service Agency, USAID, RBHS, and development partners. ^{cxviii}

JSI produced a report entitled *Universal Health Coverage in Liberia: Design Options and Roadmap*, developed and circulated in August 2013. The report emphasized a functional (as opposed to model-based) approach to health insurance, recommending a customized solution for Liberia that combines elements from various models of insurance (e.g., SHI, CBHI). In each function of a health financing system—revenue generation, pooling, purchasing, and service delivery—the report presented a range of options and suggested the most practical solution for Liberia’s context. Based on these recommendations, an indicative roadmap for implementation of a national health insurance system, with pre-legislation, post-legislation, and beyond phases, was presented to the MOH and USAID. ^{cxix}

Ultimately, the MOH proposed a geographically-phased introduction of the Liberia National Health Equity Fund (LHEF), to finance key services in the EPHS. The path to UHC is a continual process that entails trade-offs based on country context and prioritized values. The dialogue to date in Liberia has emphasized population coverage and equity—that all people should have access to health care without risk of financial burden. However, providing coverage to the entire population means ascertaining the amount of funding that can be sourced from the population and being careful with the types of services covered. Uncertain revenue generation potential and the experience of nearby Ghana have led to a reasoned, limited benefits package being proposed for the LHEF, based on the MOH's EPHS. In other words, the preference currently expressed in Liberia is to prioritize providing a limited package of services to the entire population.^{cc}

The LHEF generated positive momentum and attention at the highest levels of the government. Both President Ellen Johnson-Sirleaf and Health Minister Gwenigale publically announced and endorsed the forthcoming LHEF on multiple occasions including on the occasion of a meeting of West African health ministers in Monrovia under the auspices of the West African Health Organization. During this meeting President Sirleaf was explicit in her endorsement of the LHEF during remarks which drew heavily from a brief prepared for her by RBHS for the occasion.^{cci}

In January 2014, a first draft of the legislation was completed and submitted for review. As of May 2014, the second draft was in progress, but then progress came to a standstill with the onset of Ebola.

Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System

The Ebola impact was immediately and visibly felt in terms of people’s health and quality of life, but also felt in terms of dollars spent on healthcare interventions, and in lost productivity and educational setback resulting from public schools closing for an entire school year. Liberia’s financing system was not only ill-equipped to absorb the immediate costs of the outbreak, but will be bearing associated costs in the medium and long-term.

Resource allocation to counties is based on historical trends rather than needs.^{ccii} One frustration voiced in the RBHS endline capacity assessment in 2014 was that despite increased capacity to plan and budget according to need at the county level, the allocation never reflected the needed amount, nor was proportionate to population size or local epidemiology. Neither the Ministry of Finance, the Ministry of Development and Planning, nor the MOH apply a resource allocation formula for equitable financing.^{cciii}

Figure 36 highlights the disconnect between need and recent allocations to counties.

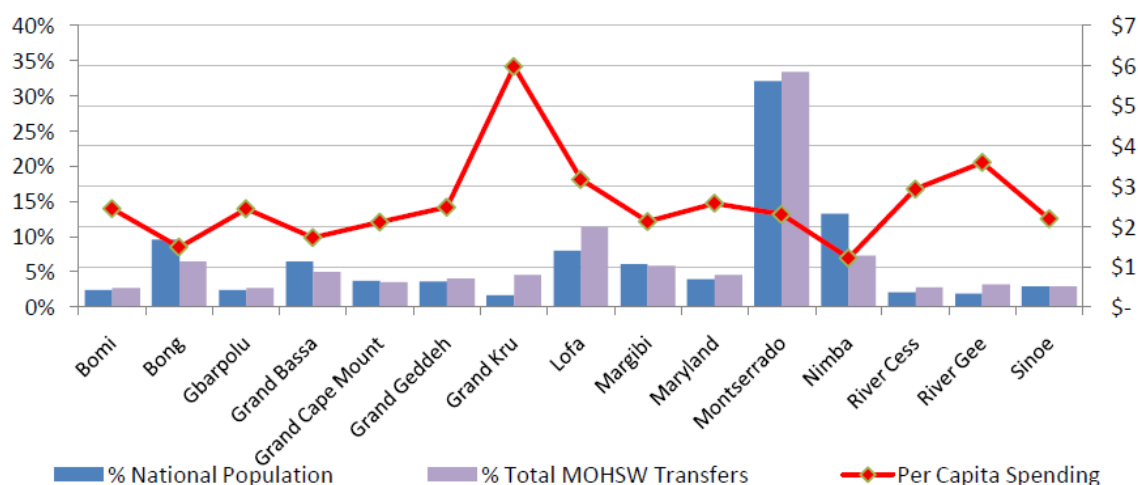


Figure 36: Distribution of MOH spending (USD) by county (2013/2014)

Source: Investment Plan for Building a Resilient Health System, 2015–2021

During Ebola, the GOL had to redirect resources from other sectors to health in order to cope with the devastation that EVD caused in communities and health facilities, including 372 EVD infections and 184 deaths among health workers in already underfunded health facilities.^{cciv}

Health financing reform also came to a standstill with Ebola. However, on February 10, 2016, President Ellen Johnson-Sirleaf appointed a Cabinet Committee on Health Financing. The Committee will serve as the Advisory Council for designing health financing reforms including the LHEF, and will include the Minister of Finance as Chair, the Minister of Health as lead technical advisor, Minister of Commerce, Minister of Foreign Affairs, Minister of Internal Affairs, National Investment Commission and the President's Legal Advisor.²²

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities

The analysis and priority ranking of the WHO Emergency Preparedness Components and Attributes shows that Building Block 5: Health Financing is among the most equipped health system components to be able to cope with a future emergency. However, while renewed progress is being made toward legislation toward universal health coverage, Liberia still lacks clear multi-sectoral strategies and mechanisms for financing emergency preparedness and management. The Investment Plan for Building a Resilient Health System, 2015–2021, ranked Health Financing last in terms of health system priorities.

²² USAID e-mail correspondence February 16, 2016

Table 24. Emergency Preparedness Assessment Results

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
5. Health financing	5.1 National and subnational strategies for financing health-sector emergency management SCORE=1.00	30. Multi-sectoral mechanisms of financing emergency preparedness and management	0
		31 Health-sector financing mechanisms	2

Building Block 6: Governance and Leadership

Objective 1: Liberian Health System Capacities, 2009–2014

Governance and leadership in health are cross-cutting issues that help drive the development of policies and ensure adequate oversight and regulation. The ultimate goal of effective governance is to ensure accountability at all levels, intrinsic to the success of any health system.

The Liberia MOH developed their decentralization policy in 2008 which included capacity building for county and district managers to address significant gaps in capacity for the overall coordination and management of services.^{ccv} In 2012, as RBHS was shifting from service delivery management to health systems strengthening, governance and leadership was one of the central MOH's strongest areas and one of the weakest for the CHTs.^{ccvi} Thus, in addition to continued central-level systems support in the areas of human resources and HMIS, a major focus of the RBHS project was to enable and empower CHTs to take on leadership roles, thus supporting and strengthening further health sector decentralization.

Table 25 illustrates interventions that occurred at the central and county levels, the level that the intervention was intended to impact, and the areas assessed as part of the RBHS baseline and endline capacity assessment, conducted in 2012 and 2014, respectively.

Table 25. RBHS Project Capacity Strengthening for MOH Governance and Leadership

	RBHS Intervention/Technical Support Areas	Capacity Building Level	Sub-component Evaluated in RBHS Capacity Assessment of MOH
BB6: governance and leadership	Improve communication between central and county levels	Individual and systems	-Level of decision making
	Policy development	Systems	-Institutional arrangements
	Licensure, accreditation, registration	Systems	-Accountability
	Decentralization	Systems	-Scope and location of service providers
	Sanctions/incentives for compliance (e.g., PBCs)	Individual and systems	-Consumer and stakeholder involvement

MOH Ownership over Capacity Strengthening

Over the life of the RBHS project, the MOH put several mechanisms in place to help sustain and expand the gains in capacity development.

First, *Regional Support Teams (RSTs)*, led by senior ministry staff, were assigned to the five regions. The RST mandate is to be a gateway to ensure timely assistance to counties through the provision of technical managerial, programmatic, financial and administrative support. Each team was comprised of representatives from various units in the MOH, RBHS advisors, and WHO advisors; now without RBHS advisors. RSTs were intended to be responsible for working with the counties to identify and respond to support and capacity needs at the county level. These needs were to be identified in part through Quarterly Review Meetings in which each county would present key health

indicators, engaging their RST and CHSWB members in a dialogue about what the data was suggesting, what was driving high/low performance, and to problem solve and plan for the next quarter. After county support needs were identified, the RSTs would then obtain responsive support from the MOH and/or its partners and follow up and document the results. Though initiated toward the end of RBHS in 2014, this mechanism seemed to have the potential to be a “one stop shop” to address one of the noted communications weakness in the system, county communication with the central Ministry.

Second, during the life of the RBHS project, the MOH hired a *full-time capacity-building coordinator* in the County Health Services Division, thus institutionalizing leadership and visibility to capacity-building efforts, in particular for the counties.

A third mechanism is the *contracting-in readiness assessment working group*, also housed within County Health Services, which was established to assess county readiness for contracting-in to deliver health services (as opposed to NGOs delivering services). This interdepartmental working group took the lead in completing the first round of county contracting-in readiness assessments and the County Health Services division has the mandate to strengthen county capacity for contracting-in.

In order to enhance county-level oversight, the *County Health and Social Welfare Boards were revitalized* and operationalized in the three focus counties in the second half of the project, and institutionalized support for their continued functioning was secured through various mechanisms including the PBF Unit and the contracting-in readiness assessment working group. The PBF scheme set up a Steering Committee as a sub-committee of the CHSWB to oversee the results of implementation of the scheme. The

MOH process for identifying county readiness for “contracting-in” included a review of the frequency and substance of CHSWB meetings, as evidenced in meeting minutes. The newly formed Regional Support Teams were intended to provide ongoing support as needed to strengthen the CHSWBs.

The development of RSTs and the contracting-in readiness assessment working group, as well as identifying staff responsible for capacity development within various units at the central MOH, show how the dialogue on capacity development has shifted within the MOH. These mechanisms are systems-level interventions with the potential to lead county capacity development. They are also indicators of the significance of continuous capacity-development within the MOH, especially in terms of moving counties toward decentralized management of health service delivery.

Internal Communications

The lack of internal communications procedures was a major contributing factor to the limited information sharing and dissemination at all levels of the MOH: central, CHT and facility. In 2013, RBHS began working with the MOH to improve internal communications. JSI first conducted an internal communications assessment at both the central and county levels. Four areas were identified as needing immediate attention: (1) non-existence of telecommunication channels at the central or county levels; (2) lack of SOPs governing internal communications; (3) lack of a communications unit (internal or external) within the MOH; and (4) a limited culture of information sharing.

Together with key MOH personnel, JSI developed an internal communications strategy for the MOH. As critical first steps, the MOH installed internet access in most central

MOH offices and rehabilitated the internal telephone system at the central MOH building. JSI also assisted the Administration Department to seek funding to rehabilitate the country's high frequency radio system, which connects all health facilities and county health offices to the central MOH. Following the Ebola outbreak, the MOH has also proposed a new unit in the MOH to handle external communications, the Bureau of Press and Public Relations (to be staffed with two people).

Health Workforce Performance Management

In 2013, the Civil Services Administration (CSA) finalized their Performance Management Handbook, the Civil Service Standing Orders and the Code of Conduct for the Civil Service. This led to the opportunity to develop and disseminate a MOH-specific health workforce performance management handbook. However, the draft guidelines were put on hold as attention was turned to the health worker strikes.

Competing with ongoing human resources challenges, such as the issue of salaries and placing workers on the government payroll, engaging leadership in performance management discussions was a challenge for RBHS. These issues are also affected by the concurrent Public Sector Reform process and the recent Global Fund requirement that its supported staff be transitioned to GOL payroll within a defined time frame. However, restoring services in the aftermath of Ebola may be creating another opportunity to introduce the system as health workers return to work in a changed mindset.

Program Management

In 2013, RBHS initiated capacity building in program management for three central MOH units—National Malaria Control Program, Community Health Division and the Infrastructure Unit—as well as for the three counties prioritized under the second half of the RBHS project—Bong, Lofa and Nimba counties. An organizational assessment was completed followed by the development of institutional terms of reference that were consistent with the overall direction of the MOH toward leaner overall structures, with more focus on policy, strategy and resource mobilization than actual implementation. Related organograms (at times representing fewer future central level positions) and job descriptions in a format supported CSA were developed. However, it was reported by RBHS staff that engaging MOH staff in the development of the program terms of reference and individual job descriptions was challenging as the fear of losing jobs affected the content and quality of participation.

Objective 2: Impact of 2014–2015 Ebola Epidemic on the Liberian Health System

With the onset of the largest Ebola epidemic in history, the still fragile health system necessitated another massive humanitarian response, where humanitarian organizations once again flooded the country and implemented activities, often with no MOH coordination or oversight.^{ccvii} MOH requests for activity reports from Ebola relief organizations, through the newly established Infection Prevention and Control (IPC) taskforce, were largely ignored.²³ The MOH was already dealing with four recent health

²³ Personal correspondence with Dr. Luigi Ciccio, former Project Director of JSI's Office of Foreign Disaster Assistance funded IPC Activity.

worker strikes for insufficient and inconsistent receipt of salaries from the central level, including ones in March and April, 2014, right when the first cases of Ebola were hitting Liberia.

Over half of all health facilities shuttered their doors during the Ebola epidemic, and lack of functioning internal communication systems prior to the epidemic, plus no functioning and integrated disease surveillance and communication system from the community-level up significantly impeded the central government's ability to maintain essential health services throughout the epidemic. The lack of clear communication to the public, combined with high health worker infections and deaths, further undermined confidence in the public health system, and in the government's ability to govern and manage the epidemic.

Chronically inconsistent under-funding to meet the HSS needs across all six building blocks prevented effective delivery of health services prior to Ebola. Overburdened and inadequately trained staff receiving inconsistent salaries from central government; completely inadequate water, sanitation and hygiene facilities in health care settings and associated lack of routine universal precautions and IPC practices among health staff; incomplete data and surveillance system with no system to gather and incorporate data collected at the community level into the existing HMIS; insufficient laboratory and diagnostic capacities; no existing experience in contact tracing; a supply chain system fraught with seepages and heavily dependent on external implementing partners for routine management; and weak MOH internal and external communications systems. All these health system weaknesses contributed to a breakdown in the central

and county level MOH to respond and manage the Ebola epidemic effectively, which essentially diverted almost all of the health sector's attention to Ebola surveillance and response for more than half of 2014.^{ccviii} This led to the neglect of other health priorities and services, as evidenced under health service provision building block 1 above.

Objective 3: Liberian Crisis-Preparedness Gaps and Government Priorities

The analysis and priority ranking of the WHO Emergency Preparedness Components and Attributes show that some real progress has been made in Building Block 6: Leadership and Governance in order to improve the country's future response to emergency management *specific to another epidemic*. Just as with financing, Liberia still lacks clear multi-sectoral frameworks and strategies for managing and preparing for future emergencies, caused by infectious diseases or other causes.

Table 26. Emergency Preparedness Assessment Results

WHO Building Block	16 Key Components	51 Essential Attributes	Implemented (2) Planned (1) Absent (0)
1. Leadership and governance	1.1 Legal framework for national multi-sectoral emergency management SCORE=0.00	1. Laws, policies, plans and procedures relevant to national multi-sectoral emergency management	0
		2. National structure for multi-sectoral emergency management and coordination	0
	1.2 Legal framework for health-sector emergency management SCORE=1.33	3. Laws, policies, plans and procedures relevant to health-sector emergency management	1
		4. Structure for health-sector emergency management and coordination	2
		5. Regulation of external health-related emergency assistance	1

1.3 National institutional framework for multi-sectoral emergency management SCORE=1.00	6. National committee for multi-sectoral emergency management	1
	7. National operational entity for multi-sectoral emergency management	1
1.4 National institutional framework for health-sector emergency management SCORE=0.33	8. National committee for health-sector emergency management	0
	9. National operational entity for health-sector emergency management	1
	10. Mechanisms of coordination and partnership-building	0
1.5 Components of national programme on health-sector emergency management SCORE=0.75	11. National health-sector program on risk reduction	1
	12. Multi-sectoral and health-sector programs on emergency preparedness	0
	13. National health-sector plan for emergency response and recovery	1
	14. Research and evidence base	1

The Investment Plan for Building a Resilient Health System, Liberia, 2015–2021 ranked Leadership and Governance low; fifth out of six health system priorities. Some improvement has been seen under this building block as a direct result of Ebola. With funding from the CDC Foundation, Liberia now has a permanent Emergency Operations Center in Monrovia located in back of the Central MOH in order to coordinate future response efforts and help prepare the country for future health emergencies.^{ccix}

Component 1.1 Legal framework for national multi-sectoral emergency management

Though not yet validated, the national legislature has passed the EPR Plan initiated by the EPR Consortium, including the Liberian National Red Cross Society. The

EPR consortium has developed EPR and other plans, however they are not being integrated into larger multi-sectoral emergency management plans. According to EPR Consortium members, due to the recent push for “One Health” there has been more engagement with the Ministry of Agriculture, and regarding the flood response in Margibi there has been more engagement with the Ministry of Internal Affairs. Nonetheless, overall there still seem to be gaps in inter-ministry coordination to respond to emergencies.²⁴

Component 1.2 Legal framework for health-sector emergency management

The National Epidemic Preparedness and Response plan itself is an example of a legal framework for health sector emergency management. The recommendations contained therein call for initiation of an IMS and associated organogram in the event of an epidemic emergency. While this is the best addressed component, effective transfer of IMS responsibilities to the MOH, once the current epidemic response IMS is deactivated, will be necessary to maintain progress related to this component. An Emergency Operations Center (EOC) was constructed in back of the central MOH. All counties are in the process of developing a disaster management plan that will sit in the office of the superintendent—the first one was developed in Lofa in late 2015.

Component 1.3 National institutional framework for multi-sectoral emergency management

²⁴ Personal correspondence with former RBHS staff and current Liberia EPR Consortium members.

A Presidential Advisory Committee on Ebola (PACE) and a National Task Force on Ebola (NTFE) were formed, but as the IMS is being decommissioned, the future status of PACE and NTFE are unclear. Further, these are structures specific to Ebola, not to any other epidemics and not for emergencies caused by other hazards.

Component 1.4 National institutional framework for health-sector emergency management. While not explicitly mentioned in either of the plans, there is a nascent QA unit within the MOH. Further, the IMS serves as the national operational entity for health-sector emergency management, though once decommissioned, IMS responsibilities will be transitioned over to the National EPR Committee, which will be housed in the Division of Disease Prevention and Control with the Division Director acting as de facto chair.

Component 1.5 Components of national programme on health-sector emergency management. The April 2016 EPR plan is the national health sector plan for emergency response and recovery. It talks briefly about (attribute 14) research and evidence base, but not on how to operationalize/integrate into existing systems and efforts. Building on the *Keep Safe, Keep Serving* IPC training and supervision curriculum and SOPs developed early in the Ebola epidemic, *Safe Quality Services* (SQS) curriculum replaced it as the national guidelines on recommended facility-based risk reduction. A QA Unit within the MOH is still in the early stages of development.

CONCLUSIONS AND SUMMARY RECOMMENDATIONS

Creating Resilient Health Systems against Modern Disruptions

Throughout history, there have been numerous events that have caused societal disruptions. However, according to Judith Rodin, President of The Rockefeller Foundation, three disruptive phenomena are distinctly modern: urbanization, climate change, and globalization.^{ccx} Scientist Brian Walker at the Stockholm Resilience Centre suggests that evidence points to a future where periods of abrupt change are likely to increase in frequency and magnitude.^{ccxi} Such change will come from climate impacts, and other drivers related to urbanization and globalization such as land use changes for agriculture, livestock, and resource extraction. Abrupt change challenges the adaptive capacity of societies and their health systems, underscoring the importance of the concept of resilience.

In the face of a crisis or abrupt change, a resilient health system is one that can effectively respond while at the same time maintaining basic functioning, ideally not reversing years of realized gains in health outcomes. Maintaining basic functioning while addressing a crisis requires that a health system has incorporated emergency preparedness at all levels—individual (behavioral), organizational (health unit), systems (policies and regulation)—and has aligned everyday public health activities with activities associated with emergency management.

Unfortunately, emergency preparedness and response initiatives are often viewed as add-on activities to HSS; not aligned to the core health system functions and operations. This is the case in Liberia with the Investment Plan for Building a Resilient

Health System, 2015–2021—the national plan developed in response to the 2014–2015 Ebola epidemic. It was also, until relatively recently, the case in the United States where emergency preparedness and response were largely under the purview of law enforcement, fire and emergency management agencies, with substantially different organizational cultures from public health.^{ccxii}

The move to integrate emergency management into the US public health system has largely commenced following the World Trade Center attacks on September 11, 2001, and subsequently in response to heightened fear of biological weapons. Since then, US health systems have been cited as having effective integration of emergency management and public health, and thus held up as examples of highly resilient systems. For example, during the Boston Marathon bombing, not only did public health, law enforcement and emergency management services work seamlessly together during the crisis, but the community was both informed of events in real time *and* actively engaged as part of the response (e.g., through identification and coordination of volunteers at the scene).^{ccxiii}

However, rather than broadening the definition of HSS to be inclusive of public health and emergency preparedness and crisis management features, as has been done in the United States, a discourse on the need to create resilient systems based on new academic criteria is evolving for application in the developing world. Despite the myriad of new resilience frameworks being developed, none provide additional clarity or utility beyond established emergency preparedness concepts in helping countries develop and implement resilient health systems, as has been done in the US.

Inclusive of emergency preparedness and response initiatives, health systems in Liberia and elsewhere can be strengthened to be more resilient, and thus better able to anticipate future challenges, adapt to meet the challenges, and then further improve the system to be able to anticipate new future challenges. However, strengthening health systems so that they are resilient takes resources, including sector-wide/HSS resources that can be used to build functioning, integrated systems and skilled, networked individuals and groups across sectors.

The Role of County Governments, Donors and Global Governance

Keeping track of development needs and funding streams in an increasingly complex and interconnected world requires strong global leadership and oversight. With the rapidly changing and increasingly complex global aid architecture, more than ever before, there is a need for strengthened global governance to track and guide: (1) funding patterns across the panoply of donor and their respective priorities, (2) new development agencies through which donor funds are channeled, and (3) what countries are receiving the funds and for what specific health focus areas.

Donors finance a significant amount of total health expenditure in Liberia, 82%, making the Liberia's health system vulnerable to donor funding fluctuations. Myopic donor priorities may result in short-term outcomes, but without substantial support for strengthening whole systems, the ability of those systems to anticipate future needs, and indeed to build resilience, is handicapped.

The West African Ebola epidemic brought to the forefront the need to clarify and refine the role of WHO. However, in addition to the need for more relevant and

responsive global governance through WHO (top-down), there is the clear concurrent need to support strengthened and resilient country health systems, who in turn can identify and guide donors (bottom-up) on their top, self-identified health and system priorities. Improvements on both ends would help to align donor and government priorities to build efficient, integrated health systems that promote and increase resilience at all levels and across all building blocks.

Pre-existing Conditions

Ebola caused Liberia to come full circle, again. The country was mired in a humanitarian response following 14 years of civil war that devastated the health sector, among other sectors. Starting in 2008, the GOL and donors began to actively move the country out of a humanitarian response mode and into development through increased systems strengthening activities. Then, in 2014, the country was thrust back into a humanitarian situation; this time in response to the devastating Ebola outbreak that again destabilized the health sector.

The 2014–2015 Ebola epidemic in West Africa has implications for how governments, donors and implementing partners design and implement HSS interventions. Prior to Ebola, the WHO Health Systems Building Blocks became the most prominent framework guiding health systems strengthening projects; Liberia incorporated the framework into their National Health Plan, 2011–2021, and health systems strengthening activities including JSI’s RBHS project were guided by the framework.

While the Liberian health system saw many improvements over the life of the RBHS project, persistent gaps in Liberia’s health system limited the government’s ability

to mount a rapid and adequate response to Ebola in the Spring of 2014. As the Ebola epidemic escalated and the health system faltered, the concept of resilience was pushed to the forefront of the HSS conversation in Liberia and globally, and was the impetus for this thesis.

This thesis reviewed the Liberian health system for the presence of WHO-defined emergency preparedness attributes, and then compared identified gaps against priorities outlined in two government documents—1) the Investment Plan for Building a Resilient Health System, Liberia 2015–2021, and (2) the draft Epidemic Preparedness and Response Plan (April 2016)—in order to identify specific activities to address any gaps not already included in Liberia’s planned recovery and resilience interventions.

At the time Ebola first emerged in Liberia, key gaps in Liberia’s health system included:

- a lack of health emergency risk management preparedness (building block 6);
- inconsistent infection prevention and control practices (building block 1);
- inadequate or non-existent basic health infrastructure including health facility access to water, soap and sanitation facilities (building block 6);
- inadequate surveillance (building block 6 and 1);
- lack of health workforce information management systems, performance management, and transfers and placements based on need (building blocks 2, 3 and 6);
- weak supply chain (building block 4);
- inefficient mobilization, distribution and transparent accounting for both financial and

- material resources (building block 5);
- lack of formalized mechanisms to engage and communicate between the health system and communities (building blocks 1, 3 and 6); and
- fragmentation of systems and services (building blocks 1, 3, 4, 5).

Under the pressure of an escalating Ebola outbreak, the pre-existing gaps translated into a deep lack of trust in the system on the part of the communities, and lack of accountability and ownership of the system on the part of health workers.

Further, the Ebola epidemic exacerbated the lack of coordination and integration within the health sector; the panoply of new donors and implementing partners and agencies that subsequently flooded into the country put increased pressure on already weak regulatory and management systems at all levels.

From Near Collapse to Resilience: Overarching Recommendations and Logic Model

Following the Ebola epidemic, the GOL identified three overarching needs: *(1) improved health infrastructure, (2) strengthened epidemic preparedness and response, and (3) sustainable community engagement*. Corresponding priorities and activities laid out in the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021 are highly-specific to preparing for and responding to a future infectious disease outbreaks, such as Ebola, with targeted interventions in those three areas.

There are two limitations to the GOL resilience plan. The first is only focusing on epidemic preparedness instead of taking a more holistic approach to addressing all-hazards preparedness. The second is proposing additional elements instead of integrating the needs and corresponding activities into the existing national HSS framework. To meet

these limitations and the gaps identified throughout this thesis, two overarching recommendations are proposed below, followed by specific recommendations organized under each of the six WHO building blocks.

Overarching Recommendation 1: Take an All-Hazards Approach

As was the case with the Ebola outbreak in Liberia, 95 percent of all disasters make their initial impact at the community level. The early, chaotic days of the outbreak were plagued by poor operational planning as well as a lack of coordination and communication, highlighting the vulnerability and lack of capacity of the Liberian health system and communities to avert major disruptions to health service delivery. While much of the post-Ebola efforts are justifiably focused on preventing another major infectious disease outbreak, Liberia is vulnerable to a variety of both natural and man-made hazards: severe flooding during the rainy season and civil unrest (be it domestic or spilling over from neighboring countries) are examples that could easily trigger internal displacement, increase food insecurity, and cause disruptions in basic services.

A fundamental step for Liberia to strengthen the capacity of health facilities and their catchment communities to withstand or respond to all hazards is to build local-level resilience through a National Incident Management System (NIMS). To be effective, the NIMS must be robust enough to respond to all hazards – including but going beyond infectious disease epidemic preparedness – and must thus naturally extend beyond the health sector (e.g., including Agriculture, Education, Public Works, and Transport).

Significant post-Ebola strides have been made by the MOH by prioritizing epidemic preparedness, surveillance and response, and early warning systems, as outlined

in the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021. In line with this, multi-lateral efforts have been concentrated on implementing an integrated disease surveillance and response system and associated health information systems and technologies, and the MOH has established an Epidemic Preparedness and Response Division to take over responsibilities in December of the of the current NGO-led EPR Consortium.

However, to fundamentally increase capacity and reduce the vulnerability of communities, health facilities and county health teams in all 15 counties, a cross-sectoral NIMS will be required to mainstream disaster risk reduction and emergency preparedness into health (and other) systems planning at the facility, community and county levels.

Key Definitions:

Disaster Risk Reduction: Reducing disaster risks through systematic efforts to analyze and manager the causes of disaster. Includes reducing exposure to hazards, lessening vulnerability of people and property, and preparedness.

Emergency preparedness: Capacity to prevent, protect against, quickly respond to, and recover from emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities.

To do this, the capacity of CHTs must be enhanced to take the lead in responding to future disasters to reduce the extent of potential casualties. At the sub-county level, health coalitions between health facilities and local communities should be formed, including public-private partnerships, and jurisdictions and responsibilities clarified within the county health systems.

Through initial planning meetings led by the CHTs, local institutions including schools, local government, private sector, health facilities and their respective communities (e.g., through the Community Health Development Committees (CHDCs)), should come together to identify risk factors - hazards, exposures, vulnerabilities, gaps in capacities – to inform prevention and mitigation activities and the appropriate required response systems. The planning process itself would increase awareness and build capacity at the community, health facility, district, and county levels, and result in coordinated yet tailored emergency operational plans (EmOPs). These plans, and subsequent drills could form the basis of a coordinated response, regardless of the nature of the hazard.

At the sub-county level, the key coordinating mechanism for strengthening preparedness could be the establishment of health coalitions. Health coalitions would reflect the local context consisting of geographically adjacent health facilities, schools, communities, private sector entities, and local government structures. The health coalitions would strengthen emergency preparedness by creating a coordinated, interoperable, and unified health care effort in the event of a disaster. For example, if one facility loses capability during a disaster (as was the case when facilities shuttered doors due to lack of capacity to deal with Ebola), unaffected facilities within the coalition could step in to fill service delivery gaps. These health coalitions could be supported by existing and new donor funds to build upon and formalize local public-private sector partnerships to provide needed transportation, fuel, water, and communications in times of need. These partnerships could take a wide variety of forms; the key is that they

strengthen the collective resilience of communities by pooling available resources. Health coalitions would allow for the continued provision of services in the event of unforeseen events ranging from the mundane (supply shortages) to the extraordinary (infectious disease outbreak). A health coalition shifts the focus from capacity building of individual facilities to building collective capacity through a joint risk assessment and EmOP planning. Supporting health coalitions as part of overall health system strengthening would be a natural integration of emergency preparedness into health systems strengthening activities.

Functional, contextually-specific EmOPs are needed that clearly establish guidelines for resource management and prioritize the coordination of priority actions. The plans should consist of a standard set of definitions, protocols and tools, including locally pertinent information including hazards, available resources, and contact information for key response personnel. The establishment of routine drills and updating of EmOPs should be routinely reinforced and linked to existing county operational planning processes.

The importance of fostering community-level cooperation and awareness has been widely cited following the Ebola outbreak, and engaging key leaders in each of the health coalitions and in EmOP development is a tangible way to operationalize this lesson.

EmOPs should be institutionalized so that emergency preparedness is a job function of key positions within each of the entities comprising the health coalitions (i.e., health facilities, schools, government structures, CHDCs). Thus, shifting the paradigm

for emergency preparedness and management from a reactive to a proactive approach will increase the likelihood of continued provision of services in the event of a crisis.

Collaborative planning and implementation will facilitate the development and dissemination of national standards, guidelines, and protocols, including the developed EmOPs. Integrating an all-hazards approach into overall health systems strengthening initiatives is fundamental to building health system resilience. A first step is through the development of an NIMS, inclusive of county-level EmOPs.

Community Resilience

Inclusive of taking an all-hazards approach to crisis preparedness is the promotion of community resilience. As noted above, 95 percent of all disasters make their initial impact at the community level, and often, by the time major interventions arrive, an epidemic is already under control.^{ccxiv} Though the epidemic was far from under control when major interventions arrived in Liberia, with the health system unable to provide care for all those in need during the height of the epidemic, and with many health facilities closed, patients in Liberia turned to community leaders requesting IPC guidance and support in order to provide community-based care.^{ccxv} The role of community care providers in helping to ultimately curb the Ebola epidemic at the community level has yet to be fully documented.^{ccxvi}

Community engagement is *implicitly* a cross-cutting feature of building blocks 1 Health Services, 2 Human Resources, 3 Health Information, and 6 Governance and Leadership. However, not *explicitly* addressing it in the framework has led to limited examples of significant, effective and sustained activities to effectively engage

communities in health promotion and maintenance. Community engagement is now a stand-alone priority in the Liberian post-Ebola planning document; however it is not integrated into the larger building block framework that guides health system improvements, meaning that community engagement activities are likely to be stand alone and fragmented.

Further, community engagement, in and of itself, should not be the ultimate objective. Rather, a broader objective should be the promotion of community resilience, inclusive of community preparedness. According to the Centers for Disease Control and Prevention, community preparedness requires active, ongoing community engagement in order to: (1) determine local risks to the health of the community, (2) build community partnerships to support health preparedness, (3) engage with community organizations to foster public health, medical and mental and behavioral health social networks, and (4) coordinate training or guidance to ensure community engagement in preparedness efforts.^{ccxvii}

According to Wells, et al.:

“Much of traditional emergency preparedness is conducted “top-down,” but immediate response in the first 72 hours and long-term recovery falls on communities following a bottom-up” approach. A central message in preparedness training is for communities to be prepared to survive for a period of time on their own, but this message is not necessarily delivered to communities predisaster or coupled with a long-term commitment by responders to assist them in preparing. There can thus be a real or perceived disconnect between the goals

and approach of preparedness initiatives and the needs of communities to respect their priorities.^{»ccxviii}

The integration of emergency planning within each of the six building blocks in the WHO health system strengthening framework would effectively provide a mechanism to enhance community resilience in part through formalizing clear roles of community members as part of health coalitions, prioritizing communication systems and resources, community relationships, communication processes, and community attributes.^{ccxix}

Specific outcomes of effective community resilience activities integrated into health system strengthening include:

- Community Resilience Capacity
- Linkage to Vulnerable Populations
- Community Volunteerism
- Agency Partnerships
- Community Knowledge of Risks/Assets
- Household/Agency Emergency Plans
- Coordination/Trust in Government
- Staff Attitudes, Knowledge, Practice
- Individual and Family Preparedness.^{ccxx}

Overarching Recommendation 2: An Integrated WHO Building Blocks Framework

Another critical step for Liberia toward strengthening the capacity of health facilities and their catchment communities to withstand or respond to all types of hazards is to integrate emergency preparedness into the existing framework upon which the

National Health Plan 2011–2021 is based (i.e., WHO Building Blocks). The Investment Plan for Building a Resilient Health System, Liberia, 2015–2021 proposes adding new stand-alone components to be addressed largely through donor-funded initiatives. This will very likely draw donor attention and funds away from general health systems strengthening and thus reduce the GOL’s progress toward meeting overall health system targets laid out in the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021.

Despite the original premise of the WHO Building Block framework where it was intended to simultaneously address all six building blocks, due to donor funding interests we are now siloing building blocks whereas before it was siloing diseases. Adding separate surveillance and early warning systems will simply amplify the siloed effect. Financing is linked to information, and the information being prioritized and collected is linked to commodities or specific sub-components.^{ccxxi} Thus, until we place an increased emphasis on sector-wide interventions and corresponding data collection that captures the interrelationships and interdependencies between the building blocks—which in part is what an effective NIMS aims to achieve—we will remain stuck in a silo; be it a disease or building block.

In order for any proposed recommendations to be effectively and sustainably operationalized, they will need to be built upon and integrated into the existing systems and frameworks, rather than simply applying a new ‘resilience’ framework on top of the existing HSS framework in place. If not, the risk of continuing with the status quo and creating new, fragmented, vertical systems is high.

While dealing with multiple other public health priorities, public health preparedness went largely unaddressed in pre-Ebola Liberia. The government, donors, and implementing partners were focusing on strengthening basic health services through a rapidly decentralizing system. The lack of integration of public health preparedness into HSS interventions left the country vulnerable to public health emergencies.

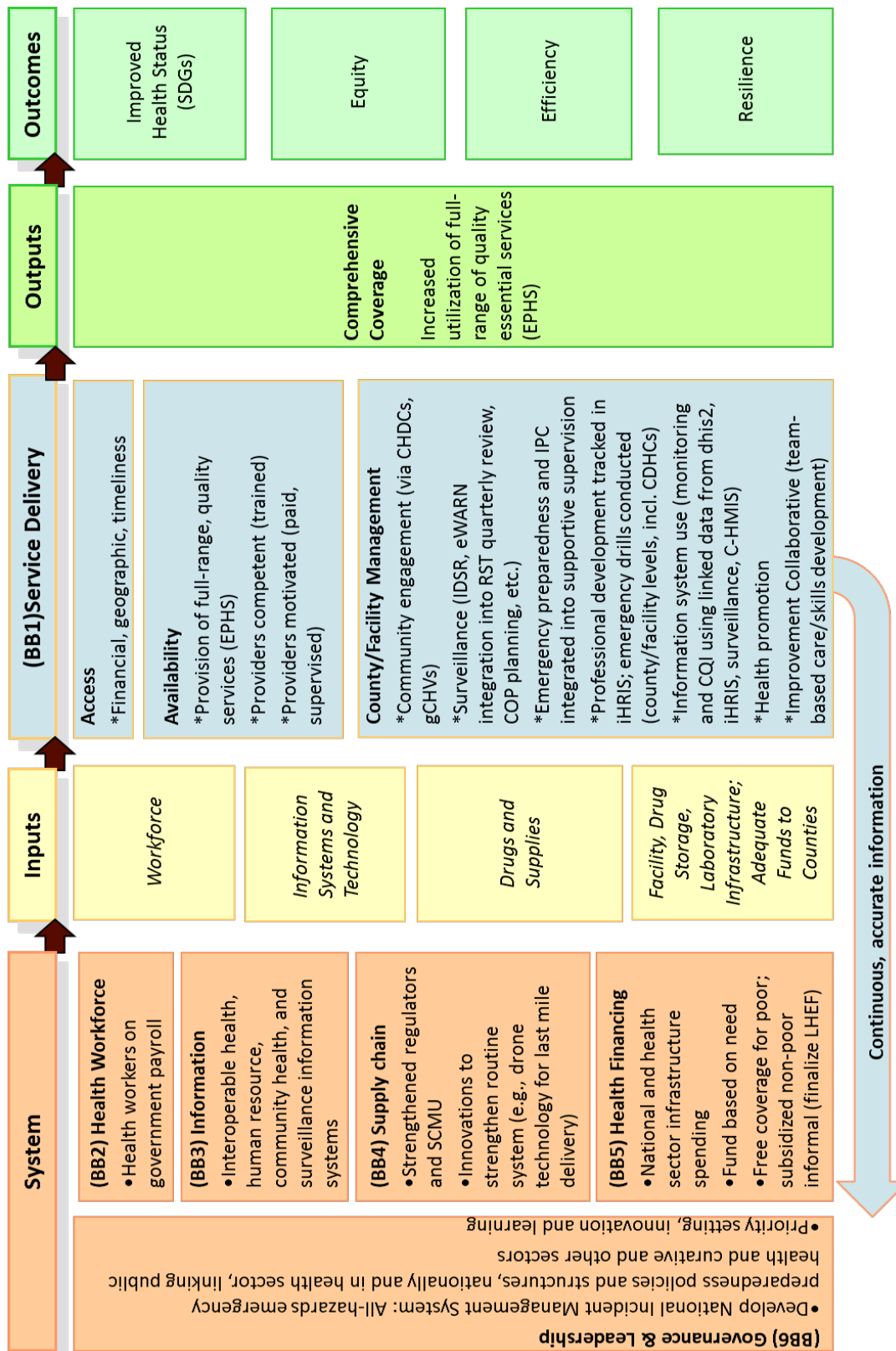
Part of the role of a MOH is to ensure that the largest drivers of health, the primary determinants in a country, are adequately being addressed through the myriad of health-related interventions and programs in the country, which should be inclusive of emergency preparedness and disaster risk reduction. This requires adequate resources and staff, health financing based on need and local epidemiology, adequate flow of information between community, facility, county and central levels, and nimble, redundant systems able to cope with a crisis while maintaining basic functioning. Moreover, all of this requires strong leadership and governance whose hands are not tied by myopic donor funding priorities.

An Integrated Logic Model

The following logic model reflects the integration of emergency preparedness activities into the classic HSS approach and shows how system level components provide the inputs in support of comprehensive services that are in turn translated into desirable outputs and outcomes. It is intended to succinctly summarize how the GOL—and donors and implementing partners—can further HSS efforts while simultaneously strengthening the country's emergency preparedness by integrating emergency preparedness activities

within each of the existing six health system building blocks (rather than adding additional blocks as proposed by the two plans).

Figure 37. Logic Model Integrating Emergency Preparedness into Health Systems Strengthening



Detailed Recommendations by Building Block

This section provides detailed recommendations for each health system building block that address specific gaps not clearly identified in either the Investment Plan for Building a Resilient Health System, Liberia, 2015–2021 or the draft EPR Plan. The building block framework is built on the premise that all building blocks should be simultaneously strengthened. However, acknowledging limited resources that may prevent the implementation of all recommendations simultaneously, the specific recommendations within each building block are organized by priority.

Building Block 1: Service Delivery

One of the criticisms of the WHO Building Block framework is that it is heavily provider-based without the explicit and significant inclusion of community at all levels. Incorporating emergency planning into each of the building block components in part will address this through ensuring a clear point of engagement between the community and health system. The following service delivery recommendations guide the incorporation of emergency preparedness and community engagement activities into health services provision.

- (1) Shift focus from preparing and responding specifically to infectious disease epidemics to a broader **all-hazards approach** to emergency preparedness. Establish a **National Incident Management System**. This includes the formation of **health coalitions** between health facilities and local communities, including public-private partnerships, and **clarify jurisdictions and responsibilities** within the county health system.

- (2) **Integrate emergency preparedness** planning into country operational planning processes resulting in **county-specific EmOPs** as a subset to the county operational plans. EmOPs should be institutionalized so that emergency preparedness is a job function of key positions within each of the entities comprising the health coalitions (i.e., health facilities, schools, government structures, CHDCs). Shifting the paradigm for emergency preparedness and management from a reactive to a proactive approach will increase the likelihood of continued provision of services in the event of a crisis.
- (3) **Regularly involve the community as well as other sectors in emergency preparedness planning** at national and county level: include, at a minimum, CHDCs, education, transportation, post and telecommunications, and security, with pre-established points of contact across all other ministries. This could be done through supporting Regional Support Team quarterly review meetings with multi-sectoral representation. Use the RST forum to identify risk factors - hazards, exposures, vulnerabilities, gaps in capacities – to inform prevention and mitigation activities and the appropriate required response systems. Incorporate findings into county-specific EmOPs. This would also serve to strengthen operationalization of the new RST structure.

Building Block 2: Health Workforce

Some progress has been made in terms of *improving the availability of services* (e.g., supervision strengthening, provision of/staff competence in the BPHS), but more is needed to expand provision to include the full package of essential health services (e.g., psychosocial and school health services), to integrate emergency preparedness into

supportive supervision tools and practices, and to get health workers on the government payroll and regularly paid.

- (1) **Get all active staff (including laboratory staff) on the government payroll and pay them**, on schedule, every month. This involves completing and routinely updating **the capture of human resource data (active employees, and deleting all others and duplicates) into iHRIS**, and finalizing **interoperability with DHIS2** (also related to building block 3). This also necessitates strong governance and leadership to overcome individual resistance to cleaning up the payroll (building block 6).
- (2) Regular and substantial community involvement into health services is clearly a need. CHDCs, community health workers, and in particular gCHVs are a key link between the community and formal health services. Form **stronger engagement with CHDCs** by actively including them in EmOP planning. Also, **better integrate gCHVs in the health sector** by identifying a role for them in collecting community-level data for capture into a new community-HMIS system (also building block 3).
- (3) Poor infection control practices lead to increased transmission to health workers and patients, with negative spiraling impact on the health system in terms of decreased trust in the system, and thus decreased ability of the system to mount an effective response to future epidemics. The **protection of health care workers** must be paramount. This necessitates regular supportive supervision on IPC, as well as sufficient water, sanitation and hygiene facilities in health care settings, and adequate

- supply of IPC commodities, thus necessitating a seamless supply chain (also building block 4).
- (4) Integration of **emergency preparedness drills and exercises** into routine county-led capacity exercises with facilities and communities in their catchment. Ideally, this would occasionally involve stakeholders from other sectors in relevant drills including education, transportation, police, as well as the private sector.
- (5) **Widely integrate emergency preparedness skills and activities** into pre-service curricula, supportive supervision tools, accreditation and re-licensure criteria, and into basic qualifications for health personnel at each level.

Building Block 3: Health Information

As noted above, the failure to mount a timely response on the part of the government, NGOs and international agencies was in part due to the lack of timely and accurate information, as well as the demands of addressing significant competing priorities within the fragile health system. Continuous and *accurate information derived from facility- and county-level management systems needs to be supplied back to the central MOH* to inform priority setting, adjustments to inputs, and new innovations and research. Information should routinely include data from the community, surveillance data, health worker professional development and supervision data, health promotion provision and effectiveness, and evidence of the use of data for decision-making at all levels (community, facility, county, regional, national). There are eight recommendations specifically related to improving health information.

- (1) **Finalize the governance of the iHRIS**, including where it resides and which offices play which roles in terms of maintaining data; maintaining the hardware and software; access and use rights, including mobile messaging. At the end of RBHS in February 2015, the critical HR functions were located in two departments: the policy and planning functions, which can be supported by iHRIS, are housed in the Planning and Policy Department in the HR Unit; the administration of personnel, including recruitment, selection, processing CSA requirements, payroll and benefits, and performance management are housed in the Personnel Unit in the Administration Department. The Training Unit is also located in Policy and Planning. This has caused confusion in terms of ownership and delays in the roll-out of the new system.
- (2) **Train users to routinely capture facility staff professional development and training data into iHRIS**. Conduct training on data collection, entry and management of human resource data using the iHRIS application for central and county staff. Engage cooperation of all of the vertical programs, partners who provide training, and the county human resource officers who can also directly input data into the system. To realize this, job descriptions of all responsible parties (e.g., human resource officers, CHSAs, vertical program staff, bilateral project staff) need to be adjusted and trained accordingly.
- (3) Develop and operationalize **capture of community-level data into a new C-HMIS**. Link system with newly ongoing efforts to improve surveillance and early warning systems at the county and community levels.

- (4) **Develop interoperability of surveillance data system (e.g., IDSR and eWARN) with DHIS2 and iHRIS, and train central MOH and selected county staff** on how to query data linked from all three systems.
- (5) **Regularly use data linked between surveillance, DHIS2, and iHRIS** to assess health worker training and distribution against health outcomes.
- (6) **Develop and incorporate indicators of emergency preparedness into the quarterly health review meetings** at regional and county level. Invite school health officials and representatives from other sectors as appropriate.
- (7) Building upon the newly established high-frequency radio system, **strengthen risk communication through the development of an emergency broadcast system** that can also be used for health promotion during non-emergencies. With relatively low cell phone coverage and very low levels of smartphone ownership, radio is still the most widespread form of technology in Liberia.
- (8) **Conduct operational research** to identify new factors which facilitate the emergence and transmission of epidemic-prone diseases, including mapping and risk assessments to determine areas at risk of epidemic-prone diseases, strengthen early warning systems, and strengthen laboratory capacity. These were activities listed as secondary priorities in the EPHS (following the first phase which was continued scaling up and strengthening of largely maternal, neonatal and child health services, as prioritized in the earlier BPHS).

Building Block 4: Medical products, vaccines, and technology

The Liberian supply chain system has notable weaknesses from the national regulatory bodies to the central MOH management unit, down to the systems and operationalization at the county level. An efficient, transparent and effective supply chain is critical under routine circumstances to ensure sufficient forecasting and requisition and distribution of essential medicines and supplies; it is equally critical in times of crisis.

There are eight critical recommendations to strengthen the Liberian supply chain system:

- (1) Integrate supply chain into larger HSS activities. **Promote a broader understanding of the importance of supply chain in achieving health outcomes** by routinely reporting on supply chain system-level indicators at RST quarterly review meetings.
- (2) **Strengthen LMHRA** to be able to adequately regulate drugs and commodities across all donor/funding streams, as well as via donations during an emergency.
- (3) **Strengthen central level SCMU capacity and leadership.**
- (4) **Fast-track National Drug Stores warehouse construction** to reduce seepage of commodities.
- (5) Ensure adequate **drug storage facilities** at county/facility levels.
- (6) Ensure adequate **laboratory facilities** at county level.
- (7) **Train facility and county staff** in quantification and correct use of SBRR and other tools.
- (8) **Update SCMP based on lessons from Interim Approach.** Develop a system that ensures integrated, coordinated supply of drugs and commodities across the entire EPHS and inclusive of EPR/IPC supplies.

Building Block 5: Health Financing

As noted in the findings section, annual deviations between estimated budget needs and actual provision of funds have been substantial; in FY2010/11 it was 33% below, and in FY2011/12, 36% below estimates.^{ccxxii} In part, this is because the central MOH has limited control of its budget where not only is the total health budget allocation determined by Congress, but specific county allocations are determined by Congress, not MOH. Such discrepancies between estimated and actual make it challenging to plan and implement activities, and have implications for building the sustainable capacity and resilience of the health system.

Also documented in the Findings section above, noted progress was made regarding *improved access* under the RBHS project, from constructing new and renovating existing health facilities, mapping facility catchment areas to better normalize access/distribute services within counties, and beginning work on drafting the LHEF. More, however, needs to be done to reach the goal of UHC, starting with the identification of who and what services will be covered under LHEF, and what services will be covered through the existing PBF mechanism. Following, there are two key recommendations related to health financing:

- (1) **Adequately fund MOH and allocate funds across counties based on need** (local epidemiology, population, etc.) rather than historical funding levels.
- (2) **Identify services in EPHS to be provided under the LHEF and supported by taxes, and those to continue being supported through the PBC mechanism to**

maximize coverage for the poor and to subsidize non-poor informal population segments.

Building Block 6: Leadership and Governance

The above logic model recommends *strengthening governance structures* that support all-hazards emergency preparedness at all levels: individual, organizational and systems. To achieve this, there are seven specific recommendations related to leadership and governance:

- (1) The newly established EPR unit, to be incorporated into the Division of Disease Prevention and Control (taking over activities from the current NGO-led EPR Consortium), is the national committee for *health-sector* emergency management, but specifically mandated to coordinate the response to future infectious disease outbreaks. **The EPR unit should expand to take an all-hazards approach to emergency preparedness.**
- (2) Further, the GOL should **develop a NIMS, inclusive of a national structure and committee for multi-sectoral emergency management that takes an all-hazards approach.**
- (3) **Expand county-level epidemic preparedness plans to broader emergency preparedness plans**, addressing potential hazards beyond infectious disease epidemics. Integrate the emergency planning process with general county operational planning processes.
- (4) Formalize and **strengthen Central MOH capacity to oversee IPC training and practices** throughout the health sector (e.g., via the new Quality Assurance Unit).

- (5) Provide ongoing government support for Regional Support Team quarterly review meetings as means of formalized data-based planning. **Regularly include all-hazard emergency preparedness data (including data from iHRIS, DHIS2, surveillance) into quarterly review meetings** to help identify emergency planning activities and needs. **Ensure community representation (e.g., via CHDCs)** at quarterly review meetings. **Include multi-sectoral representation**, especially from education, at RST meetings.
- (6) **Strengthen regulation of external health-related emergency assistance** (e.g., LMHRA to regulate drug donations, EPR Unit to activate and directly coordinate an IMS as needed)
- (7) In addition to getting staff on payroll, **develop a health workforce performance management handbook** based on the national guidelines and code of conduct.

Finally, one of the three identified GOL priorities stemming from the Ebola epidemic is improved health infrastructure; indisputably a need and clear priority in Liberia. However, as noted in the literature review above, one-fifth of deaths in Liberia are attributed to water and sanitation problems (also clearly an amplifier of the Ebola epidemic). Noting this, the historical lack of DAH and GOL allocation for water and sanitation is perplexing. Without increased attention to and funding for water supply and sanitation improvements, there can be little sustainable impact on morbidity and mortality associated with water and sanitation.

Further, 11 largely preventable diseases accounted for 73% of years of life lost in Liberia in 2010. The low investment in prevention (and the systems that support

prevention activities), combined with very low levels of overall budgetary support and water and sanitation investment limits Liberia's flexibility to address what the country prioritizes as key developmental challenges. The paradoxical situation is that Liberia needs investment in these areas in order to build its capacity to adequately forecast, request and direct funds to self-identified priorities, but to date program and project support has largely been dictated by the interests and priorities of donors, which tend to favor investment in specific diseases, or more recently, individual health sector components.

Arguably, the Liberian health system is more resilient than it was a decade ago. Though it took a matter of months—clearly not ideal—Liberia was nonetheless able to resume normal operations following Ebola quicker than it did following the civil conflicts; indicating a gain in resilience. However, it is evident that a lot more is needed to further increase the resilience of the health sector, and the country, in responding to and recovering from crises.

The MOH has been actively trying to move the country from relief to development once again, to quickly identify and restore recent (health outcomes and health system) gains lost due to the Ebola epidemic, and ultimately build a more resilient health system to better withstand future challenges. While the popular language these days is “resilience,” a review of the national and international response plans and actions following the West African Ebola epidemic indicates a patchwork response that is far from truly promoting resilience. Further, by the GOL focusing solely on epidemic preparedness, as opposed to taking an all-hazards approach, Liberia will not find itself—

even within the health system—better able to cope in the event of other types of crisis (e.g., casualties following civil unrest around upcoming elections, natural disasters such as floods and landslides).

On the other hand, the West African Ebola epidemic has opened the global conversation about what health system strengthening entails, or should entail, and thus opens the possibility for the GOL to better guide donors toward funding sector-wide health system strengthening activities, inclusive of integration of all-hazards emergency preparedness into each of the existing WHO identified health system building blocks. Effectively doing so would not only increase the resilience of the Liberia health system but would also pave the way for other countries to similarly influence and shape the substance of their health system strengthening interventions.

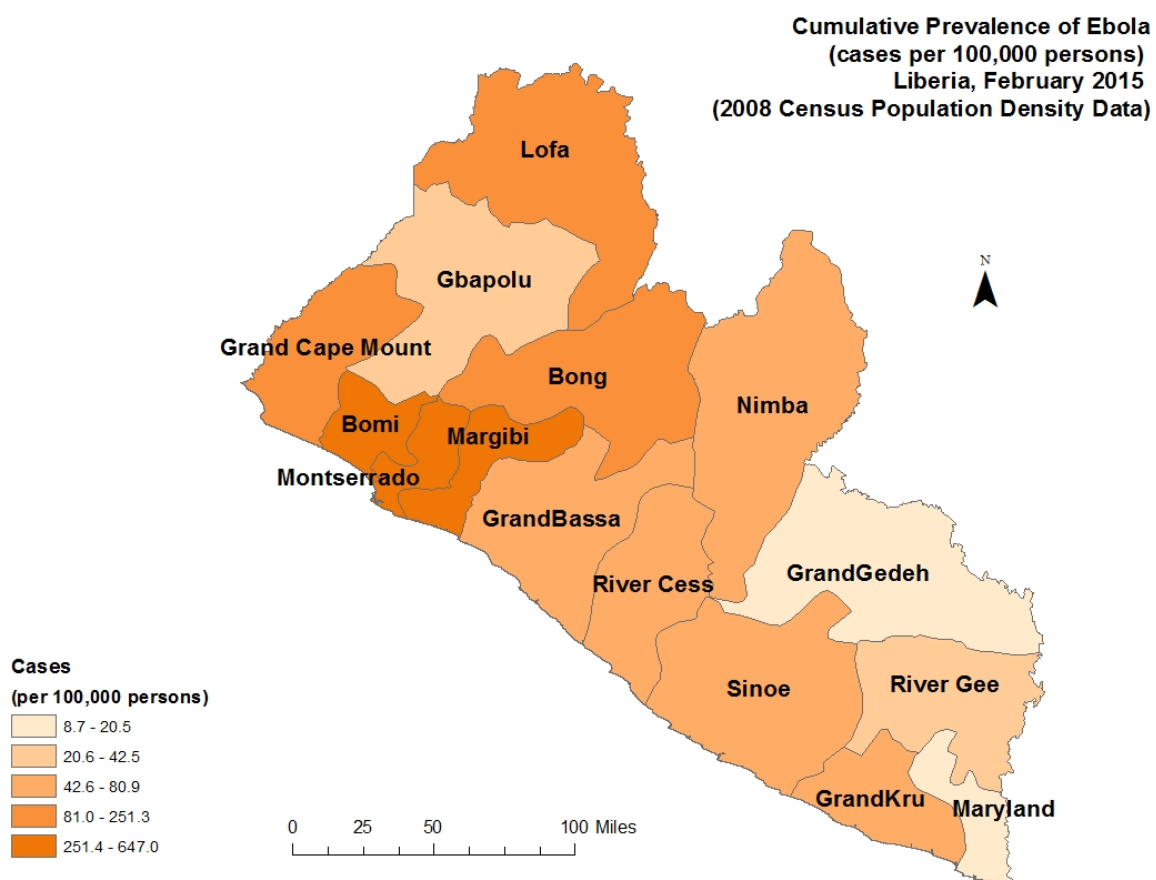
DISSEMINATION PLANS

Planned mechanisms to dissemination findings and recommendations include the following:

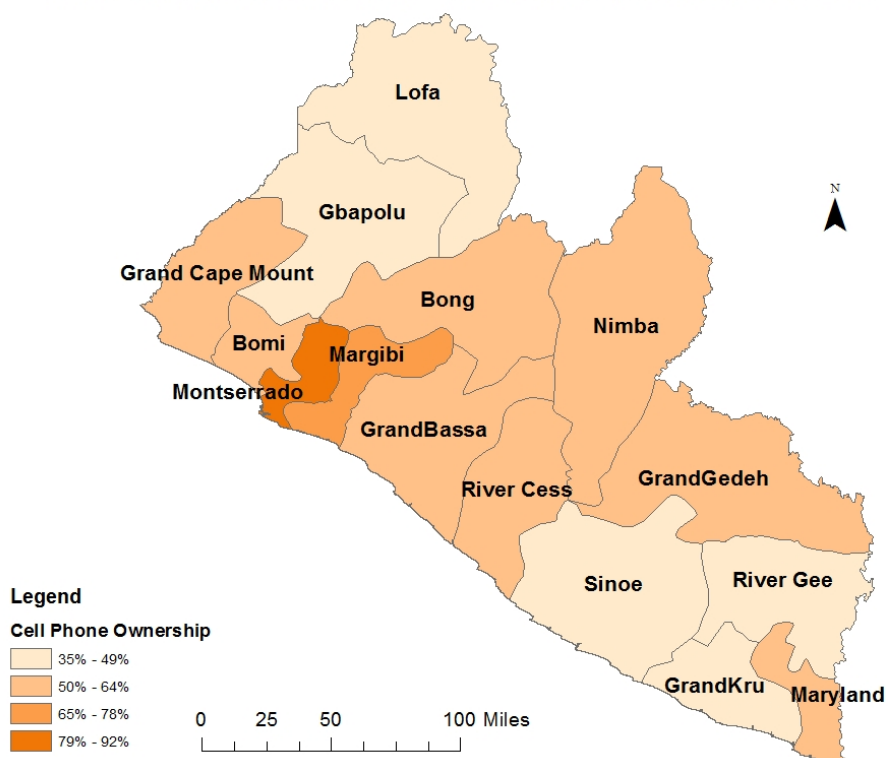
- (1) Summary report and recommendations on the design of HSS programs and interventions disseminated to key stakeholders (e.g., Liberia MOH, JSI, USAID)
- (2) Publishable manuscript for a peer-reviewed journal
- (3) Conference abstract submission (e.g., American Public Health Association, Global Health Council's Global Health and Innovation Conference, Consortium of Universities for Global Health annual conference, Global Symposium on Health Systems Research)

ANNEXES

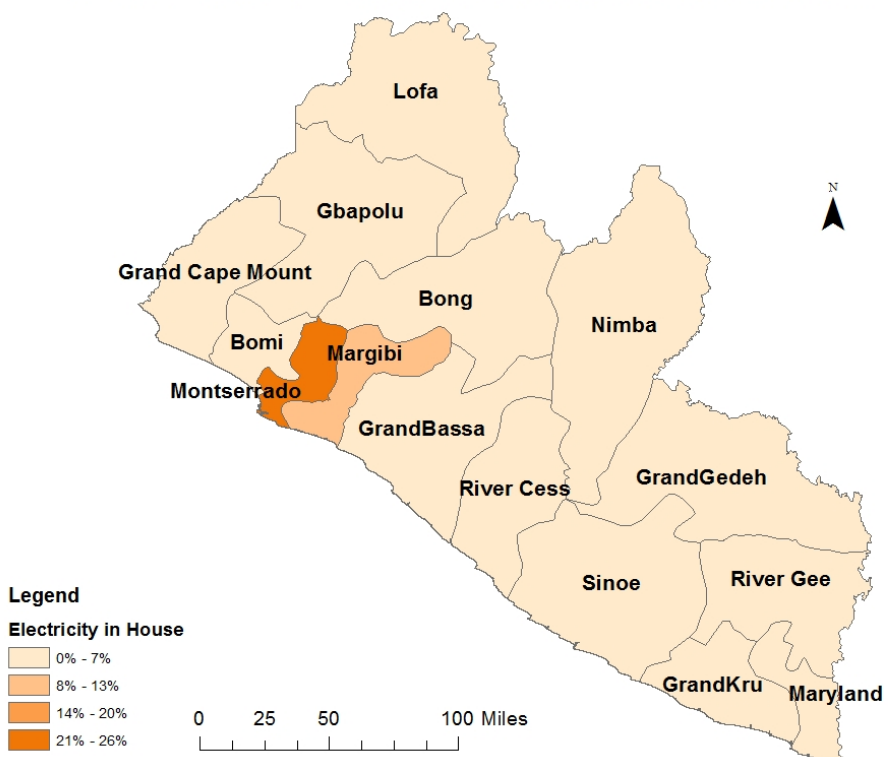
Annex 1. Liberia Background Maps



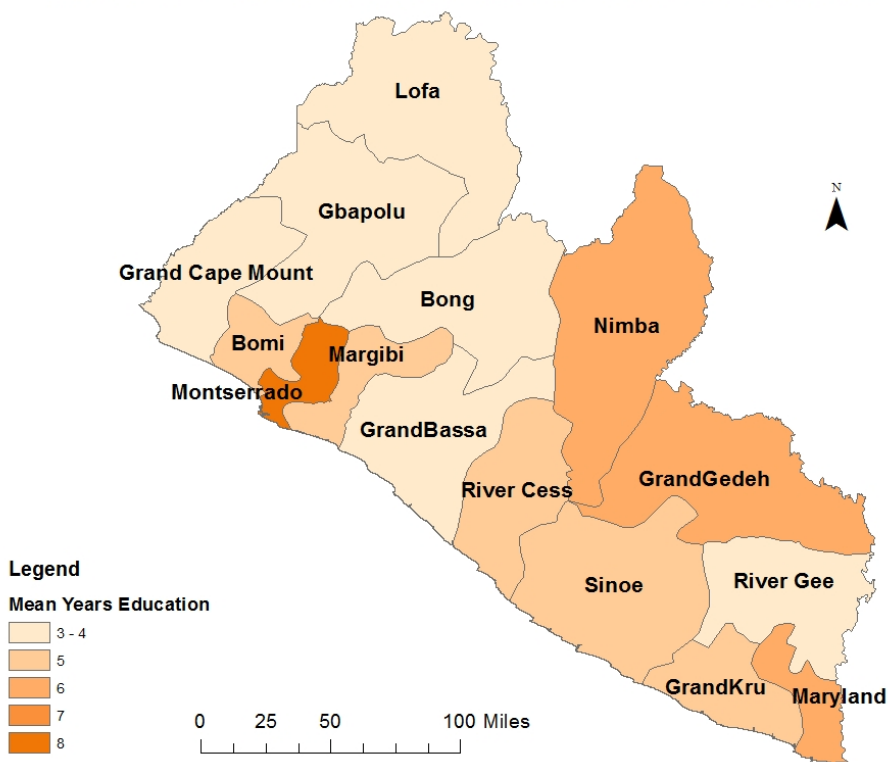
Proportion of Households with a Cell Phone, Liberia, 2013 DHS



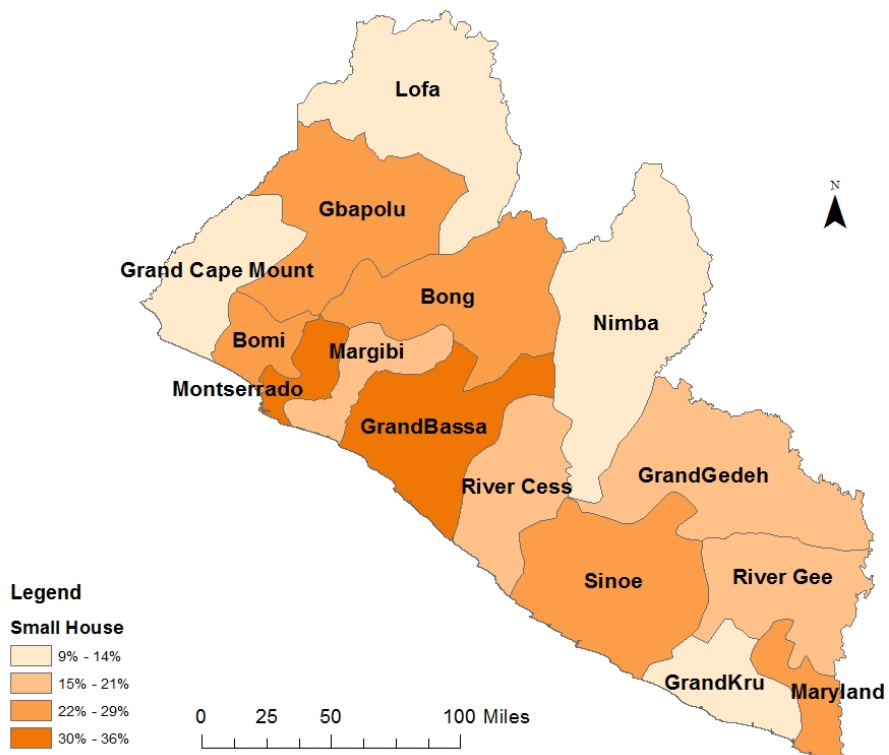
Proportion of Households with Electricity, Liberia, 2013 DHS



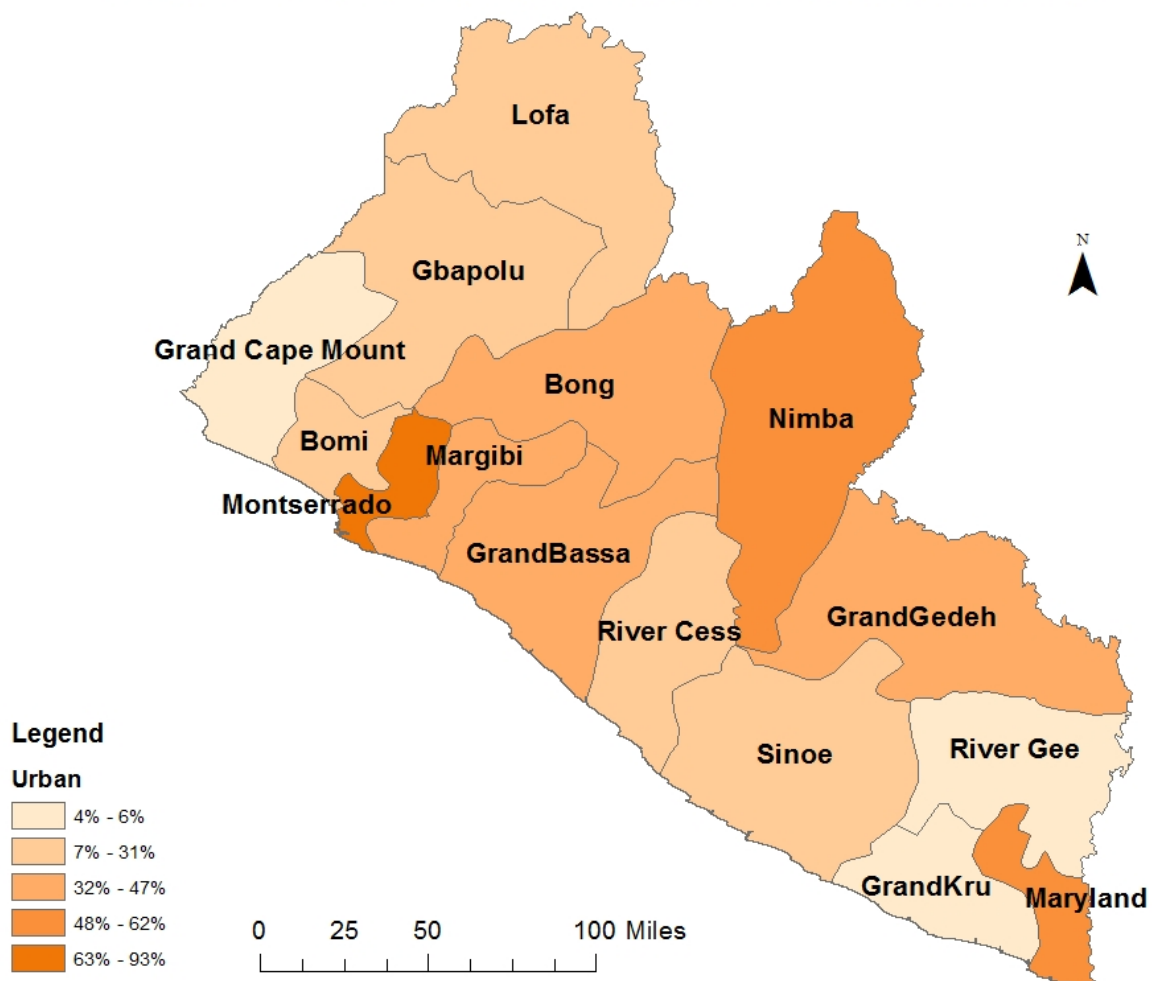
Mean Years of Education of Persons 20-49, Liberia, 2013 DHS



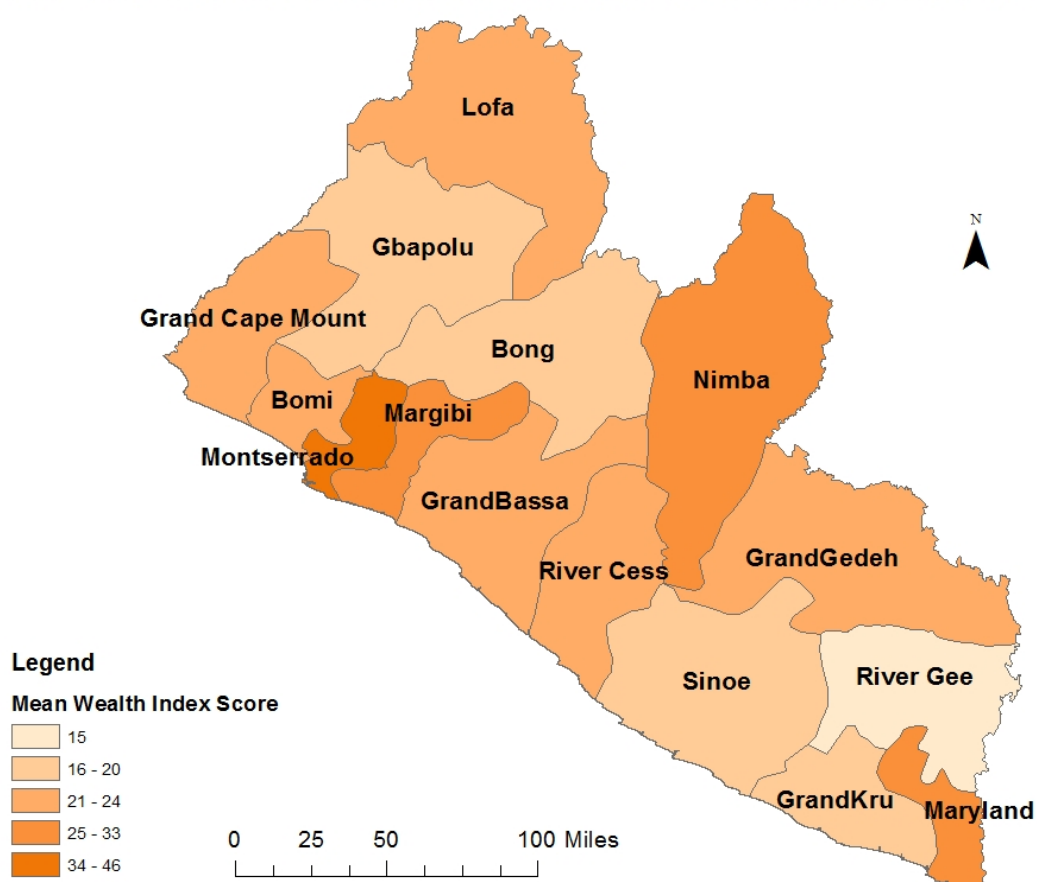
Proportion of Households with None or One Sleeping Room, Liberia, 2013 DHS



Percent Living in Urban Area in County, Liberia, 2013 DHS



Mean International Wealth Index Score of Households, Liberia, 2013 DHS



¹ The International Wealth Index (IWI) is a comparable asset based wealth index for measuring households wealth in low and middle income countries. Iwi runs from 0 to 100, with score 0 for households who have none of the included assets and 100 for households who have all.

Smits, J & R. Steendijk (2014). "The International Wealth Index (IWI)". Social Indicators

**Annex 2. Individuals Interviewed in the
RBHS Mid-term Evaluation, May/June 2011**

**List of Interviewees for PBC Assessment
(Interviewer: Deirdre Rogers)**

RBHS

- Dr. Richard Brennan, Chief of Party
- Chip Barnett, Director of M&E and Partner Coordination
- Mike Mulbah, M&E Officer
- Rufus Domah, County Coordinator, Bong
- Luogon Willie-Paye, County Coordinator, Nimba

MOHSW

- Benedict Harris, Policy and Planning
- Dominic Togba, PBC Focal Point Person

MTI (Monrovia)

- Dr. Teferi Fissehatsyone, Project Director
- Anthony Kollie, M&E Officer

EQUIP (Monrovia)

- David Waines, Country Director
- Justin Pendarvis, Deputy Country Director

EQUIP (Ganta, Nimba)

- Kristen Cahill, Medical Coordinator
- Olive Teah, HIV/TB Supervisor
- Lawrina S. Dinkey, RH Supervisor
- John G. Nenwah, Data Supervisor
- Genevive T. Nuah, RH Supervisor
- Alimso G. Paygar, Clinical Supervisor
- Gayflor Barnar, HIV/TB Supervisor
- David Z. Membah, EPI Supervisor
- Abraham D. Tozay, Clinical Supervisor

Merci (Monrovia)

- Dr. Tete Brooks, Executive Director

Africare (Monrovia)

- Ernest Gaie, Country Director

Africare (Gbarnga, Bong)

- Dr. Benjamin Vonhm, Health Coordinator
- Eric G. Sackie, M&E Officer
- 9 field staff

Africare (Kpaai Clinic, Bong)

- G. Browne, OIC and other facility staff

IRC (Monrovia)

- Allan Freedman, Country Director

IRC (Sanequellie, Nimba)

- Nick Low, Program Manager
- Peny, Clinical Supervisor
- 9 field staff

Nimba County Health Team (Sanequellie)

- C. Paul Nyanzee, County Health Division Director (CHDD)
- Dr. Cuallau Jabbe-Howe, CHO
- Isaac B. Cole, gCHV/County Health Surveillance Officer
- Jonathan S. Tokpah, County M&E Officer
- Priscilla S. Mабiah, County RH Supervisor
- Sarah W Layweh, County Registrar/Data Manager

**List of Interviewees for Community Health Assessment
(Interviewer: Mary Carnell)**

RBHS

- Dr. Richard Brennan, Chief of Party
- George Kaine, County Coordinator, GCM
- Luogon Willi-Paye, County Coordinator, Nimba
- J. Mehnmon Tokpah, County Coordinator, River Gee
- Rufus Domah, County Coordinator, Bong
- William Kowah Zazay, County Coordinator, Lofa

MOHSW

- Dr. Bernice Dahn, Deputy Minister & CMO
- Boima Tamba, Director, CHSD
- Daniel Wessih, Deputy Director CHSD
- Margaret Korpkor, County Health Team Coordinator, CHSD
- Xavier Modol, Consultant, MOHSW Ten-year Health Plan
- Frank Baer, Consultant, MOHSW Ten-year Health Plan

NMCP

- Tolbert Nyanswah, Program Manager
- Asatu Dono, CCM Focal person

GFATM

- David Logan, Coordinator

NLTCP

- Dr. Catherine Cooper, Program Manager
- Deddeh Kessele, Deputy Program Manager
- Su Su Thompson, Field Coordinator

PPAL

- Emree Mukum Bee, Program Manager
- Regina Hodges, Medical Service Delivery Officer
- Comfort Kolle, Youth IEC & Public Relations Officer
- Louise Gausi, Supervisor Market-based FP Program

BRAC

- Dr. Haroun Or Rashid, Technical Health Manager

Africare

- Dr. Benjamin Vonhm, Health Coordinator
- Anthony Yeakpalah, Clinical Supervisor
- James Kolliem, Community Health Assistant
- Patricia N. M. Amarah, Maternal Nurse
- Zowah Nenyeh, RH Supervisor
- John Gleekiah, Child Survival
- George Teo, Jr, Communicable Disease Supervisor
- Michael S. Bondo, Community Health Assistant Nutrition Supervisor
- Eric G. Sackie, M&E Officer
- Nelly K. Harris, Community Health Supervisor
- Aloysius Nyan, Clerical Assistant

Bong County Health Team

- Melepalay K. Sumo, gCHV Supervisor
- Tokpa S. Wakpolo, TB/HIV Supervisor
- Jerries L. Walker, Human Resource Manager
- Stephen S.B. Cooper, CHT Supervisor
- Taywah Bombo, Liberia Prevention of Maternal Mortality Focal Person
- Gormah M. Cole, RH Supervisor
- Arthur Loryoun, Pharmacist

Nimba County Health Team

- C. Paul Nyanzee, CHDD

- Dr. Cuallau Jabbe-Howe, CHO
- Rufus G. Saye, County Supervisor
- Isaac B. Cole, gCHV/County Health Surveillance Officer

IRC-Nimba

- Nicholas Low, Project Manager
- Larwuo Wuah, Reproductive Health Office
- Joseph M. Barkolleh, IRC Community Health Supervisor
- Perry P. Koffa, Clinical Officer
- Veleh L. Donzo, Database Manager

Equip- Nimba

- Kristen Cahill, Medical Coordinator
- Joseph K. Kilikpo, County Coordinator
- Roland T. Suomie, National Coordinator
- Sam Dahn, Regional Supervisor
- Edward B. Zaindo, Assistant Supervisor
- Esther M. Bartuah, Regional Supervisor
- Cooper S. W. Siaway, Assistant Regional Supervisor/BCC Focal Person
- P. Meney K. Hurlay, PHC Regional Supervisor
- Emmanuel S. Johnson, Regional Supervisor
- Alimso G. Paygar, Clinical Supervisor
- Blamah Molley, Regional Supervisor
- J. Emmanuel Tarr, Assistant
- Yeh G. Gweh, Regional Supervisor
- Joseph Z. Suomie, Wash Field Coordinator

Group discussions in Bong and Nimba counties

- 32 staff at 4 health facilities
- 20 mothers of children under-5 years
- 24 gCHVs
- 47 TTM/TMs
- 25 CHCs/CHDCs

List of Interviewees for BCC Assessment (Interviewer: Carol Hooks)

RBHS

- Dr. Richard Brennan, Chief of Party
- George Kaine, County Coordinator, GCM
- J. Mehnmon Tokpah, County Coordinator, River Gee
- Luogon Willie-Paye, County Coordinator, Nimba
- Rufus Domah, County Coordinator, Bong
- William Kowah Zazay, County Coordinator, Lofa

MOHSW

- Tamba Boima, Director, CHSD
- Daniel Wessih, Deputy Director, CHSD
- Dr. Saye Baawo, Director, FHD
- Rev. John Sumo, Director, HPD

NACP

- Sonpon Sieh, Director

NMCP

- Daniel Soma, BCC Coordinator
- Joseph Tamba, IEC/BCC Officer
- Bismark Wleh, IEC/BCC Officer

National Traditional Council of Liberia, Montserrado County

- Asulana Garsbah, Chief

Crusaders for Peace, Monrovia

- Julie Endee, Executive Director and Cultural Ambassador

Radio Cape Mount, 102.4

- Osmasa Mark, Director

Bong CHT

- Alphonso Kofa, CHDD
- Joe E. Smith, HP Focal Person

Africare

- Markonee Zar, Health Program Liaison & BCC Focal Person

Phebe Hospital OPD

- Emmanuel Dweh, OIC
- Nurses, ANC
- Group discussion with 16–29 year old mothers of children under-5 years

Suakoko group discussions

- Caregivers & TTMs
- Traditional Chiefs
- Girls 15–24 years
- Boys 16–23 years

Salala Clinic

- Miatta Yekee, OIC
- Mary Tennie, CM

- Group discussion with gCHVs

Grand Cape Mount CHT

- Theresa Alpha, CHDD
- John Kallon, Clinical Supervisor
- Varney C. Massaquoi, HP Focal Person

MTI, Senje

- Jerry Zangor, Head of Field Office, Bomi and Montserrado
- Florence Rogers, BCC Focal Person and SBC/Supervisor
- Community Health Promoters
- Interview with 16 year old girl in 11th grade
- Group discussion with boys 17–25 years
- Group discussion with 16–26 year old mothers of children U5

Bo-Waterside Clinic

- Patricia Gboyo, CM
- Elizabeth, Dispenser
- Joseph Kpaka, Vaccinator/Nurse Aide
- Jennih M. Gray, Registrar

Tiene Clinic

- Mayango M. Akoi, OIC
- Maria S. Freeman, CM
- Mambudu Kroma, Registrar
- Varney Ferka, Lab Technician
- Group discussion with boys 15–18 years
- Group discussion with girls 14–21 years

List of Interviewees for Capacity Building Assessment (Interviewers: Beth Gragg and Deirdre Rogers)

RBHS

- Dr. Richard Brennan, Chief of Party
- Chip Barnett, Director of M&E and Partner Coordination
- Mike Mulbah, M&E Officer
- JK Ofori, BCC Advisor
- Sarah Hodge, EmONC Advisor
- Maima Zazay, FP/RH Advisor
- David Franklin, Mental Health Advisor
- Laurretta Nagbe, HIV/TB Advisor
- George Kaine, County Coordinator GCM
- Luogon Willie-Paye, County Coordinator, Nimba
- J. Mehnmon Tokpah, County Coordinator, River Gee

- Rufus Domah, County Coordinator, Bong
- William Kowah Zazay, County Coordinator, Lofa
- Gyanu Tamang, Former Intern

MOHSW

- Dr. Bernice Dahn, Deputy Director & CMO
- Rev. John B. Sumo, Director, HPD
- Dr. Meiko Dolo, Director, Mental Health Unit
- Ellen George-Williams, Consultant, Mental Health Unit

NACP

- Sonpon Sieh, Program Manager
- Dr. Julia Toomey Garbo, Deputy Program Manager

Nimba CHT

- Rancy W. Leesola, County Health Service Administrator
- Isaac B. Cole, gCHV/County Health Surveillance Officer
- Karntey Deemie, Clinical Supervisor
- Jonathan Tokpah, County M&E Officer
- Priscilla Mабiah, County RH Supervisor
- Sarah Lewah, County Registrar
- Lewis Momo, County Pharmacist
- Nelson Kartie, Environmental Health Coordinator
- Jerry Manneh, County Accountant
- Harris Nyankaryah, County HRM Officer
- Austin G. Mehn, EHT

IRC (Nimba)

- Nicholas Low, Coordinator RBHS Program
- Kofa Perry, Clinical Supervisor

St. Mary's Clinic (Nimba)

- Celestine Yenneh, OIC
- Mercy Gullsiah, CM
- Emmanuel Dahn, Lab Technician

EQUIP (Nimba)

- Kristen Cahill, Medical Coordinator
- Olive Teah, HIV/TB Supervisor
- Lawina S. Dinkeh, RH Supervisor
- John G. Nenwah, Data Supervisor
- Genevive T. Nuah, RH Supervisor
- Alimso G. Paygar, Clinical Supervisor
- Gayflor Bamar, HIV/TB Supervisor

- David Z. Membah, EPI Supervisor
- Abraham D. Tazay, Clinical Supervisor

Hope Clinic (Nimba)

- Susannah Dolo, CM and Acting OIC

Africare (Bong)

- Dr. Benjamin Vonhm, Health Coordinator
- Eric Sackie, M&E Officer

Africare

- Markonee Willie, RH Supervisor

Yila Clinic (Bong)

- Sarah Suah, OIC
- Eunice Neahn, CM
- Samuel M. Gweh, Vaccinator
- David Dolo, Registrar

Bong CHT

- 4 patients at Hope & Yila Clinics

Annex 3. Individuals Interviewed in the 2012 and 2014 Capacity Assessments

May 19–20, 2014:

RBHS staff briefing

Assessment Team: Deirdre, Heather

May 21, 2014:

RBHS Staff Interviews

Assessment Team: Kumkum, Kate

Attendees:

Theo Lippeveld (Financing)

Sarah Hodges, Maima Zazay (FHD)

Catherine Gbozee, Theo Lippeveld, Marietta Yekee, Teah Dogmah (Community Health)

Catherine Gbozee, Theo Lippeveld, Judith Oki (County Health Services)

Joe Moyer (Infrastructure)

Bal Ram Bhui, Theo Lippeveld (HMER)

Zaira Alonso (HR Unit/Personnel Unit)

Marion Subah (Training Institutions & Boards)

Floride Niyuhire (PBF)

Marietta Yekee, Teah Dogmah (NHPD & NMCP)

Nimba CHSWT

Assessment Team: Deirdre, Heather, Rose, Adolphus (MOHSW), J. Mehmon Tokpa, Imenteelea Grimes

Attendees

Collins S Bowah (CHO), C. Paul Nyanzee (CHDD), Priscilla Mabilia (RH Supervisor),

Kou Yelabo (Mental Health), Jerry Mannah (Accountant), Wilson Dolo (Logistician),

Rancy Leesala (CHSA),

Steven Wongbay (Nutritionist), Barnard Lakpor (EPI Supervisor), Nelson Kartee (EHT),

Harris Nyankaryah (HR Officer), John G. Nenwah (Africare M&E), J. Gonleyen Dahn (M&E Officer CHT).

May 22, 2014:

Esther Bacon School of Nursing and Midwifery (EBSNM)

Assessment Team: Deirdre, Heather, Judith, Adolphus (MOHSW), Caleb, Pauline

Attendees: Harriet Dolo, Esther Toloco, Rebecca Seleweyan, Anna Kybuku, Kebe

Koroyon, (+ 2 recent graduates working in obstetrics ward)

Tubman National Institute of Medical Arts (TNIMA)

Assessment Team: Kumkum, Kate

Attendees: Sarah Kollie (Administrator), Ada Brown (Acting Director, School of Nursing and Midwifery), Kerkula Kollie (Director, School of Environmental Health Technicians), Vachel Harris (Instructor, School of Nursing and Midwifery), Edwin Beyan (Instructor, School of Nursing and Midwifery), Lassana Kelleh (Instructor, School of Nursing and Midwifery), Jestina Cole (Instructor, School of Nursing and Midwifery), Musu Kiawon (Instructor, School of Nursing and Midwifery), Dorothy Dagaboi (Instructor, School of Nursing and Midwifery), Cecelia Massaline (Instructor, School of Nursing and Midwifery), Fatu Kettor (Instructor, School of Nursing and Midwifery), Mr. Barclay (Instructor, School of EHT), Hector Weah (Instructor, School of Nursing and Midwifery), Abraham Zayzay (Instructor, School of Nursing and Midwifery), Augustus Reeves (Librarian), Rebecca Kiazer Timbo (Instructor, School of Nursing and Midwifery), James Dogba (Instructor, School of EHT), Rebecca Scotland (Instructor, School of Physician Assistant)

NMCP

Assessment Team: Kumkum, Kate

Attendees: Oliver Pratt (Program Manager, NMCP)

May 23, 2014:

Lofa CHSWT

Assessment Team: Deirdre, Heather, Judith, Adolphus Clark (MOHSW), Caleb, Pauline

Attendees: Aaron Kollie (CHO), Dorfelson Jayguhwoiyan (District Health Officer), Howard Yokie (EPI Supervisor), Wolobah Y. Moore (County Pharmacist), Abraham Flomo & John Akoi (Clinical Supervisors), Gunkanue Monwan, (HIV Focal Person), Edmund Eisah, (Director of Community Health), Prince Sesay (Director of County Health Services), John B. Arku (Logistician), Elizabeth Tamba & Esther Y. Argba (MCH Supervisors)

PBF Unit

Assessment Team: Kumkum, Kate

Attendees: Louise Marpleh (FARA Manager), Dominic Togba (Acting Coordinator PBF), Tendra Tenwah-Gweh (PBF Officer), Mildred Harris (PBF Officer)

Mental Health

Assessment Team: Kate

Attendees: Meiko Dolo (Director Mental Health Unit)

HMER Unit

Assessment Team: Kumkum, Kate

Attendees: Luke Bawo (Coordinator M&E, HMIS & Research)

May 26, 2014:

Infrastructure Unit

Assessment Team: Deirdre, Kumkum

Attendees: David Jallah (Director), Edwina Robinson (Secretary), Solomon (Snr. Engineer), Sumo (Snr. Engineer)

National Health Promotion Division

Assessment Team: Deirdre, Kumkum

Attendees: Rev. JohnSumo (Director)

County Health Services

Assessment Team: Deirdre, Kumkum

Attendees: Vera Mussah (Director), Byron Zahnweah (Contracting-in Coordinator), Precellia Goanue (Quality Assurance Coordinator), John Kollie (Improvement Collaborative)

Personnel Unit

Assessment Team: Deirdre, Kumkum

Attendees: James Beyan (Personnel Director)

Community Health Services

Assessment Team: Deirdre, Kumkum

Attendees: Tamba Boima (Director), Olasiford Wiah (River Gee), Patience Sorsor (River Gee)

Family Health Division

Assessment Team: Deirdre, Kumkum

Attendees: Sarah Layweh (Acting for Director Caullau Jabbeh-Howe)

May 27, 2014:

Bong CHSWT

Assessment Team: Kate, Heather, Marion, Justin Korvayan (MOHSW), Luogon Willie-Paye, Mohammed Massaley

Attendees: Dr. Samson Arzoaquoi (CHO), Getrude Cole (RH Supervisor), (Jerries Walker (HRO), Fatuma Jusu (CHSA), Peter Tiah (Child Survival Focal Person), Saturday Kollie (County Diagnostics Officer), John Gleekiah (Clinical Supervisor), Peter Yarkpawolo (HIV/AIDS Coordinator), James Juman (EHT Supervisor), James Sibley (TB/Leprosy Focal Person), Prince Dolo (Logistics Officer), Melvin Fania (Data Clerk), William Gbelee (Nutrition Focal Person), Darkermue Kollie ((Mental Health Focal Person), Korwan Flomo (Accountant), Samuel Gayflor (Pharmacist/Supply Chain Chief)

Central MOHSW Building Block 2: Human Resources

Assessment Team: Deirdre, Kumkum

Attendees: Matthew Flomo (Deputy Minister for Administration), James Beyan (Personnel Director)

Central MOHSW Building Block 3: HMIS

Assessment Team: Deirdre, Kumkum

Attendees: Stanford Wesseh (Assistant Minister, Vital Statistics), Stephen Gbanyan (Acting Director, HMIS Unit)

May 28, 2014:

Central MOHSW Building Block 5: Health Care Financing

Assessment Team: Deirdre, Kumkum

Attendees: Benedict Harris (Assistant Minister, Planning), Momolu Sirleaf (External Aid Coordinator), Louise Marpleh (FARA Manager), Schiffer Sowandi (FARA Accountant-OFM)

May 29, 2014:

Central MOHSW Building Block 1: Delivering Essential Health Services

Assessment Team: Deirdre, Kumkum

Attendees: Dr. Bernice Dahn (Deputy Minister, Health Services/Chief Medical Officer), Cllr. Tolbert Nyenswah (Assistant Minister, Preventive Services), Vera Mussah (Director, CHS Unit), Tamba Boima (Community Health), Sarah Layweh (FHD)

Central MOHSW Building Block 4: Access to Essential Medicines

Assessment Team: Deirdre, Kumkum

Attendees: Reverend Tijli Tarty Tyee, Logistics/Supply Chain Manager

Liberian Board of Nursing & Midwifery (LBNM)

Assessment Team: Heather, Kate, Nowai

Attendees: Cecelia A. Morris (Chairperson LBNM), Darboi G. Korkoyah (M&E Director), Cecelia C.K. Flomo (Registrar), Velma Okoro (Finance Officer), Elizabeth Bemah Slewion (Mental Health M&E Officer)

May 30, 2014:

Central MOHSW Building Block 6: Leadership and Governance

Assessment Team: Deirdre, Kumkum, Rose Macauley, Judith Oki

Attendees: Dr. Bernice Dahn (Deputy Minister, Health Sciences/Chief Medical Officer), Justin Korvayan (Director of Planning & Decentralization), Cllr. Tolbert Nyenswah

(Assistant Minister, Preventive Services), Matthew Flomo (Deputy Minister for Administration), Cllr. Vivian Cherue (Deputy Minister, Social Welfare)

Liberian Medical Dental Council (LMDC)

Assessment Team: Heather, Kate Nowai Johnson (RBHS)

Attendees: Dr. Moses Pewu, Dr. Mark Kieh (Acting Registrar-General & Clinical Coordinator), Andrew Tulay (Field Clinical Coordinator)

Annex 4. Advantages and Disadvantages of the Case Study Design

Advantages of the case study methodology:

1. Allows for a deeper evaluation of and potentially new insight from the recent Ebola epidemic in Liberia and the impact on the health system. A qualitative case study methodology allows for a description of complexity.
2. Has the potential to stimulate new research. Documenting capacity gains through a ‘traditional’ WHO HSS building blocks lens, and then reanalyzing the same systems and capacities through a resilience lens may stimulate new research and thinking into how traditional HSS interventions are designed.
3. May contradict or build upon established theory or practices. The methodology allows for an in-depth analysis of whether we are asking the right questions in ‘traditional’ health systems strengthening interventions.

Disadvantages of the case study method:

1. The researcher’s subjective feelings may influence the case study resulting in researcher bias in both the data collection and interpretation. All RBHS mid-term evaluation and capacity assessment tools were developed collaboratively by the researcher, members of the RBHS project team, and members of the MOH, and in consultation with USAID. The researcher was involved in all qualitative data collection taking place between 2009 and 2015, and personally conducted key informant and group interviews (see Annexes 2 and 3 for lists of individuals interviewed). Though this consistency is highly valuable on the one hand, it is possible that her interpretations influenced the way that the data were collected (e.g., what follow-up and probing questions were asked and how questions were asked).
2. Memory distortions. Interviews with MOH and NGO staff required that they recall information about past experiences, situations, and events. Since people tend to focus on factors that they find important themselves, they may have been unaware of other possible influences. In an attempt to address this in the RBHS mid-term evaluation in 2011, and the two capacity assessments conducted in 2012 and 2014, interviews were conducted with a very wide range of stakeholders, combined with extensive supporting document review and secondary data analysis (see data sources below).
3. Does not facilitate estimations of impact on coverage or other population-level health indicators. Further, it is not possible to replicate findings. As a result, there are problems in generalizing case study results obtained from unique individuals or groups to other people or groups because the findings may not be representative of any particular population.^{ccxxiii ccxxiv}

BIBLIOGRAPHY

-
- ⁱ Margaret Harris Cheng, “Reviving Health Care in Liberia,” *The Lancet* 373, no. 9671
- ⁱⁱ “United States Government, Global Health Initiative, Liberia Strategy, September 2011,” 2011.
- ⁱⁱⁱ “Country Development Cooperation Strategy: Liberia, 2013-2017,” 2012.
- ^{iv} “Multidimensional Poverty Index, UNDP, 2013” (United Nations Development Programme, 2013), <http://hdr.undp.org/en/content/table-6-multidimensional-poverty-index-mpi>.
- ^v “Human Development Index, UNDP, 2013” (United Nations Development Programme, 2013).
- ^{vi} “LIBERIA’S SECOND-ROUND NATIONAL HEALTH ACCOUNTS PART I: INSTITUTIONAL HEALTH SPENDING 2009/10” (Liberian Ministry of Health and Social Welfare, November 2011).
- ^{vii} Deirdre Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project,” 2014.
- ^{viii} “Performance-Based Contracting: Using Health Financing to Strengthen the Liberian Health System: The RBHS Experience” (JSI Research & Training Institute, Inc., May 2014).
- ^{ix} “The Improvement Collaborative Approach: Rolling Out Clinical Standards for Liberia” (JSI Research & Training Institute, Inc., May 2014).
- ^x “Pre-Service Education: A New Approach to Learning and Teaching” (JSI Research & Training Institute, Inc., May 2014).
- ^{xi} “Improving HMIS Performance: Measurement and Interventions” (JSI Research & Training Institute, Inc., May 2014).
- ^{xii} “Liberia: Standard DHS, 2007. LISGIS, Monrovia, Liberia and Ministry of Health and Social Welfare, Monrovia, Liberia and National AIDS Control Program, Monrovia, Liberia and Macro International Inc. Calverton, Maryland, USA,” 2007.
- ^{xiii} “Liberia: Standard DHS, 2013. LISGIS, Monrovia, Liberia and Ministry of Health and Social Welfare, Monrovia, and Macro International Inc. Calverton, Maryland, USA,” 2013.

^{xiv} Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”

^{xv} I. Labouba and E.M. Leroy, “Ebola Outbreaks in 2014,” *Journal of Clinical Virology*, 2015, in press.

^{xvi} Kevin Sack et al., “How Ebola Roared Back,” December 29, 2014, http://www.nytimes.com/2014/12/30/health/how%ADebola%ADroared%ADback.html?partner=rss&emc=rss&_r=0.

^{xvii} “Liberia Ebola SitRepno. 108 Ministry of Health and Social Welfare Aug 31, 2014,” August 31, 2014.

^{xviii} Clare Chandler et al., “Ebola: Limitations of Correcting Misinformation,” *The Lancet*, December 19, 2014, 1–2.

^{xix} Sanjana J. Ravi and Eric M. Gaudin, “Sociocultural Dimensions of the Ebola Virus Disease Outbreak in Liberia,” *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 12, no. 6 (2014): 1–5.

^{xx} James M. Shultz, Florence Baingana, and Yuval Neria, “The 2014 Ebola Outbreak and Mental Health: Current Status and Recommended Response,” *JAMA: The Journal of the American Medical Association*, 313, no. 6 (2015): 567-568.

^{xxi} François Lamontagne et al., “Doing Today’s Work Superbly Well — Treating Ebola with Current Tools,” *New England Journal of Medicine*, 371, no. 17 (October 23, 2014): 1565–66.

^{xxii} Kate E. Jones et al., “Global Trends in Emerging Infectious Diseases,” *Nature* 451, no. 7181 (February 21, 2008): 990–93, doi:10.1038/nature06536.

^{xxiii} A. Townsend Peterson, “Good and Bad News about Ebola,” *PLoS Neglected Tropical Diseases* 9, no. 3 (March 12, 2015): e0003509, doi:10.1371/journal.pntd.0003509.

^{xxiv} Joanna Mazet, “Predicting and Preventing Emerging Infectious Diseases in a Changing World: A Project of USAID’s Emerging Threats Program” (Consortium of Universities for Global Health, Boston, MA, 2015).

^{xxv} Clair MacDougall, “Palm Oil Company Is Accused of Exploiting Liberia’s Ebola Crisis,” *The New York Times*, August 1, 2015, <http://www.nytimes.com/2015/08/02/world/africa/palm-oil-company-is-accused-of-exploiting-liberias-ebola-crisis.html>.

^{xxvi} “Do We Need the WHO? | Devpolicy Blog from the,” *Development Policy Centre*, accessed February 6, 2015, <http://devpolicy.org/do-we-need-the-who-20150203/>.

^{xxvii} Homi Kharas, “Trends and Issues in Development Aid” (Wolfensohn Center for Development at the Brookings Institution, November 2007).

^{xxviii} “Do We Need the WHO?”

^{xxix} “Foreign Humanitarian Assistance: Joint Publication 3-29,” January 3, 2014.

^{xxx} Kira Kern on August 10 and 2011 at 9:24am View Blog, “What is the Role of Military in Development,” accessed August 5, 2015, http://www.internationalpeaceandconflict.org/profiles/blogs/what-is-the-role-of-military-in-development?xg_source=activity.

^{xxxi} Stephen J. Hoffman, Clarke B. Cole, and Mark Pearcey, “Mapping Global Health Architecture to Inform the Future” (Centre on Global Health Security, January 2015).

^{xxxii} Rifat Atun and Michel Kazatchkine, “Promoting Country Ownership and Stewardship of Health Programs: The Global Fund Experience,” *Journal of Acquired Immune Deficiency Syndromes*, 52 (November 1, 2009): S67–S68.

^{xxxiii} Homi Kharas, “Trends and Issues in Development Aid.” Accessed December 14, 2016, https://www.brookings.edu/wp-content/uploads/2016/06/11_development_aid_kharas.pdf

^{xxxiv} OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*, Geographical Distribution of Financial Flows to Developing Countries (OECD Publishing, 2015), http://www.oecd-ilibrary.org/development/geographical-distribution-of-financial-flows-to-developing-countries-2015_fin_flows_dev-2015-en-fr.

^{xxxv} OECD, *Development Co-Operation Report 2014*, Development Co-Operation Report (OECD Publishing, 2014), http://www.oecd-ilibrary.org/development/development-co-operation-report-2014_dcr-2014-en.

^{xxxvi} Joseph L. Dieleman et al., “Sources and Focus of Health Development Assistance, 1990–2014,” *JAMA: The Journal of the American Medical Association*, 313, no. 23 (June 16, 2015): 2359, doi:10.1001/jama.2015.5825.

^{xxxvii} Ibid.

^{xxxviii} Ashley E. Warren et al., “Global Health Initiative Investments and Health Systems Strengthening: A Content Analysis of Global Fund Investments,” *Global Health* 9, no. 1 (2013): 30.

^{xxxix} Homi Kharas, “Trends and Issues in Development Aid.” Accessed December 14, 2016, https://www.brookings.edu/wp-content/uploads/2016/06/11_development_aid_kharas.pdf

^{xl} OECD, *Development Co-Operation Report 2014*.

^{xli} “WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation,” n.d., <http://www.wssinfo.org/>.

^{xlii} “Liberia: Standard DHS, 2013. LISGIS, Monrovia, Liberia and Ministry of Health and Social Welfare, Monrovia, and Macro International Inc. Calverton, Maryland, USA.”

^{xliii} “Liberia: Standard DHS, 2007. LISGIS, Monrovia, Liberia and Ministry of Health and Social Welfare, Monrovia, Liberia and National AIDS Control Program, Monrovia, Liberia and Macro International Inc. Calverton, Maryland, USA.”

^{xliv} “LIBERIA NATIONAL HEALTH ACCOUNTS 2007/08,” October 2009.

^{xliv} “LIBERIA’S SECOND-ROUND NATIONAL HEALTH ACCOUNTS PART I: INSTITUTIONAL HEALTH SPENDING 2009/10.”

^{xlvi} “2012 Physician Specialty Data Book Center for Workforce Studies” (Association of American Medical Colleges, November 2012).

^{xlvii} “Healthcare Crippled as Ebola Overwhelms Hospitals in Liberia,” *Reuters*, October 10, 2014, <http://www.reuters.com/article/uk-health-ebola-idUSKCN0HZ0XB20141010>.

^{xlviii} “GLOBAL BURDEN OF DISEASES, INJURIES, AND RISK FACTORS STUDY 2010,” 2010.

^{xlix} “LIBERIA’S SECOND-ROUND NATIONAL HEALTH ACCOUNTS PART I: INSTITUTIONAL HEALTH SPENDING 2009/10.”

^l “Liberia: Public Expenditure and Financial Accountability (PEFA) Assessment” (IMF Country Report No. 12/273, September 2012).

^{li} “Official Development Assistance for Health: Liberia” (WHO, February 13, 2012).

^{lii} *Ibid.*

-
- liii “LIBERIA NATIONAL HEALTH ACCOUNTS 2007/08.”
- liv “LIBERIA’S SECOND-ROUND NATIONAL HEALTH ACCOUNTS PART I: INSTITUTIONAL HEALTH SPENDING 2009/10.”
- lv “Liberia: Public Expenditure and Financial Accountability (PEFA) Assessment.”
- lvi Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”
- lvii “Liberia_-_Infrastructure_and_Inclusive_Growth_-_Full_Report.pdf,” accessed September 11, 2016, http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Liberia_-_Infrastructure_and_Inclusive_Growth_-_Full_Report.pdf.
- lviii Cesar G Victora et al., “Co-Coverage of Preventive Interventions and Implications for Child-Survival Strategies: Evidence from National Surveys,” *The Lancet* 366, no. 9495 (October 2005): 1460–66, doi:10.1016/S0140-6736(05)67599-X.
- lix OECD, *Geographical Distribution of Financial Flows to Developing Countries 2015*.
- lx Alliance for Health Policy and Systems Research, *Strengthening Health Systems: The Role and Promise of Policy and Systems Research*. (Geneva: Alliance for Health Policy and Systems Research, 2004).
- lxi “The Relative Contribution of Multiple Determinants to Health Outcomes. Researchers Continue to Study the Many Interconnected Factors That Affect People’s Health,” *Health Affairs Health Policy Brief* (August 21, 2014).
- lxii “Establishing a Holistic Framework to Reduce Inequities in HIV, Viral Hepatitis, STDs, and Tuberculosis in the United States An NCHHSTP White Paper on Social Determinants of Health, 2010 National” (National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC, 2010).
- lxiii “The Relative Contribution of Multiple Determinants to Health Outcomes. Researchers Continue to Study the Many Interconnected Factors That Affect People’s Health.”
- lxiv Bridget Booske et al., “COUNTY HEALTH RANKINGS WORKING PAPER DIFFERENT PERSPECTIVES FOR ASSIGNING WEIGHTS TO DETERMINANTS OF HEALTH,” February 2010.
- lxv “GLOBAL BURDEN OF DISEASES, INJURIES, AND RISK FACTORS STUDY 2010.”

-
- ^{lxvi} Bridget Booske et al., “COUNTY HEALTH RANKINGS WORKING PAPER DIFFERENT PERSPECTIVES FOR ASSIGNING WEIGHTS TO DETERMINANTS OF HEALTH.”
- ^{lxvii} “The State of US Health: Innovations, Insights, and Recommendations from the Global Burden of Disease Study,” accessed August 17, 2015, <http://www.healthdata.org/policy-report/state-us-health-innovations-insights-and-recommendations-global-burden-disease-study>.
- ^{lxviii} Silvia Stringhini et al., “Association of Socioeconomic Position with Health Behaviors and Mortality,” *JAMA: The Journal of the American Medical Association* 303, no. 12 (March 24, 2010): 1159–66, doi:10.1001/jama.2010.297.
- ^{lxix} World Health Organization, ed., *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks* (Geneva, Switzerland: World Health Organization, 2009).
- ^{lxx} World Health Organization, *A Conceptual Framework for Action on the Social Determinants of Health: Debates, Policy & Practice, Case Studies.*, 2010, http://apps.who.int/iris/bitstream/10665/44489/1/9789241500852_eng.pdf.
- ^{lxxi} “GLOBAL BURDEN OF DISEASES, INJURIES, AND RISK FACTORS STUDY 2010.”
- ^{lxxii} “Synopsis: Impact of HSS on Health” (USAID, n.d.).
- ^{lxxiii} Robert L. Cohen et al., “An Evaluation of the President’s Emergency Plan for AIDS Relief Effect on Health Systems Strengthening in Sub-Saharan Africa,” *JAIDS Journal of Acquired Immune Deficiency Syndromes* 62, no. 4 (April 2013): 471–79, doi:10.1097/QAI.0b013e3182816a86.
- ^{lxxiv} Quinhas F Fernandes et al., “Effects of Health-System Strengthening on under-5, Infant, and Neonatal Mortality: 11-Year Provincial-Level Time-Series Analyses in Mozambique,” *The Lancet Global Health* 2, no. 8 (August 2014): e468–77, doi:10.1016/S2214-109X(14)70276-1.
- ^{lxxv} Ari D. Johnson et al., “Assessing Early Access to Care and Child Survival during a Health System Strengthening Intervention in Mali: A Repeated Cross Sectional Survey,” *PLoS One* 8, no. 12 (December 11, 2013): e81304, doi:10.1371/journal.pone.0081304.
- ^{lxxvi} Peter C. Drobac et al., “Comprehensive and Integrated District Health Systems Strengthening: The Rwanda Population Health Implementation and Training (PHIT)

Partnership,” *BMC Health Services Research* 13, no. Suppl 2 (May 31, 2013): S5, doi:10.1186/1472-6963-13-S2-S5.

^{lxxvii} Anbrasi Edward et al., “Configuring Balanced Scorecards for Measuring Health System Performance: Evidence from 5 Years’ Evaluation in Afghanistan,” *PLoS Medicine* 8, no. 7 (July 26, 2011): e1001066, doi:10.1371/journal.pmed.1001066.

^{lxxviii} Theo Lippeveld, “Routine Health Information Systems: The Glue of a Unified Health System,” 2001.

^{lxxix} Theo Lippeveld and Rainer Sauerborn, “Ch 2: A Framework for Designing Health Information Systems,” in *Design and Implementation of Health Information Systems*, 2000.

^{lxxx} Lippeveld, “Routine Health Information Systems: The Glue of a Unified Health System.”

^{lxxxii} Lippeveld and Sauerborn, “Ch 2: A Framework for Designing Health Information Systems.”

^{lxxxii} Shehla Zaidi, “Choked Pipes: Reforming Pakistan’s Mixed Health System,” *Bulletin of the World Health Organization* 88, no. 11 (November 1, 2010): 876–876, doi:10.2471/BLT.10.079285.

^{lxxxiii} Alliance for Health Policy and Systems Research, *Strengthening Health Systems*.

^{lxxxiv} Ibid.

^{lxxxv} Patrick T. Lee et al., “An Analysis of Liberia’s 2007 National Health Policy: Lessons for Health Systems Strengthening and Chronic Disease Care in Poor, Post-Conflict Countries,” *Globalization and Health* 7, no. 1 (2011): 37.

^{lxxxvi} “National Health & Social Welfare Policy & Plan 2010-21,” July 2011, <http://liberiamohsw.org/>.

^{lxxxvii} “Health Systems Strengthening Workshop” (Global Fund, June 2009).

^{lxxxviii} “WHO Health Systems Strengthening Glossary,” n.d., http://www.who.int/healthsystems/hss_glossary/en/index5.html.

^{lxxxix} “Health System Strengthening - Current Trends and Challenges. Executive Board 128th Session, Geneva, 17-25 January 2011,” January 17, 2011, http://apps.who.int/gb/ebwha/pdf_files/EB128/B128_37-en.pdf.

^{xc} M. Islam ed., “Health Systems Assessment Approach: A How-To Manual.” (U.S. Agency for International Development, Health Systems 20/20, Partners for Health Reformplus, Quality Assurance Project, and Rational Pharmaceutical Management Plus, 2007).

^{xcii} Josefien van Olmen et al., “Health Systems Frameworks in Their Political Context: Framing Divergent Agendas,” *BMC Public Health* 12, no. 774 (2012): 1–13.

^{xciii} George Shakarishvili et al., “Converging Health Systems Frameworks: Towards a Concepts-to-Actions Roadmap for Health Systems Strengthening in Low and Middle Income Countries,” *Global Health Governance* 3, no. 2 (2010), http://www.ghgj.org/Shakarishvili_Converging%20Health%20Systems%20Frameworks.pdf.

^{xciv} van Olmen et al., “Health Systems Frameworks in Their Political Context: Framing Divergent Agendas.” *BMC Public Health*, 12 (2012): 774. DOI: 10.1186/1471-2458-12-774

^{xcv} T. Adam et al., “Evaluating Health Systems Strengthening Interventions in Low-Income and Middle-Income Countries: Are We Asking the Right Questions?” *Health Policy and Planning* 27, suppl 4 (October 1, 2012): iv9-iv19, doi:10.1093/heapol/czs086.

^{xci} Drobac et al., “Comprehensive and Integrated District Health Systems Strengthening.” *BMC Health Services Research*, 13, Suppl. 2 (2013): S5. doi:10.1186/1472-6963-13-S2-S5

^{xcii} Wilbroad Mutale et al., “Systems Thinking in Practice: The Current Status of the Six WHO Building Blocks for Health System Strengthening in Three BHOMA Intervention Districts of Zambia: A Baseline Qualitative Study,” *BMC Health Services Research* 13, no. 1 (August 1, 2013): 291, doi:10.1186/1472-6963-13-291.

^{xciii} World Health Organization and others, “Everybody’s Business—strengthening Health Systems to Improve Health Outcomes: WHO’s Framework for Action,” 2007, <http://apps.who.int/iris/handle/10665/43918>.

^{xciv} Ibid.

^{xcv} Ibid.

^c Adam et al., “Evaluating Health Systems Strengthening Interventions in Low-Income and Middle-Income Countries.”

-
- ^{ci} Grace Chee et al., “Why Differentiating between Health System Support and Health System Strengthening Is Needed,” *International Journal of Health Planning and Management* 28, no. 1 (January 2013): 85–94, doi:10.1002/hpm.2122.
- ^{cii} Lisanne Brown, Anne LaFond, and Katherine Eve Macintyre, *Measuring Capacity Building* (Carolina Population Center, University of North Carolina at Chapel Hill, 2001), <http://heart-intl.net/HEART/Financial/comp/MeasuringCapacityBuilg.pdf>.
- ^{ciii} Ingvar Theo Olsen, “Sustainability of Health Care: A Framework for Analysis,” *Health Policy and Planning* 13, no. 3 (1998): 287–95.
- ^{civ} Karl Blanchet et al., “Advancing the Application of Systems Thinking in Health: Analysing the Contextual and Social Network Factors Influencing the Use of Sustainability Indicators in a Health System—a Comparative Study in Nepal and Somaliland,” *Health Research Policy and Systems* 12 (2014): 46.
- ^{cv} Ligia Paina and David H. Peters, “Understanding Pathways for Scaling up Health Services through the Lens of Complex Adaptive Systems,” *Health Policy and Planning* 27, no. 5 (August 1, 2012): 365–73, doi:10.1093/heapol/czr054.
- ^{cvi} Brown, LaFond, and Macintyre, *Measuring Capacity Building*.
- ^{cvii} Olsen, “Sustainability of Health Care: A Framework for Analysis.”
- ^{cviii} Judith Rodin, *The Resilience Dividend: Being Strong in a World Where Things Go Wrong.*, First (Rockefeller Foundation, 2014).
- ^{cix} Steven Gale and Sarah Jackson, eds., *The Future Can’t Wait: Over-the-Horizon Views on Development*, 2012.
- ^{cx} Matthew Castleden et al., “Resilience Thinking in Health Protection,” *Journal of Public Health* 33, no. 3 (September 2011): 369–77, doi:10.1093/pubmed/fdr027.
- ^{cxii} Ibid.
- ^{cxiii} Chinwe Ifejika Speranza, Urs Wiesmann, and Stephan Rist, “An Indicator Framework for Assessing Livelihood Resilience in the Context of Social–ecological Dynamics,” *Global Environmental Change* 28 (September 2014): 109–19, doi:10.1016/j.gloenvcha.2014.06.005.
- ^{cxiiii} Margaret E. Kruk et al., “What Is a Resilient Health System? Lessons from Ebola,” *The Lancet* 385 (May 9, 2015): 1910–12.

-
- ^{cxiv} Rodin, *The Resilience Dividend: Being Strong in a World Where Things Go Wrong*.
- ^{cxv} Christopher Nelson et al., “Conceptualizing and Defining Public Health Emergency Preparedness,” *American Journal of Public Health* 97, Suppl. 1 (April 2007): S9–11, doi:10.2105/AJPH.2007.114496.
- ^{cxvi} Rodin, *The Resilience Dividend: Being Strong in a World Where Things Go Wrong*.
- ^{cxvii} Alonzo Plough et al., “Building Community Disaster Resilience: Perspectives from a Large Urban County Department of Public Health,” *American Journal of Public Health* 103, no. 7 (2013): 1190–1197.
- ^{cxviii} Weltgesundheitsorganisation, ed., *Toolkit for Assessing Health-System Capacity for Crisis Management:: Strengthening Health-System Emergency Preparedness. 1: User Manual* (Copenhagen: World Health Organization, Regional Office for Europe, 2012).
- ^{cxix} Claire Bayntun, Gerald Rockenschaub, and Virginia Murray, “Developing a Health System Approach to Disaster Management: A Qualitative Analysis of the Core Literature to Complement the WHO Toolkit for Assessing Health-System Capacity for Crisis Management,” *PLoS Currents*, 2012, doi:10.1371/5028b6037259a.
- ^{cxx} “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021” (Liberian Ministry of Health and Social Welfare, May 12, 2015).
- ^{cxxi} “National Epidemic Preparedness and Response Plan” (Liberia Ministry of Health, April 2016).
- ^{cxxii} Robert E. Stake, “Chapter 14: Case Studies,” in *Handbook of Qualitative Research*, Norman K. Denzin, Yvonna S. Lincoln, Eds. (Sage Publications, 1994), 236–47.
- ^{cxxiii} Robert K. Yin, *Case Study Research: Design and Methods*, 5th ed. (Sage Publications, 2014).
- ^{cxxiv} “National Health & Social Welfare Policy & Plan 2010-21.”
- ^{cxxv} Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”
- ^{cxxvi} Wayne M. Getz et al., “Tactics and Strategies for Managing Ebola Outbreaks and the Salience of Immunization,” *Computational and Mathematical Methods in Medicine* 2015 (2015), doi:10.1155/2015/736507.

^{cxxvii} Saurabh R. Shrivastava, Prateek S. Shrivastava, and Jegadeesh Ramasamy, “Lessons Learnt from the 2014 Ebola Outbreak in West-Africa,” *Journal of Research in Medical Sciences*, 20, no. 1 (January 2015): 107–8.

^{cxxviii} “Ebola in Africa: The End of a Tragedy?,” *The Economist*, January 14, 2016, <http://www.economist.com/blogs/graphicdetail/2016/01/daily-chart-12>.

^{cxxix} Getz et al., “Tactics and Strategies for Managing Ebola Outbreaks and the Salience of Immunization.” *Computational and Mathematical Methods in Medicine*, 2015:736507. <http://dx.doi.org/10.1155/2015/736507>

^{cxxx} “Number of Ebola Cases and Deaths in Affected Countries - Humanitarian Data Exchange,” accessed July 17, 2016, <https://data.humdata.org/dataset/ebola-cases-2014>.

^{cxxxi} “WHO | Lassa Fever,” *WHO*, accessed September 10, 2016, <http://www.who.int/mediacentre/factsheets/fs179/en/>.

^{cxxxii} “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

^{cxxxiii} “Liberia Ebola SitRepno. 108 Ministry of Health and Social Welfare Aug 31, 2014.”

^{cxxxiv} Chandler et al., “Ebola: Limitations of Correcting Misinformation.” *Lancet*, 385 no. 9975 (2015): 1275-1277. doi: 10.1016/S0140-6736(14)62382-5

^{cxxxv} Ibid.

^{cxxxvi} Adewale L. Alli et al., “The Post-Ebola Virus Disease Scourge in Nigeria: Individual Levels of Preparedness among Physicians in the Federal Capital Territory Abuja,” *Annals of African Medicine* 15, no. 4 (October 1, 2016): 171, doi:10.4103/1596-3519.194278.

^{cxxxvii} Andrew McKenzie et al., “Building a Resilient Health System: Lessons from Northern Nigeria” (IDS Working Paper, April 2015).

^{cxxxviii} Ibid.

^{cxxxix} Marcelo F. C. Gomes et al., “Assessing the International Spreading Risk Associated with the 2014 West African Ebola Outbreak,” *PLoS Currents*, 2014, doi:10.1371/currents.outbreaks.cd818f63d40e24aef769dda7df9e0da5.

^{cxl} Getz et al., “Tactics and Strategies for Managing Ebola Outbreaks and the Salience of Immunization.” *Computational and Mathematical Methods in Medicine*, 2015:736507. <http://dx.doi.org/10.1155/2015/736507>

^{cxli} Shrivastava, Shrivastava, and Ramasamy, “Lessons Learnt from the 2014 Ebola Outbreak in West-Africa.”

^{cxlii} Jon Cohen, “New Reports Highlight Long-Term Risks from Ebola Infection, Limits of ZMapp,” *Science*, February 24, 2016, doi:10.1126/science.aaf4100.

^{cxliii} Natalie E. Dean et al., “Transmissibility and Pathogenicity of Ebola Virus: A Systematic Review and Meta-Analysis of Household Secondary Attack Rate and Asymptomatic Infection,” *Clinical Infectious Diseases*, February 29, 2016, ciw114, doi:10.1093/cid/ciw114.

^{cxliv} “Building Sustainable Capacity for Performance-Based Financing in Liberia’s Health System” (JSI Research & Training Institute, Inc., May 2014).

^{cxlv} “The Improvement Collaborative Approach: Rolling Out Clinical Standards for Liberia.”

^{cxlvi} Kumkum Amin and Deirdre Rogers, “RBHS Internal Assessment 2011 Final Report,” 2011.

^{cxlvii} Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”

^{cxlviii} Ibid.

^{cxlix} “REHABILITATING & REVITALIZING THE LIBERIAN HEALTH INFRASTRUCTURE” (JSI Research & Training Institute, Inc., 2011).

^{cl} “Performance-Based Contracting: Using Health Financing to Strengthen the Liberian Health System: The RBHS Experience.”

^{cli} “Building Sustainable Capacity for Performance-Based Financing in Liberia’s Health System.”

^{clii} “Liberia: Standard DHS, 2013. LISGIS, Monrovia, Liberia and Ministry of Health and Social Welfare, Monrovia, and Macro International Inc. Calverton, Maryland, USA.”

cliii “Liberia: Standard DHS, 2007. LISGIS, Monrovia, Liberia and Ministry of Health and Social Welfare, Monrovia, Liberia and National AIDS Control Program, Monrovia, Liberia and Macro International Inc. Calverton, Maryland, USA.”

cliv Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”

clv Amin and Rogers, “RBHS Internal Assessment 2011 Final Report.”

clvi Ibid.

clvii Ibid.

clviii “Health Sector Assessment Report” (Liberia Ministry of Health, 2015), http://www.mohsw.gov.lr/documents/Health%20Sector%20Assessment_Report_Final_2015.pdf.

clix “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

clx Ibid.

clxi “Health Sector Assessment Report.”

clxii Ibid.

clxiii “REHABILITATING & REVITALIZING THE LIBERIAN HEALTH INFRASTRUCTURE.”

clxiv “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

clxv “National Health & Social Welfare Policy & Plan 2010-21.”

clxvi “The Improvement Collaborative Approach: Rolling Out Clinical Standards for Liberia.”

clxvii Amin and Rogers, “RBHS Internal Assessment 2011 Final Report.”

clxviii “Pre-Service Education: A New Approach to Learning and Teaching.”

clxix Ibid.

clxx “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

clxxi Ibid.

clxxii Ibid.

clxxiii “WHO | Health Worker Ebola Infections in Guinea, Liberia and Sierra Leone,” *WHO*, accessed July 21, 2016, <http://www.who.int/csr/resources/publications/ebola/health-worker-infections/en/>.

clxxiv “RBHS Annual Report Year 6, 1 NOVEMBER 2013– 31 OCTOBER 2014,” November 2013.

clxxv “Liberia PRISM Assessment Report 2012” (JSI Research & Training Institute, Inc., 2012).

clxxvi Ibid.

clxxvii “Improving HMIS Performance: Measurement and Interventions.”

clxxviii “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

clxxix “Essential Package of Health Services, June 2011” (Liberia Ministry of Health, June 2011).

clxxx “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

clxxxi Ibid.

clxxxii “RBHS Annual Report Year 6, 1 NOVEMBER 2013– 31 OCTOBER 2014.”

clxxxiii Steven Perry, Ariella Bock, and Marie Tien, “Liberia: Interim Approach Assessment Report. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 7.” 2015, http://deliver.jsi.com/dlvr_content/resources/allpubs/countryreports/LR_InteApprAsse.pdf.

clxxxiv Ibid.

clxxxv Ibid.

clxxxvi Ibid.

clxxxvii “Health Sector Assessment Report.”

clxxxviii “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

clxxxix Perry, Bock, and Tien, “Liberia: Interim Approach Assessment Report. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 7.”

cx^c “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

cx^{ci} Ibid.

cx^{cii} “Health Sector Assessment Report.”

cx^{ciii} “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

cx^{civ} “National Health & Social Welfare Financing Policy & Plan 2010-21” (Liberia Ministry of Health, 2011).

cx^{cv} “Performance-Based Contracting: Using Health Financing to Strengthen the Liberian Health System: The RBHS Experience.”

cx^{cvi} “Drafting of National Health Financing Policy and Strategic Plan,” *Oxford Policy Management*, June 13, 2014, <http://www.opml.co.uk/projects/drafting-national-health-financing-policy-and-strategic-plan>.

cx^{cvi} “TOWARD UNIVERSAL HEALTH COVERAGE Introducing National Health Insurance in Liberia,” July 29, 2015.

cx^{cvi} Ibid.

cx^{cix} Ibid.

cc Ibid.

ccⁱ Ibid.

ccⁱⁱ “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

ccⁱⁱⁱ Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”

cc^{iv} “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”

cc^v Ibid.

-
- ^{ccvi} Rogers et al., “Endline Capacity Assessment of MOHSW and FARA Counties, May 12 – June 27, 2014. RBHS Project.”
- ^{ccvii} Ibid.
- ^{ccviii} “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”
- ^{ccix} “National Emergency Operations Centers Support Long-Term Public Health Infrastructure in West Africa,” *CDC Foundation*, accessed August 4, 2016, <http://www.cdcfoundation.org/pr/2015/emergency-operations-centers-support-long-term-public-health-infrastructure-west-africa>.
- ^{ccx} Rodin, *The Resilience Dividend: Being Strong in a World Where Things Go Wrong*.
- ^{ccxi} “Applying Resilience Thinking - Stockholm Resilience Centre,” text, (February 19, 2015), <http://www.stockholmresilience.org/research/research-news/2015-02-19-applying-resilience-thinking.html>.
- ^{ccxii} Plough et al., “Building Community Disaster Resilience.”
- ^{ccxiii} Rodin, *The Resilience Dividend: Being Strong in a World Where Things Go Wrong*.
- ^{ccxiv} Alicia Rosello et al., “Ebola Virus Disease in the Democratic Republic of the Congo, 1976-2014,” *eLife* 4 (November 3, 2015): e09015, doi:10.7554/eLife.09015.
- ^{ccxv} Catherine Cooper et al., “Infection Prevention and Control of the Ebola Outbreak in Liberia, 2014–2015: Key Challenges and Successes,” *BMC Medicine* 14 (2016): 2, doi:10.1186/s12916-015-0548-4.
- ^{ccxvi} “Investment Plan for Building a Resilient Health System, Liberia 2015 to 2021.”
- ^{ccxvii} Plough et al., “Building Community Disaster Resilience.”
- ^{ccxviii} Kenneth B. Wells et al., “Applying Community Engagement to Disaster Planning: Developing the Vision and Design for the Los Angeles County Community Disaster Resilience Initiative,” *American Journal of Public Health* 103, no. 7 (2013): 1172–1180.
- ^{ccxix} J. Brian Houston et al., “The Centrality of Communication and Media in Fostering Community Resilience A Framework for Assessment and Intervention,” *American Behavioral Scientist*, 2014, 2764214548563.
- ^{ccxx} Kenneth B. Wells et al., “Applying Community Engagement to Disaster Planning: Developing the Vision and Design for the Los Angeles County Community Disaster Resilience Initiative,” *American Journal of Public Health* 103, no. 7 (2013): 1172–1180.

^{ccxxi} Chee et al., “Why Differentiating between Health System Support and Health System Strengthening Is Needed.” *International Journal of Health Planning and Management*, 28 no. 1 (2013): 85-94. doi: [10.1002/hpm.2122](https://doi.org/10.1002/hpm.2122)

^{ccxxii} “Liberia: Public Expenditure and Financial Accountability (PEFA) Assessment.”

^{ccxxiii} Yin, *Case Study Research: Design and Methods*.

^{ccxxiv} Nicky Hayes, *Doing Psychological Research: Gathering and Analysing Data* (St Edmundsbury Press, Bury St Edmunds, Suffolk: Open University Press, 2000).

CURRICULUM VITAE

DEIRDRE A. ROGERS

63 Kenton Road, Jamaica Plain, MA 02130 (617) 823-7456 deidrearogers@gmail.com

SUMMARY OF PROFESSIONAL EXPERIENCE

Deirdre Rogers has over 18 years of domestic and international public health experience. She is experienced in project management, technical assistance (TA), training and facilitation, and project development. Areas of technical expertise include: HIV/AIDS, substance abuse, sexually transmitted diseases, MNCH, FP/RH, cancer, health systems strengthening and capacity development, emergency preparedness, Ebola, and monitoring and evaluation (M&E), including health information systems. Dr. Rogers has a Master's of Science from the Harvard School of Public Health and a Doctorate in Public Health from the Boston University School of Public Health.

EDUCATIONAL BACKGROUND

DrPH	Boston University School of Public Health (2017) Global Health Boston, Massachusetts
SM	Harvard School of Public Health (1998) Population and International Health Boston, Massachusetts
BS	Cornell University (1993) International Nutrition/International Development Ithaca, New York

PROFESSIONAL EXPERIENCE

2008 – Present **JSI Research & Training Institute, Inc.**
Boston, Massachusetts

Deputy Director, Monitoring and Evaluation Provide overall coordination of project M&E activities for the United States Department of State funded DREAMS-Innovation Challenge Funds Manager. Oversees technical and M&E activities of 46 grantees consisting of international and local organizations providing HIV/AIDS services to adolescent girls and young women in 10 African countries. Provides technical and organizational M&E-related capacity development to grantees, and ensures timely results reporting, dissemination and use of information.

Senior Advisor Provide program management support to the USAID District Coverage of Health Services Project in Zambia, the Sustaining the HIV/AIDS Response (SHARe II) project in Zambia, and for three post-Ebola recovery projects in Liberia: the Office of Foreign Disaster Assistance funded Infection Prevention and Control Activity, World

Bank funded Restoring Essential Health Services, and a Harvard University study of Liberian health system resilience.

Senior Monitoring and Evaluation Technical Advisor Provide M&E TA to United States Agency for International Development (USAID) bilateral funded projects, including: Maternal and Infant Health Project in Ukraine, Together for Health reproductive health project in Ukraine, Healthy Women Ukraine, Rebuilding Basic Health Services Project in Liberia, Sustaining the HIV/AIDS Response (SHARe I and SHARe II) projects in Zambia; the LIVESTRONG-funded Cancer Anti-Stigma Initiatives in South Africa and Mexico; and the USAID centrally-funded AIDSFree project. Also a subject matter expert for the Massachusetts Department of Public Health Ebola Concept of Operations Plan, and member of JSI's Center for Health Information Monitoring and Evaluation.

Senior Technical Advisor—HIV Resource Allocation Model (ONAP/OHAIDP/CDC) Provide TA to three US Health Departments on a CDC-developed HIV prevention resource allocation mathematical model.

Senior Technical Advisor—Ebola Concepts of Operations Project Provide TA to the Massachusetts Department of Public Health to develop the Massachusetts Ebola Response Plan, as well as a Region I New England Ebola Response Plan and Concept of Operations.

2007 – 2008

**JSI Research & Training Institute, Inc.
West Bank/Gaza, Palestine**

Monitoring and Evaluation Director Responsibilities included development and refinement of project M&E systems including clarifying project objectives, developing indicators, and ensuring data collection tools accurately and adequately measure project activities. Documented and disseminated project outcomes through routine and end of project reporting.

2001 – 2007

**JSI Research & Training Institute, Inc.
Boston, Massachusetts**

Project Director – Region I Infertility Prevention Program (Center for Disease Control) Responsibilities included facilitation of regional advisory board, liaison between CDC and board on regional chlamydia and gonorrhea activities, collaboration with CDC and OPA staff, participation in bi-annual CDC meetings, assistance with program planning and evaluation, development of project website, data management, analysis and report writing, provision of technical assistance to states, and conducting site visits.

M&E Technical Advisor Provided M&E technical assistance to USAID-funded projects including Uganda Program for Human and Holistic Development, Healthy Woman in

Georgia, Sustaining the HIV/AIDS Response Project in Zambia, Sudan Health Transformation Project, and CAPACITY HIV/AIDS Project in the Central Asian Republics.

Quality Assurance Specialist – MTCT Plus Initiative (Columbia Mailman School of Public Health) Identified needs and provided data-related technical assistance to six African sites expanding primary care and HIV antiretroviral treatment to mothers and their partners in addition to infants. Provided ongoing quality assurance of all clinical and programmatic data submitted to JSI from sites.

Technical Assistance Coordinator – SAMSA/CSAP Project (Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Prevention, Department of Health and Human Services) Provided programmatic and evaluation technical assistance to the three-year multi-site evaluation of an integrated HIV and substance abuse prevention project which funded 47 grantees across the country through the Minority AIDS Initiative. Conducted site visits for 16 Cohort 1 funded grantees.

2000 – 2001

**Center for Community Health,
Education and Research
Boston, Massachusetts**

Consultant Provided support and technical assistance to Haitian AIDS service organizations for two CDC funded capacity-building grants: REACH 2010 (Racial and Ethnic Approaches to Community Health) and CAPAB (Capacity Building Assistance to Prevent AIDS in Boston). Conducted needs assessments, developed community action plans, participated in community planning, and assisted in writing grant proposals, program evaluation, and training curriculum.

2000 – 2001

**Department of Veteran Affairs,
Management Decision & Research Center
Boston, Massachusetts**

Management & Healthcare Program Analyst, Health Services Research and Development Conducted research, evaluations, and analyses at the request of senior Veterans Affairs (VA) managers and policy makers through the National Management Consultation Program. Worked with leadership to conduct strategic analyses to identify the consultation needs of VA senior managers, and to reach out to potential clients and investigators. Monitored progress of all projects including database maintenance, development of letters of agreement for clients and researchers, and tracking budgets for all projects. Supervised support staff.

1998 – 2000

**Boston AIDS Consortium
Boston, Massachusetts**

Senior Project Manager Provided support and technical assistance to community-based organizations including research and evaluation, proposal writing, grant management, capacity building, and community planning. Developed and wrote research and evaluation products including needs assessments, standards of care, and outcome measures for program evaluation, and comprehensive plans for HIV prevention and care. Wrote significant portions of federal, state, city, and private grant applications and managed contracts. Staffed Ryan White CARE Act Title I Planning Council and Committee meetings. Provided education and training on community planning processes. Presented oral and written epidemiological and public policy reports to large and small group audiences.

1997 – 1998

**Harvard School of Public Health
Boston, Massachusetts**

Research Assistant – Data for Decision Making Conducted research on health policy, health economics, and health sector reform in developing countries. Wrote, edited, and reviewed documents for publication in technical journals.

June 1997 – September 1997

**BRAC Health and Population Division
Dhaka, Bangladesh**

Researcher Conducted qualitative and quantitative research on violence against children and malnutrition and gender discrimination in rural Bangladesh.

1993 – 1994

**Organization of Rural Association for
Progress
Bulawayo, Zimbabwe**

Researcher Conducted qualitative HIV/AIDS research in rural Matabeleland, including the design and implementation of surveys, and the facilitation of focus group discussions. Drafted rural-based HIV/AIDS prevention needs assessment. Developed HIV/AIDS materials to be used in training rural-based health workshop facilitators. Formed collaborations with urban-based HIV/AIDS organizations and programs.

COUNTRIES OF PROFESSIONAL WORK

Bangladesh, Egypt, Kenya, Malawi, Mexico, Mozambique, Lesotho, Liberia, Palestinian Territories, Russia, South Africa, South Sudan, Swaziland, Tanzania, Uganda, Ukraine, United States of America, Zambia, and Zimbabwe

PROFESSIONAL AFFILIATIONS AND APPOINTMENTS

Adjunct faculty Brandeis University, Masters level course: “Using Health Information for Health System Improvement”, 2013–present

Director and Clerk of the Boston AIDS Consortium Board of Directors, 2002 – 2007

PRESENTATIONS AND PUBLICATIONS

Rogers, Deirdre; Bal Ram Bhui. *Re-analysis of 2011 Liberia Malaria Indicator Survey data to provide project-level IPTp, ITN and malaria treatment estimates: Rebuilding Basic Health Services Project*. African Population Studies, 2013, Vol 28, No 2, Supplement: 1022–1034.

Rogers, Deirdre. *Rewarding Results: Performance Based Contracting in Liberia*. American Public Health Association, November 2013, Boston, Massachusetts.

Rogers, Deirdre. *Re-analysis and interpretation of 2011 Liberia malaria indicator survey data to provide project-specific estimates for select malaria indicators*. American Public Health Association, November 2013, Boston, Massachusetts.

End of Project *Workplace Assessment: Knowledge, Attitudes and Practices (KAP) and Situation Analysis among Employees, Final Report*. JSI/SHARe project, October 2010

Goriacha, Tetiana; Rogers, Deirdre. *Together for Health Baseline and Endline Assessment Report: Lviv, Kharkiv, Dnipropetrovsk, Odessa, Poltava, Volyn, and Vinnytsa Oblasts*. JSI/TfH project, September 2010.

Rogers, Deirdre. *Measuring HIV/AIDS-related Absenteeism in Businesses and Public Sector Institutions with SHARe-Supported Workplace HIV/AIDS Prevention and Treatment Programs*. JSI/SHARe project, August 2010.

Vergeer, Petra; Rogers, Deirdre; Brennan, Richard; Sarcar, Shiril. *Identifying Indicators for Performance-Based Contracting (PBC) is Key: The Case of Liberia*. World Bank, June 2010.

Rogers, Deirdre. *Project CAPAB: Capacity Building Assistance to prevent AIDS in the Metro Boston Haitian Community*. Capacity Building Leadership Conference, March 6–9, 2002, Chicago, Illinois.

Rogers, Deirdre. *Community-Based HIV Prevention Planning in an Immigrant Community Paralyzed by Fear, Denial and Distrust*. National HIV Prevention Conference session: “HIV Prevention Programs for Special Populations.” August 13, 2001, Atlanta, Georgia.