

# “Factors Influencing Effective Cholera Prevention and Control in Liberia”

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**Factors Influencing Effective Cholera prevention and Control in  
Liberia**

A thesis submitted in partial fulfillment of the requirement for the degree of Master  
of Public Health

By

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LIBERIA

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# **ABSTRACT**

## **Background**

In Liberia, cholera is endemic, with cases reported yearly-a cumulative incidence of 85,218 cases recorded between 1970 and 2012. The entire country is vulnerable to cholera; however, cholera hotspot counties have been mapped over the years. The cholera bacterium *Vibrio cholera 01* has been isolated in environmental reservoirs in the country.

## **Objective**

To explore factors influencing the effective prevention and control of cholera in order to recommend feasible actions to prevent and control the disease in Liberia.

## **Methods**

Literature review of secondary data from Liberia and other countries on cholera was used. The World Health Organisation (WHO) cholera policy recommended framework was used to analyse effective cholera prevention and control by applying it to other countries strategies as well as the current initiatives on cholera prevention and control in Liberia.

## **Findings**

Although actions have been undertaken to prevent and control cholera in Liberia, the study findings show several gaps in the current cholera prevention and control strategy. These include: limited Water Sanitation and Hygiene services, weak surveillance system where paper based reporting systems are used, low access to cholera treatment with only 62% access to ORS treatment and weak communication approaches on cholera.

## **Conclusion and Recommendation**

Cholera can be reliably prevented. For effective cholera prevention and control, there is a need to increase political commitment and resource mobilization, strengthen WASH service provision particularly in cholera hotspot areas, strengthen surveillance system using mobile phones, and strengthen cholera communication approaches using community structures.

**Keywords:** Cholera, Liberia, Prevention, Control programme, plan,

**Word count: 13,152**

## **ACRONYMS**

BCC	Behaviour Change Communication
CFR	Case Fatality Ratio
CHC	Community Health Club
CLTS	Community-Led Total Sanitation
CTC	Cholera Treatment Centres
CTU	Cholera Treatment Units
EHT	Environmental Health Technicians
EPI	Expanded Programme on Immunisation
GIS	Geographic Information System
HWTS	Household Water Treatment and Safe Storage
IDP	Internally Displace Population
IDSR	Integrated Disease Surveillance and Response
MoHSW	Ministry of Health and Social Welfare
MPW	Ministry of Public Works
OCV	Oral Cholera Vaccines
OD	Open Defecation
ODF	Open Defecation Free
ORS	Oral Rehydration Solution
RDT	Rapid Diagnostic Test
SODIS	Solar Disinfection
TIHE	Total Institutional Health Expenditure
UNICEF	United Nations Children’s Fund
WASH	Water Sanitation and Hygiene
WHO	World Health Organisation

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## GLOSSARY

**Access to drinking water:** “The drinking water source is less than 1 kilometre away from its place of use and that it is possible to reliably obtain at least 20 litres per member of a household per day” (WHO& UNICEF cited in Ensink 2014)

**Access to safe drinking water:** “The proportion of people using improved drinking water sources-household connections, public standpipes, boreholes, protected wells, protected spring” (WHO& UNICEF cited in Ensink 2014)

**Community Health Club Approach:** “This approach encourages households to recognize, develop and meet demands for more than toilets. Male and female members join monthly sessions led by trained health staff. The clubs may focus on many kinds of progress: Open Defecation Free (ODF), safe storage and drawing mechanism for drinking water in the homes, safe handwashing, methods for drinking water in homes, utensils drying frames. The aim is behavioural change in households of members” (IRC International Water Institute 2012)

**Community-Led Total Sanitation (CLTS) Approach:** “The CLTS approach follows a process of pre-triggering, triggering and post triggering. Pre-triggering is the introduction and rapport building period to introducing CLTS in a community. Triggering consists of variety of activities that stimulate a community-level sense of disgust about open defecation, inciting a community to change its sanitation situation. Post triggering efforts relate to follow-up activities by CLTS facilitators to ensure that communities follow through to eradicating open defecation” (Plan and United Nations Water Institute 2012)

**Geographical Information System (GIS):** “A Geographical Information System (GIS) integrates hardware, software and data for capturing, managing, analyzing and displaying all forms of geographically referenced information. GIS allows us to view, understand, question, interpret and visualize data in many ways that reveal relationships patterns and trends in the form of maps, globes, reports and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared. GIS technologies can be integrated into any enterprise information system framework” (Esri n.d)

**Improved Sanitation Facilities:** These are facilities that are likely to ensure hygienic separation of human excreta from human contact. They include the following facilities: flush/pour flush connected to piped sewer system, septic tanks, pit latrine; ventilated improved pit latrine, Pit latrine with slab, composting toilet (WHO and UNICEF 2013).

**Integrated Disease Surveillance and Response:** Provides modality for the reporting of diseases of epidemic potentials from the local level to the national level stating in detail which reporting competencies should be available at each level

**Open Defecation:** When human faeces are disposed of in fields, forests, bushes, open bodies of water, beaches or other open spaces or disposed of with solid waste (WHO and UNICEF, 2013).

**Safe drinking water:** "Water with microbial, chemical and physical characteristics that meet WHO guidelines or national standards on drinking water quality (WHO& UNICEF cited in Ensink 2014).

**Sanitation coverage:** "Proportion of people using improved sanitation facilities: Public sewer connections, septic system connections, pour flush latrines, simple pit latrine, ventilated improved pit latrine" (WHO& UNICEF cited in Ensink 2014)

**Shared Sanitation facilities:** Sanitation facilities of an (otherwise) acceptable type shared between two or more households. Only facilities that are not public are not considered improved (WHO and UNICEF 2013).

**Suspected case of cholera:** "In an area where the disease is not known, a patient aged 5 years or more develops severe dehydration or dies from acute watery diarrhoea; while in an area where there is a cholera epidemic, a patient aged 5 years or more develops acute water diarrhoea, with or without vomiting" (CCPC 2013)

**Unimproved Sanitation Facility:** Facilities that do not ensure hygienic separation of human excreta from human contact, including pit latrines without slab or platform, hanging latrines and bucket latrines (WHO and UNICEF 2013).

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## **INTRODUCTION**

This thesis explores the factors influencing effective cholera prevention and control in Liberia. As a Liberian, I have developed significant interest in understanding the various factors that are connected to the endemicity of cholera in Liberia. My interest stems from the fact that in the 21<sup>st</sup> century, a time when public health tools and strategies are available and have been tested in other places in preventing and controlling cholera, the disease continues to be a serious public health problem in my country.

Over the past 10 years, I have worked with the Ministry of Health and Social Welfare, Health Services Department as the Assistant Director for Programmes and Technical Services within the Division of Environmental and Occupational Health. As an environmental health professional charged with the responsibility to support the ministry in the implementation of effective environmental health programmes, a number of initiatives have been undertaken to address numerous environmental health challenges faced Liberia, among which includes cholera.

However, although some actions have been undertaken, cholera cases continue to be reported yearly with high case fatalities. The need to understand influencing factors to this situation of repeated occurrence of cholera cases among the population has been an area of interest for me, as it will provide useful information for effective implementation of public health interventions to prevent and control the disease.

Based on the above, this thesis has been written and is organised in seven chapters. Chapter one provides general background information to the country context. Chapter two outlines the problem, justification, objective and methodology; chapter three describes the epidemiology of cholera in Liberia. International good examples, strategies and innovations employed in cholera prevention and control in other countries as well as current initiatives and issues in cholera prevention and control in Liberia are presented in the results section of the thesis which are grouped into chapters Four and Five respectively. Critical analysis of findings is presented in the discussion chapter-Chapter 6; followed by chapter 7 which includes conclusion and recommendations. Annexes are presented to provide additional information on issues and aspects covered in the body of the thesis.

# CHAPTER 1: GENERAL BACKGROUND

## 1.1 Geography

Liberia is situated on the West Coast of Africa bordering the Republics of Sierra Leone on the Northwestern part, Guinea on the North, Ivory Coast on the East and the Atlantic Ocean on the South. The area of Liberia is 111,370 square kilometres, of which the land area is 96,320 square kilometres and the water area is 15,050 square kilometers with a coastline of 579 square kilometers. The country has a tropical climate and the terrain ranges from flat to rolling coastal plains and low mountains. The Coastline is characterized by Lagoons, mangroves and swamp lands (LISGIS and MEASURE DHS 2007).

Liberia is divided into 15 political subdivisions called counties (Figure 1). These counties are subdivided into districts. The population of Liberia is estimated at 3.4 million inhabitants with a growth rate of 2.1%. The population is sparsely settled in small towns and villages with density of 90 persons per square kilometers (LISGIS 2008). Liberia is a post conflict country that suffered a 14 year civil crisis which spanned between 1989 and 2003.

Figure 1: Map of Liberia showing counties



Source: Maps of the World (2013)

## **1.2 Demographic characteristics**

The population of Liberia comprise of mostly young people (0-34 years) with this age group accounting for an estimated 76% of the total population (LISGIS 2008). There are 16 ethnic groups with diverse cultural beliefs and practices. The country ranks 174 among 186 countries with a life expectancy of 57.3 years at birth and under five mortality is estimated at 103 per 1000 live births-one of the highest in the world (UNDP 2013).

## **1.3 Socio economic characteristics**

In Liberia, most people are poor, with national poverty levels estimated at 63.8%-national poverty line set at \$1.25 per day (UNDP 2013). Housing conditions are extremely deplorable with an estimated 67.5% of the population living in poorly built houses made of materials such as mud, stick, palm trunk, straw thatch and zinc metal and the access to electricity is limited with an estimated 97% of the population not connected to the electricity grid; only 51.5% of the population has radio, 7.0% has television (LISGIS and MEASURE DHS, 2007). There are 5 mobile phone service providers in the country with an estimated 59% of the population using mobile phones (LTA 2012).

## **1.4 Healthcare services and resources**

### **1.4.1 Governance**

The Ministry of Health and Social Welfare (MoHSW) has a ten-year National Health and Social Welfare Policy and Plan which spans between 2011 and 2021. For better healthcare service provision, the MoHSW has organised the country into 89 health districts with 15 County Health Teams (CHTs) managing these health districts and a three tier health service delivery system is in place including primary care which has basic preventive and curative health care delivered through health clinics and small health centres as well as involves the provision of environmental and community health services at the community level (LMoH 2010a).

The secondary level of healthcare system comprises of county hospitals and large health centres (40 beds) and provides preventive and curative care as well as receives referrals from the health clinics. The tertiary level of health services comprises of specialist hospitals. The country is in the process of

decentralisation with some major management functions now being transferred to county health teams (LMoH 2010a).

#### **1.4.2 Human Resources for Health**

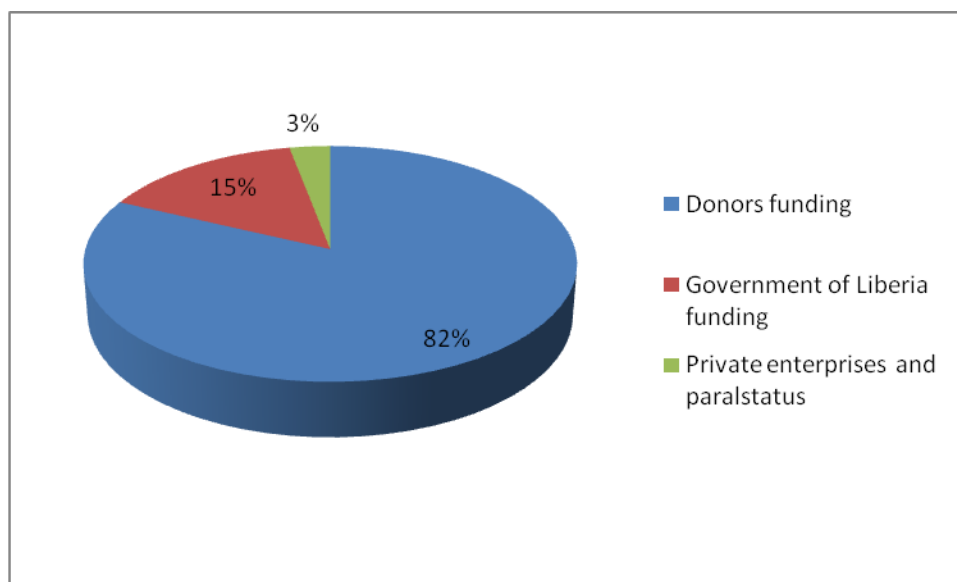
Human resources for health are inadequate to provide quality health care services to the population. According to the 2010 health workers census, clinical staff (physician, nurses, certified midwives) estimated at 0.55 per 1000 population, while Environmental Health Technicians (EHTs) estimated at 0.05 per 1000 population, and laboratory Technicians 0.11 per 1000 population ( LMoH 2010b). These health personnel are unevenly distributed among counties (see annex 1a&b). According to the MoHSW national policy, deployment of clinical staff in rural areas has been difficult due to salary issue and generally inadequate incentive packages to motivate and retain health staff in rural and remote areas (LMoH 2011a).

#### **1.4.3 Healthcare financing**

The country spends 3.9% of its GDP of 2.1 billion on health (UNDP 2013). The health sector is heavily dependent on donor funding (Figure 2). According to the National Health Account 2010, funding from donors accounted for 82% of total health expenditure in 2009. Government spending on healthcare services is estimated at 15% of Total Institutional Health Expenditure (TIHE), although as percentage of government budget, this is even low and estimated at 8%, placing Liberia below target set by the Abuja declaration for national governments in Africa to allocate 15% of their total government expenditure to Health (LMoH 2010a; LMoH 2011b). Funding for cholera emergencies is limited and is not captured into overall health expenditure. Donors, including European Commission- Humanitarian Aid & Civil Protection, IrishAid and the United States Agency for International Development have been supportive in providing funding for cholera emergencies.



Figure 2: Healthcare Financing Sources 2009-2010 (N=US\$ 926,640438)



Source: LMoH 2011b (Note: private enterprises and parastatal include private out of pocket expenditure)

#### **1.4.4 Access to health services, health seeking behaviour and utilisation of services**

As the country rebuilds its infrastructure and basic social services, access (geographical) to healthcare services has been recorded to be low. Most rural households live more than 5 kilometres from nearest health facility. Where health facilities are accessible, utilisation of these services remains low. Health workers attitude towards patients, long waiting times and lack of drugs and medical supplies as well as long distances have been recorded as some reasons for low utilisation of public health services. Most counties have limited hospitals and health centres providing 24 hours care for conditions requiring hospitalization and emergency services (LMoH 2011a).

#### **1.4.5 Burden of disease**

Liberia like other lower and middle income countries is experiencing the epidemiological transition but still experiences very high burden of infectious diseases including cholera.

Cholera is a virulent diarrhoeal disease caused by the bacterium *Vibrio Cholerae* resulting from ingestion of contaminated food and water; it has an incubation period of about 2 hours to 5 days and 75% of cases do not

develop symptoms but persons can be infective for 7-14 days and people with low immunity such as malnourished children and HIV infected individuals are most vulnerable (WHO 2012a).

In Liberia cholera is endemic and the cholera bacterium common is the *Vibrio cholerae* 01 (LMoH 2013a). Between 1970 and 2012 an estimated cumulative incidence of 85,218 with 0.96% Case Fatality Ratio (CFR) was recorded in Liberia (WHO, 2013a).

## **CHAPTER 2: PROBLEM STATEMENT, JUSTIFICATION OBJECTIVES AND METHODOLOGY**

### **2.1 Problem statement**

Globally, cholera remains a serious health problem with cases reported from all continents with an estimated 245,393 cases reported in 2012 of which 48% of these cases were in Africa, 49% from the Americas, the remaining 3% in other parts of the world (WHO 2014). Most cholera cases occurring in Sub-Saharan Africa have been recorded in countries along the coastal areas of the continent (Rebaudet et al 2013).

Cholera remains a problem in Liberia notwithstanding the fact that there is a cholera control strategy in place. Recent data published by the MoHSW, reported that between 2012 and 2013, 200 cases of cholera with a CFR of 4% were recorded (LMoH 2013b). This is worrying, given the fact that historically the CFRs were normally below 1%.

The entire country remains vulnerable to cholera. Liberia experiences most of the risk factors for cholera that have been identified over the years and which are outlined in Table 1. This includes poor water sanitation and hygiene services, overcrowded living conditions with people living in cramped conditions in slums.

The country also experiences flooding annually during the rainy season (April to October) and over the last two decades has experienced massive displacement of the population as a result of armed conflict; both situations contribute to disruption in already limited social services- clean water supplies, better garbage disposal services and healthcare services (Gaffga, Tauxe & Mintz, 2007).

According to a World Bank Desk Study report, Liberia loses an estimated US\$7.1 million annually on diarrhoeal related diseases of which cholera is a part (World Bank, 2012).

Table 1: Cholera Risk Factors

Risk factors	Causes
<b>Rain fall/flooding</b>	Heavy rains and flood disrupts water systems and spread cholera
<b>Water sources contamination</b>	A specific water source, such as lakes, rivers or domestic water pipes, is contaminated with cholera
<b>Poor sanitation</b>	General term used in many reports to refer to a lack of adequate latrines
<b>lack of potable water</b>	Limited water available forces people to use contaminated water for domestic purposes
<b>Refugee Camps</b>	Camps for refugees or internally displaced people are over-crowded with limited resources, such as water and latrines
<b>Food</b>	Contaminated shellfish or unwashed raw vegetables
<b>Imported/travellers</b>	Travellers with cholera carry the disease to a new area
<b>Conflict zones</b>	War zones can increase the risk of outbreaks because infrastructure is damaged and people do not have access to proper sanitation or medical care
<b>Urban/dense population</b>	In cities and slums, people living in extremely close proximity increase the burden on sanitation and facilitates transmission
<b>Seasonal</b>	In some endemic areas, cholera reoccurs during certain seasons
<b>Funeral/feast</b>	Some traditional funeral rites include the washing of the deceased and preparation of a large meal. This situation, combined with the fact that mourners often travel, allows for the spread of the disease
<b>Prison</b>	Prisoners do not always have control of their sanitation needs and live in close proximity to one another

Source: Adapted from Griffith et al (2006)

## **2.2 Justification**

Liberia is a post conflict country and efforts are being applied to rebuild lives, infrastructure and the general economy. The health system like other systems in the country is reorganising to provide better healthcare services to the population. Although the entire country is at risk of cholera, the MoHSW has identified cholera hotspot counties including: Montserrado, River Gee, Lofa, Margibi and Grand Gedeh (see map above) and these counties are either situated along the coastline or border the Republics of Guinea, Ivory Coast and Sierra Leone. Sierra Leone and Guinea experience frequent epidemics of cholera with the most recent being in 2012 (LMoH 2013a).

Cholera cases are confirmed every year with sporadic outbreaks occurring in some counties in Liberia. The yearly occurrence of outbreaks of cholera has negative impact on the country's health system as the health system is often overwhelmed with high number of cases.

As Cholera is endemic in Liberia and its neighbouring countries, outbreaks in 2012 in these neighbouring countries and yearly cases in Liberia make it more compelling argument to have effective cholera prevention and control programme in Liberia as the population in these countries is highly mobile due to cross border trade and refugee crisis. Liberia has been implementing a cholera prevention and control programme over the years, but annually, cases are still occurring with high case fatality. This shows that there exist gaps in the national cholera prevention and control programme and this requires urgent actions in order to present practical and feasible actions to increase the country's resilience to cholera.

There is no operational research on cholera in Liberia and knowledge on factors influencing effective cholera prevention and control in the country is limited. This thesis seeks to help identify existing gaps in the draft National Inter-sector Cholera Prevention and Control Strategy and Plan, and contribute to the body of knowledge that will help improve cholera prevention and control in Liberia.

## **2.3 Objectives**

To explore factors influencing effective Cholera prevention and Control in Liberia in order to recommend feasible actions in preventing and controlling cholera among the population in Liberia.

### **2.3.1 Specific objectives**

- To describe cholera epidemiology in Liberia
- To identify international strategies and examples in cholera prevention and control in countries with similar context as Liberia.
- To explore current initiatives and issues in cholera prevention and control in Liberia
- To recommend feasible actions to improve prevention and control of cholera in the context of Liberia.

## **2.4 Methodology**

The writing of this thesis employed literature review of published and unpublished literature. The Liberia Draft National Cholera Inter-Sector Strategy and Plan was used to identify gaps that serve as influencing factors to effective cholera prevention and control in Liberia by comparing it with other countries strategy, plans and guidelines.

### **2.4.1 Search strategy**

Electronic literatures used in this thesis were retrieved from databases such as PubMed, Vrije University Library and through online search engines such as Google scholar. Organisational web pages such as United Nations Children's Fund (UNICEF), MoHSW, and World Health Organisation (WHO) were used to retrieve relevant reports and information to inform the writing of this thesis. Search terms such as Cholera, Surveillance, influencing factors, guidelines, diagnosis, vaccines, innovation, case management, Liberia, Africa and prevention were used in combination with Boolean operators such as 'AND' "OR" during the process of obtaining electronic articles and documents.

A number of inclusion and exclusion criteria were used for selection of literature. Most of the literature used were based on African studies and in some instances where specific literature on influencing factors were not seen on Liberia and other countries in Africa but were available for developing countries similar to Liberia, such literatures were used. Only documents written and/or published between 2002 -2014 were used. Literatures written in other languages other than English were excluded.

### **2.4.2 Review of existing cholera data**

The burden of disease of cholera in Liberia for the period 2000-2012 was determined using cholera data from the MoHSW reported to WHO. Graphs showing cholera cases based on annual and seasonal patterns were used to describe trend in cholera occurrence in the country.

### **2.4.3 Conceptual Framework (WHO Cholera policy framework) (WHO 2008)**

The WHO cholera prevention and control policy framework was used in the writing of this thesis as it has important components relevant to the context of cholera in Liberia (see below) compared to other frameworks such as the Centre for Disease Control and Prevention Framework for infectious disease. The WHO policy framework shows key components which should be considered when developing countries cholera prevention and control strategies and plans. It categorizes these components into: Prevention, Diagnostic, Case Management and Vaccination services.

#### **2.4.3.1 Prevention**

This section of the policy framework discusses the availability and scale-up of prevention activities such as improvements in Water Sanitation and Hygiene (WASH) for the entire populations. Food safety and hygiene intervention for the general public also is important in all cholera prevention activities. It includes national surveillance systems for early detection of cases. It also includes the role of Communication interventions including, community mobilization as well as information education using appropriate media in cholera prevention and control.

#### **2.4.3.2 Diagnostic Services**

This WHO cholera policy framework component stresses the importance of national cholera prevention and control programmes to have diagnostic capabilities including Laboratory. The gold standard for cholera confirmation is the stool culture, but the use of Rapid Diagnostic Test (RDT) at community level is also recommended in strengthening local capabilities.

### **2.4.3.3 Case Management**

The use of Oral Rehydration Salt/Solution (ORS) in treating 80% of cholera (rehydration) is discussed here. Also, 20% of cases who develop severe dehydration should be treated in a Cholera Treatment Units (CTU) or Cholera Treatment Centres (CTC) with appropriate infusion solution such as Ringers lactate and use of appropriate antibiotics is recommended.

### **2.4.3.4 Vaccination**

This component looks at introduction of Oral Cholera Vaccines (OCV) by countries based on need and such can target vulnerable groups.

### **2.4.4 Study Limitation**

Using secondary data analysis of grey and published literature is a limitation of this thesis as current situation in Liberia may be different from the information available in the literatures reviewed. Additionally, globally, only around 10% of cholera cases are reported by national governments (Njoh 2010) and cholera data (cases) used in this thesis may be under reported by the Liberia MoHSW due to fearing for trade restrictions on international trade as is the case with many cholera endemic countries (Gaffga, Tauxe & Mintz, 2007). Coordination is not mentioned in the WHO policy framework but has been used in this thesis.



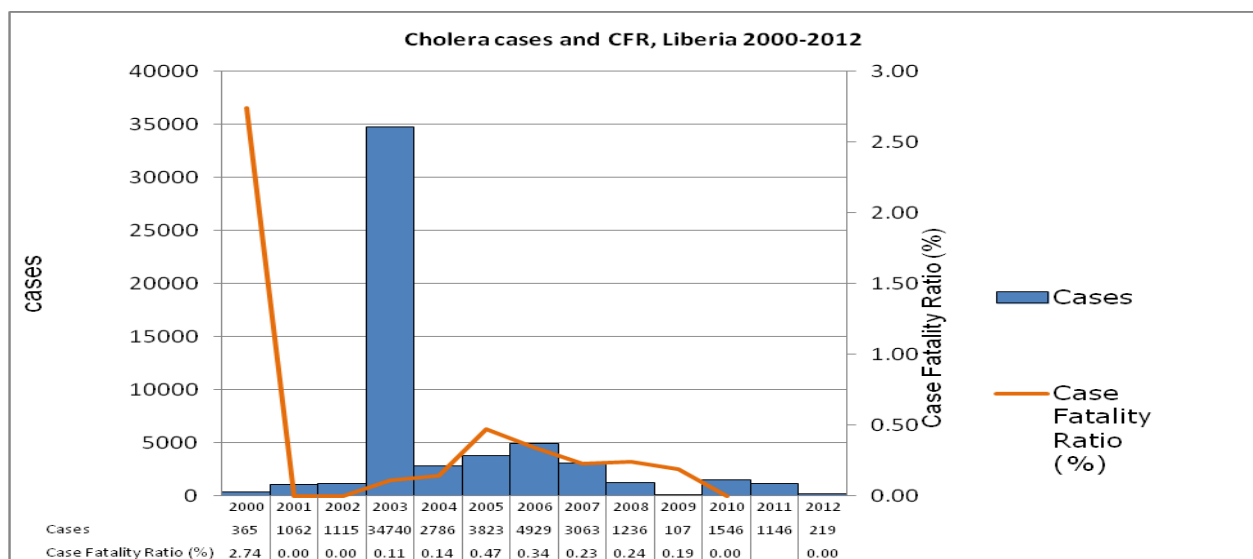
## CHAPTER 3: CHOLERA EPIDEMIOLOGY IN LIBERIA

In this chapter, the epidemiology of cholera in Liberia is presented. The history of the disease, environmental and climate change factors influencing the spread of the disease in Liberia are explained. The burden of disease associated with cholera is presented for the period 2000 to 2012. Seasonal trends, patterns and distribution of the disease in the country are also described.

### 3.1 Cholera in time (History)

The first case of recorded Cholera in Liberia was in 1970 when the disease first spread from Asia to Africa, with a total of 160 cases recorded in the same year (WHO 2013a; Gaffga, Tauxe & Mintz, 2007). Since 1970, there has been an increase in cholera cases recorded with sporadic cases reported yearly. Figure 3 below shows cholera cases and fatalities in time in Liberia for 2000 to 2012. The highest reported cholera cases in Liberia were recorded in 2003 with an estimated 34,740 cases and a CFR of 0.11% (WHO 2013a). This outbreak occurred during the peak of the Liberian Civil War, which triggered mass displacement of residents in most parts of the country and particularly in Monrovia, with over 250,000 people living in 90 Internally Displaced Population (IDP) camps; with a record 26,815 cases reported between July-October of the same year (WHO 2004).

Figure 3: Annual cholera case and fatalities (2000 to 2012)



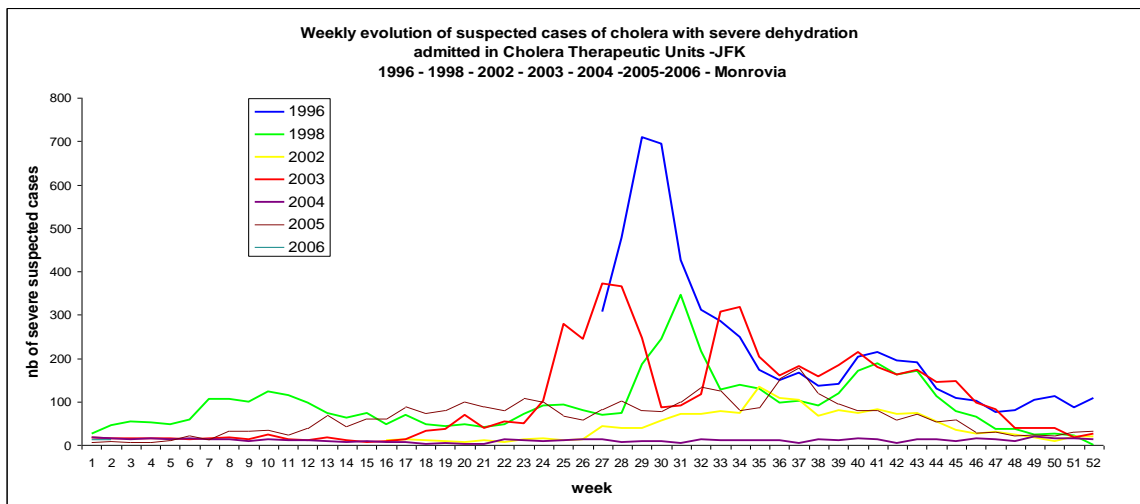
Source: Adapted from WHO (2013a).

### 3.2 Spatial and seasonal occurrence of cholera

Review of cholera data from MoHSW (published in weekly MoHSW epidemiological bulletin-2012 and 2013) showed that cases of cholera are occurring in counties not included among the hotspot counties. New counties reporting suspected cholera cases include Grand Cape Mount, Bomi, and Maryland counties, a situation which reflects a change in spatial occurrence and distribution of cholera. The reported occurrence of cholera cases in these other counties is associated with factors such as the highly mobile population in Liberia both from within the country including traders and mine workers and population such as refugees and migrant workers coming from outside Liberia and from cholera endemic countries such as Guinea and Sierra Leone (LMoH, 2013a)

Although the country is experiencing less number of cholera cases as mentioned above, high peaks are still recorded during the rainy season. Weekly evolution of suspected cholera cases admitted at the Cholera Treatment Unit in Monrovia (Figure 4) shows a historically high incidence of cases between weeks 23 and 35 (traditionally rainy season in Liberia).

Figure 4: Weekly Cholera Trend in Liberia (Cases admitted at the Cholera Treatment Centre in Monrovia)



Source: LMoH 2013a

This trend is associated with several factors including seasonal as a result of heavy rains that are normally experienced during this period April to October as mentioned in previous section of the thesis.

### **3.3 Environmental factors**

The cholera bacterium (*Vibrio cholerae 01*) has been isolated in certain estuaries in Liberia (Scheelbeek et al 2009) and is said to thrive well in sea waters, fresh waters in rivers, canals, ponds or lakes due to warm and nutrient contents of these water bodies which increase saline levels and makes them suitable for the growth of the bacterium (Rebaudet et al). The cholera bacterium also thrives during rainy seasons when these environmental conditions are conducive for copepods growth, organisms with which the cholera bacterium is also associated (Magny et al, 2008; Gaffga, Tauxe & Mintz, 2007). These environmental factors are common in Liberia.

## **CHAPTER 4: INTERNATIONAL STRATEGIES AND EXAMPLES IN CHOLERA PREVENTION AND CONTROL**

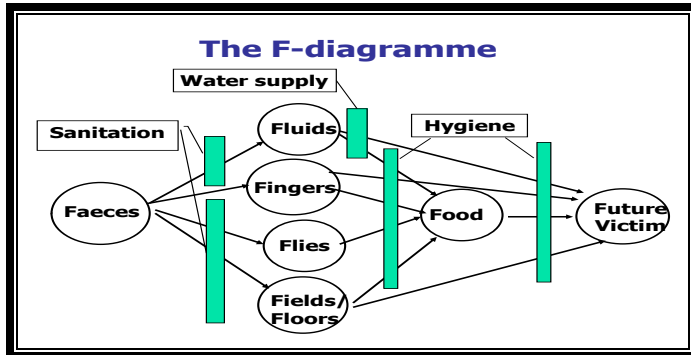
This chapter discusses strategies and examples in cholera prevention and control in cholera endemic countries. Although some examples mentioned in this chapter have not undergone formal evaluation to measure the effectiveness of the interventions and approaches, their use in this thesis is based on the fact that they have been employed in cholera prevention and they provide prospects for replication in the Liberia context if proven effective through future action research. Selection of countries cholera prevention and control guidelines and plans used in this chapter of the thesis is based on the fact that these guidelines and plans include a complete range of prevention and control strategies including WASH, cholera communication, active surveillance, case management, laboratory services and the role of OCV in cholera prevention and control. Their use is not based on the effectiveness of individual country cholera prevention initiatives, but merely on the consideration of the complete range of cholera prevention strategies and policy components as recommended by WHO.

### **4.1 Strategies to scale-up water Sanitation and hygiene services**

Poor and persistent lack of improved water (quality and quantity), sanitation and hygiene services among the population has been associated with cholera outbreaks in many other countries (WHO 2012b). Access to piped treated water supplies and public sewerage services is considered an effective tool in preventing and controlling cholera, but countries in Africa where there is low coverage of WASH services will take many years to achieve this (Gaffga, Tauxe & Mintz, 2007). Figure 5 below shows how by providing improved WASH services, the faecal oral route in the transmission cycle of cholera can be interrupted.

Improved sanitation blocks contamination of fluids, fields, floors and flies; improving water supplies (quantity and quality) blocks transmission through fluids. Hygiene services are the most effective as they interrupt multiple routes of the transmission cycle (Kolsky n.d).

Figure 5: 'F-Diagramme' showing interruption of faecal oral route of cholera transmission by WASH services.



Source: Kolsky n.d (note: original 'F-diagramme' developed by Wagner and Lanoix (1958) without the barriers. Direct transmission to new host from flies is still unclear)

By scaling up WASH interventions such as Household Water Treatment and Safe Storage (HWTS) promotion, countries in Sub-Saharan Africa have been able to reduce cholera incidences as demonstrated in Mozambique; while the use of water filtration materials such as 'sarin' cloth in Bangladesh to filter households' drinking water proved effective in removal of copods (organisms to which cholera bacteria attached) contributing to reduction in cholera transmission among the rural population (Gaffga, Tauxe & Mintz, 2007). Several innovations of water filtration systems such as ceramic filters for use at the household level are now being used in many African countries (Clasen et al 2009).

An intervention study using the Community Health Club (CHC) approach showed improvement of sanitation and hygiene in homes in rural communities. The club members involved with cholera prevention activities as drama to raise awareness on health issues. Other activities undertaken by the CHC which impacted on cholera prevention included construction of garbage pits in communities to manage refuse, construction of hand washing facilities and promoting Zero Open Defecation among club members (Waterkeyn and Cairncross cited in Njoh 2010).

The CHC approach applied during the cholera outbreak in Zimbabwe in 2009 when collapse of the urban water supply, sanitation and garbage collection system led to raw sewage being washed into the open water sources used

by the population; saw reduction in cholera incidence with only 4 cases and a 0% CFR in the highly densely populated suburb of Sakubva, in Mutare; while in other affected areas where the approach was not applied the cholera incidence was 12,700 with CFR 3.3%. This in part was due to hygiene behaviour and environmental campaigns such as removal of solid waste from streets, maintaining storm drains along roads, undertaken by the CHC members as argued by Waterkeyn & Matinami (2009).

Handwashing with soap is an effective tool in the prevention and control of cholera. According to Cairncross et al (2010), handwashing with soap promotion activities was effective in reducing diarrhoeal disease including cholera by 47%. It is worth noting that this result was of the effectiveness of promotion rather than handwashing itself. Handwashing practices should be done with soap and water (quantity and quality) at key occasions-after faecal contact, before eating or before feeding a child (Biran et al 2009)

A cluster randomise trial showed how free soap promoted in handwashing programmes increase handwashing practices resulting in reduction in diarrhoea incidence among study population. Regular use of soap was measured by 'electronic soap use data loggers'. The data loggers were used in a random sub sample to monitor the use of soap for hand washing at key times. The logged bars given to households were used in place of their existing soap and were left in households for 7 days with data recorded on 2 to 6 days. The loggers recorded movement of the soap bars as an indication of use of the soap by households for domestic purposes including hand-washing (Biran et al 2009).

#### **4.2 Surveillance and early case detection strategies and examples**

The rapid detection of public health risks, prompt risk assessment, notification and response are key aspects of an early warning system required in a surveillance system. Command, communications and control mechanisms are required to respond to outbreaks. Developing a model system for efficient electronic data transmission and management in routine national epidemiological surveillance is critical to early warning of potential epidemics (WHO 2013b)

Innovations in health such as the use of mobile phone applications used in the Central African Republic have been useful in saving time between the occurrence of health events such as cholera outbreaks and information availability for analysis and action (WHO 2013b). A pilot study in Haiti using

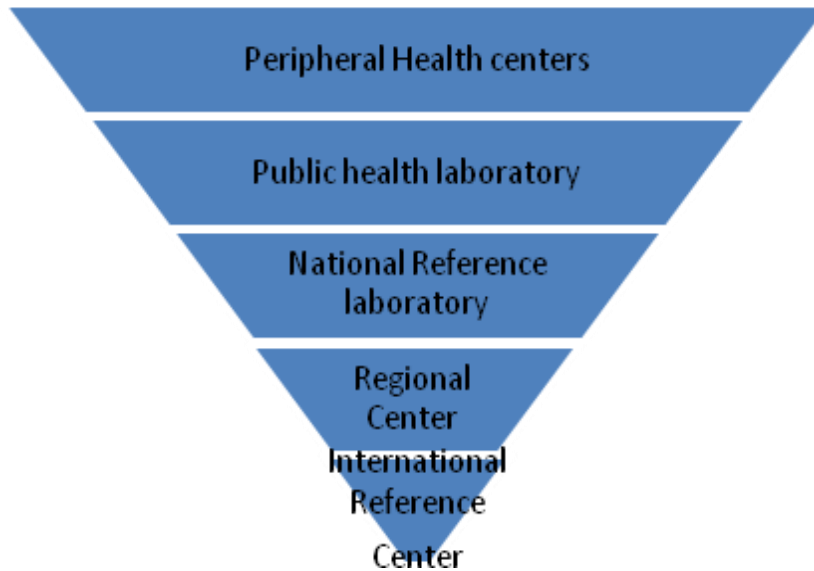
mobile phones programmed and used by Community Health Workers (CHW) help track information on persons with cholera in isolated communities. Prompts in the local language are user friendly and allow CHW to input data about number of people showing signs of cholera, number that have sought treatment at the treatment centre and number that have died (Partners in Health, 2011).

Geographical Information System (GIS) technologies are becoming increasingly useful in epidemiological surveillance of diseases including cholera. The use of GIS tools in enhancing early warning systems for alerting national cholera prevention control systems in countries such as Ethiopia and Uganda has informed prompt preparedness and response to cholera prevention and control (Bambaiha, 2009). Monitoring cholera epidemics by using GIS technology is combined with field visits to assess sources of exposure and transmission of cholera. In the Democratic Republic of Congo, GIS technologies used to generate weekly mapping of cholera cases provides data for rapid response in the case of an outbreak. GIS tool is used to assess community vulnerability to cholera by comparing cholera case locations and the availability or lack of water sanitation and hygiene services in affected geographical areas and identifying specific areas for immediate intervention (GAAC, 2011).

### **4.3 Cholera diagnosis innovations and strategies**

The timely and accurate diagnosis of Cholera is important in the prevention and control of any cholera epidemic. According to the WHO, clinical and laboratory diagnosis as well as rapid diagnostic test for suspected cholera cases can have a profound impact on early detection, prevention and control of the disease (WHO, 2013b). A robust laboratory system (Figure 6) with different strata at peripheral health centres, public health laboratory, national reference laboratory, a regional centre and international reference centres are significant for prompt outbreak detection for diseases of epidemic proportion (Rituparna et al, 2013).

Figure 6: Different strata of laboratories required for a robust surveillance system and for prompt outbreak detection



Source: Rituparna et al, 2013 (Different Strata of laboratories required for a robust surveillance system and for prompt outbreak detection)

Although laboratory confirmation by stool culture is the gold standard for cholera diagnosis, in endemic areas, simple case definition can be used, but Rapid Dipstick Test (RDT) allowing quick testing at patients' bed can facilitate early warning and case detection (WHO 2008).

Kalluri et al (2006) describes how useful RDT-'Institute Pasteur®' has been in early detection of suspected cases of cholera (with a 94% Negative Predictive Value and 63% Positive Predictive Value) in rural areas where the gold standard (stool culture) laboratory test is not readily available, and in situation such as refugee camps, remote communities where skilled personnel are not available. It is less expensive and less time consuming. Table 2 below shows benefit, cost and limitations of three RDTs.



Table 2: Cost, benefit and limitation of RDTs

Areas	SMART <sup>®</sup>	IP (Institute Pasteur) <sup>®</sup>	Medicos <sup>®</sup>
Testing Time	15 minutes	10 minutes	10 minutes
Storage	Refrigerator-long term	Room temperature	Refrigerator
Cost	US\$14/devise	Not yet commercially available	US\$4/dipstick

Source: Adapted from Kalluri et al 2006

Another RDT, the crystal VCR<sup>®</sup> for Vibrio Cholera 01 is cheap and can provide results in approximately 10 minutes. It can be used to detect outbreaks early if distributed to all levels of the national health system. It can be used by less skill staff in remote settings (UNICEF 2013). In Guinea Bissuea, a field evaluation of the Crystal VCR<sup>®</sup> during the 2008 cholera outbreak that affected 13,921 with 221 deaths, showed that RDT used in confirming the cholera outbreak proved useful in informing public health authorities of the growing epidemic at a time when the country experienced a delay in laboratory confirmation due to power shortage at the national laboratory (Harris et al. 2009).

#### **4.4 Cholera communication strategies**

Behaviour Change Communication (BCC) is important in cholera prevention and control as it provides community members with key information on the how to prevent the disease and in situations where a family member has cholera, what actions to take. The use of word of mouth through community structures (CHWs/leaders) in repeated information sharing on Cholera has shown effective in cholera prevention and control in traditional settings- Papua New Guinea for example (Rosewell et al, 2013)

#### **4.5 Cholera Case Management**

Cholera deaths can be significantly prevented by simple administration of Oral Rehydration Salt/Solution (ORS) therapy for less severe cholera; while severe cases can be treated with intravenous fluid replacement and the administration of appropriate antibiotics to limit duration of the disease. This

can maintain case fatality ratio below 1% (Gaffga, Tauxe & Mintz 2007; CCPC 2013).

According to Van Damme and Van Lerberghe (2004), routine health services reduce potential cholera deaths by 60% while additional interventions (during cholera emergencies) reduce potential cholera deaths by 30% as was found in Guinea. The same study found that mobile teams were organised to improve case management in cholera treatment centres linked to existing health facilities with intensive support from specialised teams.

However simple ORS administration at community level (using Community members, care givers) for less severe dehydrated cholera cases can be done with less cost and such is feasible in resource limited settings (Munos MK, Walker CLF, and Black RE, 2010). According to WHO the economic benefit (cost) of ORS treatment (US\$0.50 per patient) outweighs that for intravenous fluid replacement by -US\$10.00 per patient (WHO n.d).

#### **4.6 Cholera vaccination field examples and lessons learned**

The World Health Organisation (WHO) recommended to member countries to institute OCV programmes in combination with WASH services to prevent and control cholera due to the limited effectiveness of OCV. There is growing body of evidence of the use of OCV in cholera prevention and control (Bhattacharya et al, 2013; Luquero et al 2012).

OCVs are now available and the WHO has prequalified two vaccines (see annex 2). A five-year cluster-randomised, double blind placebo control trial showed that two doses of OCV reduce incidence of clinically significant cholera by 2/3 among study population (Bhattacharya et al, 2013). The Use of OCVs can increase the vulnerable population, such as people living in flood prone areas, refugees, individuals with HIV/AIDS and mobile populations involved with cross border trade resilience to cholera (CCPC, 2013). Table 3 presents summary of WHO decision criteria on OCV.

**Table 3:** WHO decision-making tool for OCV use in complex emergencies (Three step process)

<b>Steps</b>	<b>Areas</b>
1.	The risk of a cholera outbreak (this assessment should be undertaken first)
2.	Whether key public health priorities are or can be implemented in a timely manner together with analysis of the capacity to respond to a possible cholera outbreak
3.	The feasibility of an immunization campaign

Source: Adapted from WHO (2010)

Although WHO recommends the use of OCVs only in complex emergency situation due to its expensive nature, and the huge logistics connected to its use, a number of countries such as South Sudan and Zanzibar have included OCV use in their national guidelines (CCPC 2013).

OCV use in outbreak settings is now being recorded (Date et al 2011). The first ever use of OCV (Shanchol) during an emergency in Africa was among individuals in an outbreak in the Republic of Guinea which recorded high coverage of 89% and 87.7% of first and second rounds respectively. The vaccine efficacy was at 60-85% for 2-3 years as argued by Luguero et al (2012). But its efficiency and effectiveness is still being studied. Similarly, In South Sudan (Maban county), Medicins Sans-Frontieres organised a mass OCV campaigns among refugees and host population. The campaign achieved an administrative coverage of >85%. The efficacy of the vaccines among the population was not recorded (Conan & Lenglet 2013).

OCV acceptance in cultural settings similar to Liberia has been studied. A study in Kenya showed that there is a high level of acceptance among rural and urban dwellers with residents showing a high willingness to pay for the OCV. The study found that 95% of study population preferred a price of \$0.8 United States Dollars for the OCV in non emergency situations (Sundaram et al; 2013). This level of acceptance among rural populations provides opportunity for the large scale application of OCV in emergency and non emergency situation.

#### **4.7 Regional Collaboration and coordination during cholera outbreak**

As mentioned above, cholera epidemics have been recorded in Liberia and its neighboring countries and due to the profound trans-boundary dimension of the disease; regional collaboration becomes increasingly important to any prevention and control strategies. Migrant populations and refugee crises have been experienced in this part of the West African Sub-region. Migrant population including refugees is at high risk of contracting cholera due to cross border movements (Said 2011). This stresses need for coordination.

During a recent outbreak in 2012 in Guinea and Sierra Leone, health authorities in these two countries established a cross-border collaboration committee comprising senior and technical staff from the ministries of health Disease Prevention and Control Divisions and National Reference Laboratories. The committee met regularly to discuss preparedness and response measures to control the outbreak (CCPC 2013).

#### **4.8 Elements of good examples found in countries cholera prevention and control guidelines and plan**

Cholera control programmes in some Africa countries have under-taken several actions to guide stakeholders in the prevention as well as prompt and effective management of any cholera outbreaks. Good examples found in three countries national cholera guidelines and plan including Kenya, Zimbabwe and South Sudan are presented below. Page 41 shows table comparing these plans with Liberia's.

##### **4.8.1 Zimbabwe National Cholera Guidelines (ZMoH 2009)**

The Zimbabwe National Cholera Guidelines developed during a major cholera epidemic in Zimbabwe includes the burden of disease of cholera and trend between 1975 and 2007. It provides useful information on etiology of cholera in Zimbabwe (*Vibrio cholera* 01). Also it has a clear goal, which seeks "to provide standardised public health measures for cholera control in order to contribute to reduction of morbidity and mortality due to cholera". The guidelines describe what is expected of all health workers involved with cholera prevention and control from national level, the province and to the districts level; as well as Non-governmental Organisations and partners supporting cholera response.

#### **4.8.1.1 Water Sanitation and Hygiene**

On WASH service provision, the guidelines lays emphasis on intensive health promotion and environmental campaigns by ensuring safe water sanitation and hygiene services such as ensuring safe water supplies with clear water quality measures (making water safe by boiling, point source chlorination procedures and setting standard for free residual chlorine levels for public water points-piped water systems, standpipes and water tanker trucks). It promotes community involvement in environmental sanitation and food hygiene both for street food and among families.

#### **4.8.1.2 Cholera Surveillance and diagnosis**

On cholera surveillance, the guidelines prioritises early case detection at community level using weekly epidemiological bulletins with in-depth data analysis, establish daily contact with each reporting centre, map cholera intervention areas and partners as well as maps all cholera treatment centres and captures and analyse aggregated data on new admissions and deaths daily. Laboratory services ensure collection of stool sample for culture before administration of antibiotics. The guideline also recommends the collection and laboratory analysis of samples of water, sewage and food of persons with suspected cholera in investigating source of outbreak.

#### **4.8.1.3 Case Management**

Additionally, regarding cholera case management the guideline recognises the importance of reducing cholera mortality by setting standard treatment protocols and the need for immediate treatment of cholera patients as delayed inadequate treatment quickly results to patients' deaths. It provides clear guidance on setting up and management of Cholera Treatment Centers. It organised the ineffectiveness of mass treatment of community members with antibiotics (mass chemoprophylaxis). The use of Oral Rehydration Salts in treating less severe cholera is promoted and mandates institutions such as prisons, military and police barracks and schools to have in stock ORS to treat 100 cases of Acute Watery Diarrhoea.

#### **4.8.1.4 Role of Oral Cholera vaccines**

The use of OCVs in cholera prevention during emergency settings is mentioned, but has not adopted its use in Zimbabwe (ZMoH 2009).

#### **4.8.2 Kenya National Cholera Inter-sector Plan (KMoPH 2011)**

The Kenyan national cholera inter-sector plan describes the healthcare system in Kenya and levels of healthcare services. It indicates the financing mechanism and health sector reform process in relation to its five years National Health Sector Plan. The general cholera situation is described with the epidemiology of cholera in Kenya. *Vibrio Cholera* 01 is found in Kenya natural environment.

Moreover, it recognizes the International Conventions on Cholera; WHO Regional Committee for Africa adoption of the Resolution-AFR/RC57/3 on Resurgence of Cholera in the WHO Africa Region: current situation and Way Forward. The resolution urges member states to mobilize resources for strengthened programmes for safe water and safe food practices and environmental sanitation, to put cholera control among the priority agenda of government and to ensure multi-sectoral coordination involving stakeholders including community, civil society, private sector, non-governmental organisations and partners.

##### **4.8.2.1 Water Sanitation and Hygiene**

Regarding Water Treatment Strategies, the plan emphasizes the use of common Point of Use (PoU) water treatment technologies-chlorination, filtration and solar disinfection at the household level in cholera endemic areas. Community-Led Total Sanitation (CLTS) is national strategy for sanitation.

##### **4.8.2.2 Cholera surveillance, case management and OCV use**

Additionally, on cholera case detection and management the plan adapts the Integrated Disease Surveillance and Response (IDSR) framework for multi-disease surveillance including cholera. Cholera treatment guidelines are used. The use of OCV during cholera emergencies is mentioned but has not adopted its use (KMoPH 2011).

### **4.8.3 South Sudan National Cholera Prevention and Control Guidelines (SSMoH 2011)**

The cholera epidemic preparedness and response guidelines of the Republic of South Sudan adopt a multidisciplinary approach in prevention, preparedness and response to cholera. It identifies the main cholera Vibrio serotype present in South Sudan, which provides useful information as to the virulence of the bacteria existing in the natural environment. A clear definition using WHO recommended definition for cholera is outlined.

#### **4.8.3.1 Surveillance**

A clear surveillance approach to cholera is outlined in the guideline based on an effective surveillance system using the Integrated Disease Surveillance and Response (IDSR) framework. Mapping of states and counties reporting cholera cases and outbreaks is done. A community based surveillance approach using Community Health Workers (CHWs) who are trained and tasked to report suspected cases to the nearest health facility is in place. Mobile phones are used to report suspected cases of cholera from community level to county, state and national level. Environmental surveillance on water sources is conducted periodically to identify potential sources of contamination and forms an integral part of the country's cholera early warning system. At the state level, health cluster meetings are activated during emergency and are held monthly.

#### **4.8.3.2 Water Sanitation and Hygiene**

The provision of adequate WASH services is identified as a critical factor in mitigating all potential sources for cholera. During an outbreak, the guidelines recommend provision of safe water, proper sanitation; conduct of health education on hygiene and safe food handling practices at community level. As cholera is endemic in the country, the guidelines outlines risk factors associated with the disease. Such factors include the existence of environmental and social risk factors-Internally Displaced Populations (IDPs), inadequate safe water supplies, poor hygiene, and very low latrine coverage.

#### **4.8.3.3 Cholera case management**

A clear case management guideline is incorporated in the national guidelines. The guideline prohibits the use of chemoprophylaxis for cholera

as it is ineffective. Mandates the setting up of Cholera Treatment Centres and Units among affected population during emergency situations and emphasizes the effectiveness of such treatment centres should keep case fatality ratio below 1%. Cholera outbreak activities such as planning and coordination, micro planning and training of health staff on signs and symptoms of cholera, case management, prevention at community level and barrier methods for infection control at Cholera Treatment Centers/Units are outlined

#### **4.8.3.4 Communication**

On cholera communication approaches, the guidelines prioritise the provision of information about sources of food and water contamination and ways to avoid infection such as proper and effective handwashing for adults and children, simple water decontamination at homes through use of simple methods as boiling and use of chlorine based products. Messages targeting street vendors and community food sources are also prioritised. The role of flies in cholera transmission is recognised as being linked to the presence of unsanitary living conditions.

#### **4.8.3.5 Role of Oral Cholera Vaccines**

On the use of Oral Cholera Vaccines (OCV), the guidelines recommend the use of OCVs in high risk areas in combination with improvement in water, sanitation and hygiene services.



## **CHAPTER 5: CURRENT INITIATIVES AND ISSUES IN CHOLERA PREVENTION AND CONTROL IN LIBERIA**

This chapter describes the current initiatives and issues connected to cholera prevention and control in Liberia. A description of institutions involved with cholera prevention and control is outlined. Inadequacies and issues in the current approaches and initiatives employed in cholera prevention and control are described.

Under its Essential Package of Health Services launched in 2010, the MoHSW has prioritised infectious diseases among many others. This has led to the initial drafting of the national cholera control strategy and plan in 2013. This document outlines a multi-sectoral approach with key partners and NGO supporting this initiative. The strategy has 4 broad areas which include: Water Sanitation and Hygiene (WASH), Communication, Surveillance, and Case Management.

### **5.1 Prevention**

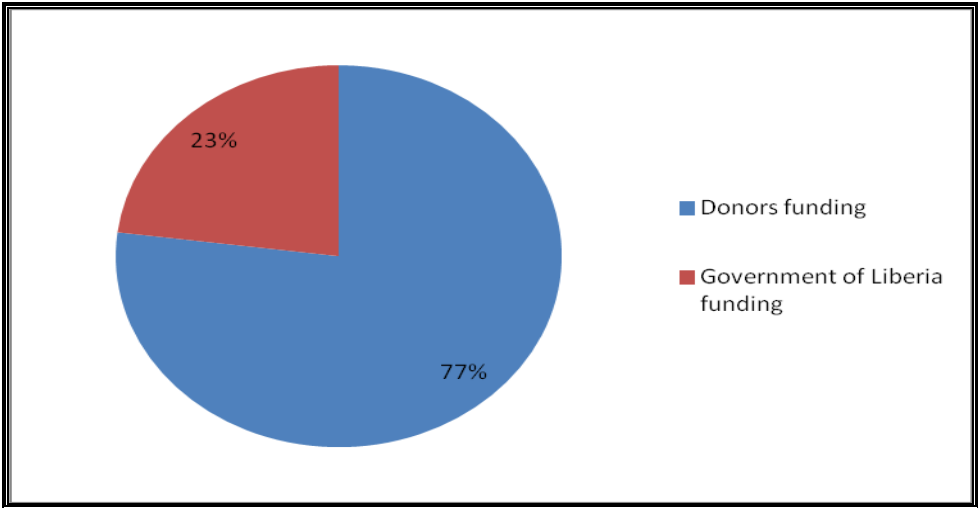
#### **5.1.1 Water Sanitation and Hygiene (WASH) services organisation**

Water Sanitation and Hygiene (WASH) Services in Liberia are currently provided by a number of institutional actors including the MoHSW responsible for hygiene services, water quality monitoring and promoting sanitation at the community level through community mobilization. The Ministry of Public Works leads on construction of water supply and sanitation infrastructures for communities with population less than 5,000 inhabitants, while the Ministry of Lands Mines and Energy leads on the overall governance of water resources. The Liberia Water and Sewer Corporation leads on provision of pipe borne water and sewerage systems to towns and cities with more than 5,000 inhabitants (GoL, 2011a).

To enhance coordination among these institutions, a National Water Sanitation and Hygiene Promotion Committee is in place housed at the MPW and coordinates WASH services in the country. The WASH sector has as goal, "to increase access to safe water supply and sanitation and improved hygiene practices, thereby contributing to improved human welfare, development and Liberia's long term sustainability" (GoL 2011a). Several non-governmental institutions and private companies are involved with scaling up WASH service in the country.

Funding for WASH services (Figure 7) is limited and mostly dependent on donors. The 2012/2013 funding to the sector accounts for only 10% of annual funding required for Liberia to meet its WASH targets outlined in its five years sector strategic plan by 2017 (GoL 2013). There is little political will to scale-up WASH services and this is evident by the low funding allocated by national government to the sector. Although there have been some improvements in the delivery of WASH services in Liberia, several issues continue to hamper the scale-up of these services as outlined below.

Figure 7: WASH funding sources for fiscal year 2012/2013 (N=US\$10.8 million)



Source: GoL 2013

**5.1.1.1 Access to improved Drinking Water supply**

Access to improved drinking water supply in Liberia has been estimated at 51% and 79% in rural and urban areas respectively (WHO and UNICEF 2013) which put Liberia in a better position to meet the Millennium Development Goal (MDG) target on water by 2015. However, in 2011, a water point mapping was conducted and results showed that 25.3% of an estimated 10,000 water points in urban and rural areas were broken down, 11% were functional but with problems, 63.7% were functional but with some being seasonal (GoL 2011a). Only 2.3% of the population is connected to the pipe water system (GoL 2013).

Population without access to improved water supply use streams, rivers and creeks to meet their water needs. In urban areas, people rely on vended water transported in carts. Frequent contamination of vended water has been reported and is one of several risk factors of cholera (UNICEF 2013)

### **5.1.1.2 Water quality**

As mentioned above in the 'F-diagramme', in order to reduce cholera spread, water of good quality and sufficient quantity needs to be available to enable the population exercise healthy hygiene. The Liberia WASH sector has employed a number of initiatives to ensure water quality at the household level particularly in some cholera hotspot communities but there are inadequacies.

Household Water Treatment and Safe Storage (HWTS) programmes such as promotion of tight lid containers, rolling boiling of drinking water, ceramic bucket filters, Solar Disinfectants (SODIS), chlorine based products (locally produced 'waterguard', AguaTabs), for water disinfection are promoted geared towards improving drinking water quality at the household level (GoL 2011a). Point of Use-PoU technologies -boiling, chlorine based solutions, ceramic water filters have proved effective in preventing diarrhoeal diseases including cholera in some countries by 53% (Fewtrell et al, 2005). However, while these technologies are effective in preventing cholera, in Liberia interventions promoting their use, places less priority on cholera hotspot areas.

To ensure that water from fixed point including boreholes and hand-dug wells meet the national water quality standards, water quality testing on physical, microbiological and chemical parameters is conducted by the Ministry of Health and Social Welfare (LMoH 2010c). According to GoL (2013), the MoHSW has in 12 out of 15 counties, a mini water quality laboratory equipped with portable field testing kits (WagTech) which enables its Environmental Health Teams to conduct periodic water quality monitoring on community water points (See table 4 for some tests result).

Table 4: Water Quality Analysis Results (2011)

<b>Bacteriological test result areas</b>	<b>Hand dug well with hand pump</b>	<b>Drill well with hand pump</b>	<b>Unprotected hand dug well No pump</b>	<b>Kiosk</b>	<b>City water tap (Including 4 below ground vault</b>	<b>Source water from Kiosk-trucked water</b>	<b>Total</b>
Water points with Detected E-Coli	76	8	18	9	4	2	117
Water points with E-Coli Absent	71	10	0	3	2	1	87
Total water points tested	147	18	18	12	6	3	<b>204</b>

Source: GoL (2013). Note Liberia Water Quality Standard for E-coli is 0/100ml. Detection of e-coli in water points could be linked to ground water contamination from septic tanks but studies have not being conducted to confirm this)

Despite the HWTS intervention in the country, only 16% of the population use PoU water treatment technologies (LISGIS and MEASURE DHS 2007). A study in Liberia found that some families did not use a locally produced point of use water treatment technology (waterguard) due to unavailability of the chlorine base product (LMoH and USAID n.d).

Another issue with current water quality approaches is that street water vending is unregulated although widely practiced. Contaminated drinking water both at household level and street vended has been associated with Cholera outbreaks.

### **5.1.1.3 Sanitation access and approaches**

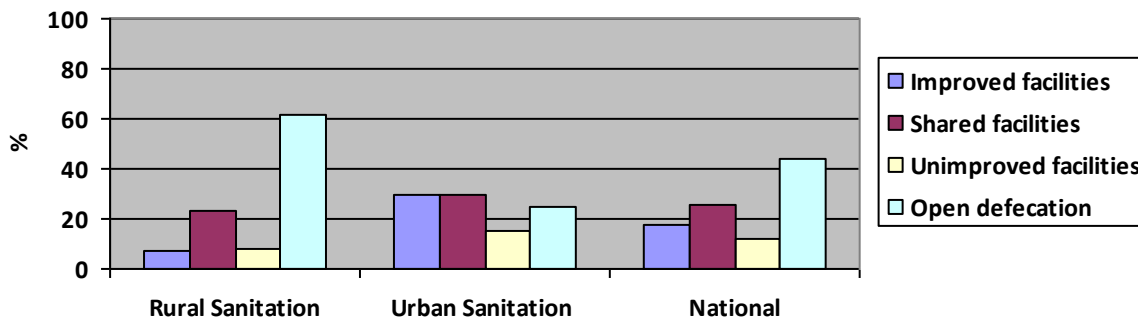
Inadequate sanitation services are a major cause of infectious disease including cholera. Sanitation services when provided substantially improve the health of individuals and communities.

To enhance provision of sanitation services in the country, the MoHSW and WASH partners have engaged in strategies such as Community-led Total Sanitation (CLTS). CLTS has been an effective strategy in scaling up access to sanitation services although the approach works well mostly in rural settings (Kar & Chambers 2008) and it struggles well in maintaining the achieved sanitation coverage (Plan International and United Nations water

Institute 2012). Institutional latrine construction targeting schools, clinics and market places is also a part of the current initiatives to increase access to sanitation among the population (GoL 2013)

Overall sanitation coverage is low in the country. The Joint Monitoring Programme report estimates a national Open Defecation (OD) rate of 44% in 2011, a decline from 56% in 2000. The same report estimates use of improved sanitation facilities among urban dwellers as 30% and only 7% of all rural dwellers use improved sanitation facilities (WHO and UNICEF, 2013). Figure 8 shows the sanitation coverage by type in Liberia.

Figure 8: 2013 updates on sanitation access in Liberia



Data Source: WHO and UNICEF 2013

Due to the conflict, public connections to the sewerage lines was badly affected posing serious issue to improvements in urban sanitation services provision with only 13.8% of the country’s population (mostly in Monrovia) having access to conventional sewerage system (GoL 2013).

Another area of significant importance to cholera persistence in Liberia is poor solid waste management practices (Osie and Duker, 2008). Refuse dumps are poorly managed and communities dispose their refuse mixed with human excreta in streets, drainages, river bodies. There is only one national solid waste management facility situated in Whien Town (GoL, 2011b). The municipal council of Monrovia and other cities do not have the logistics and human resources to manage solid waste that is generated by the over 1

million inhabitants in Monrovia (GoL, 2011b). A study in Ghana, Ashanti region shows a strong link between cholera cases and households within 500 metres of an existing poorly managed refuse dump. Flies contact with food were linked to the transmission (Osie and Duker, 2008).

#### **5.1.1.4. Food and Hygiene services**

The Division of Environmental and Occupational Health of MoHSW is responsible to provide food hygiene services (LMoH, 2010c). The sale of street food is widely practiced in the country. Contaminated street foods have been reported to spread diarrhoea (including cholera) in some parts of Africa (Mensah et al 2002). To ensure the prevention of food contamination among street food vended to the public, the division monitors public food establishments including restaurants, and local eateries 'cook shops' through quarterly and routine inspections. The inspection process is not rigorous and only done in few counties (mostly non cholera hotspot areas). Training of street food vendors on safe handling of food is not routinely done due to limited prioritisation by the MoHSW (GoL, 2010).

Although the National Food Safety Guidelines of MoHSW mandates the certification of all street food vendors based on thorough medical examination for diarrhoeal diseases and proof of a basic training in food hygiene, there is no certification scheme for street food vendors in place to ensure such quality assurance in public food standard in the country (GoL, 2010). The sale of raw fish is common in the country and without proper inspection for safety issues. A study conducted on fish harvested from the Meserrado River near urban slums in Monrovia showed a high level of *Vibrio cholera* O1 concentration in the raw fish (Scheelbeek et al, 2009).

Also, a study on street vended food in Ghana, showed that traditional food preparation practices such as use of bare hands, unclean utensils to prepare food and keeping food below the recommended temperatures of 50-90°C were common and were linked to contamination of these street food and are associated with cholera occurrence (Mensa et al, 2002). According to UNICEF (2013), food contaminated by sewage containing water before marketing and eaten raw is one of the vehicles for cholera transmission.

#### **5.1.1.5 Hygiene promotion services**

At the community level, hygiene promotion through community mobilization and use of mass media is undertaken although heavily donor driven.

National estimates on hand hygiene (handwashing) coverage in Liberia are not available but presumed to be low. A study conducted in Liberia by Subbah Belleh and Associates in 2008 as cited by the WASH sector strategic plan found that 43% of the study population do not practice handwashing with soap at critical times—after defecation, changing babies diapers, before preparing food and before eating in their communities (GoL 2011a). Several barriers including psychosocial factors (habit and nurturing behaviour) and technical factors (unavailability of soap and water for handwashing) have been noted to limit people’s ability to practice positive hygiene behaviors such as handwashing (Hulland et al 2014). These factors are experienced in Liberia (see below).

### **5.1.2 Cholera Communication approaches**

The National Health Promotion Division of MoHSW is responsible for cholera communication in Liberia. A National Cholera Communication Strategy is in place and has as goal, “to increase the adoption of safe water, sanitary practices and hygiene among families and communities in Liberia contributing to the reduction of Acute Watery Diarrhoea (AWD) and Cholera” (LMoH and UNICEF 2012). The division and its partners including UNICEF are engaged with cholera communication initiatives such as advocacy by engaging support of organisation and influential leaders such as town chiefs and religious leaders; interpersonal communication among families at the community level through support from general Community Health Volunteers (gCHVs) and students in school settings; supported and reinforced by mass media such as radio, posters, television, billboards and mobile phone text messaging (LMoH and UNICEF 2012).

Although several actions have been taken by the MoHSW to increase awareness among the population on cholera, hygiene behaviours such as handwashing practices are low (as mentioned above). Traditional and cultural practices such as eating food in the same bowl using bare hands with other family members is common among the population. A study conducted by Oxfam in Sierra Leone identified this cultural practice as a cholera risk factor (Oxfam 2013). Cholera awareness levels in Liberia is not known but presumed to be low. As mentioned above, community structures are vital in cholera communication, but study in 2013 on sources of health and hygiene messages including cholera information among rural dwellers in Liberia showed that only 17% received messages from community health volunteers while 36% receive messages from radio, remaining study

population receive from other sources (UNICEF and Oxfam 2013). It is worth noting that information alone does not lead to behaviour change that impact on cholera prevention. As mentioned above, psychosocial factors and availability of appropriate technologies are of vital importance.

### 5.1.2.1 Barriers and public perception to cholera prevention

National estimates on public perception on diarrhoea including cholera in Liberia as a serious health problem was not found, but a small scale study in rural Liberia (n=614) found this to be high among rural dwellers (Webster 2011). Local beliefs and practices have been associated with cholera spread (Njoh 2010). In Liberia barriers including several norms, beliefs and perceptions around cholera and WASH services have been noted to limit the effectiveness of communication approaches. Table 5 shows some quotations on barriers that affect cholera Behaviour Change Communication (BCC).

Table 5: Local barriers, beliefs & perceptions affecting cholera BCC in Liberia

<b>Barriers to hand washing</b>
<i>"There is no special place to wash hands and no special utensils"</i>
<i>"I wash my hands without soap, because no one has educated me about the importance of using soap during hand washing"</i>
<i>"I don't like to wash children hands because they always play on the ground"</i>
<b>Beliefs</b>
<i>"Children have a special angel that guards them and prevents them from harmful things. So they can eat from the ground or eat without washing their hands and they do not get sick"</i>
<b>Access to soap</b>
<i>"Sometimes I feel like washing my hands with soap but cannot afford to buy it"</i>
<b>Social etiquette and social norms</b>
<i>"I don't wash my hands when someone gives me food so that they will not feel that I am the only civilized person"</i>
<b>Barriers to latrine use</b>
<b>Habit</b>
<i>"Since I was a child until now I have no time seen anybody in my village going to defecate in a latrine. Everyone goes to the stream or the bush. Even the one public latrine available that was built by an NGO is not used by anybody. For this reason the grass has covered it and it is now spoiled"</i>
<i>"I feel ashamed when people see me going to the latrine. Therefore I prefer to use the bush or the stream when I go to the toilet"</i>

Source: Adapted from LMoH and USAID (n.d, p.9-15)



### 5.1.3 Surveillance

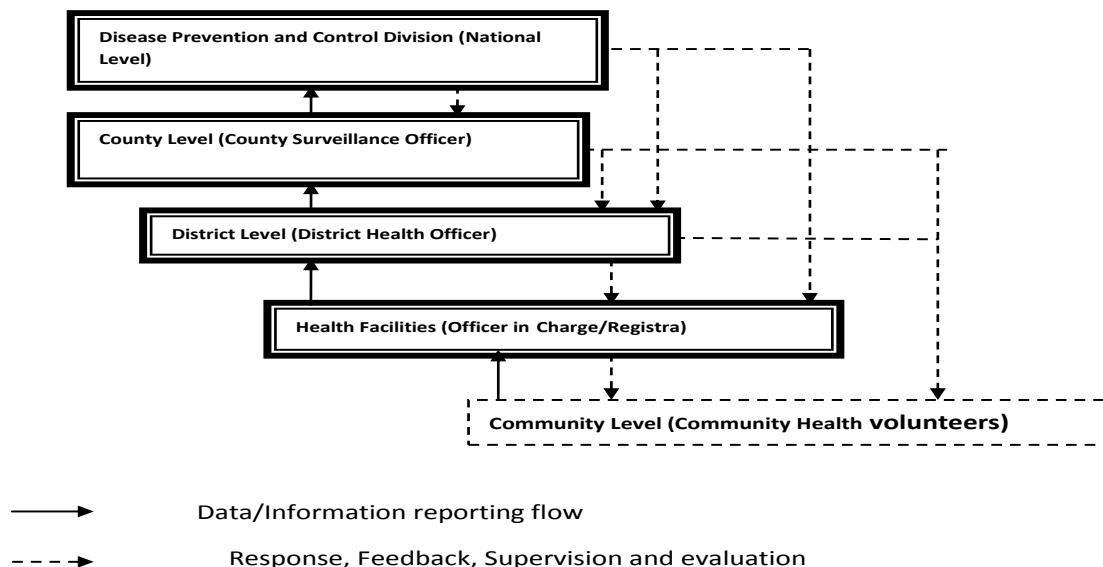
Surveillance is significant to early cholera case detection. The draft national cholera strategy outlines important steps and processes in cholera surveillance as mentioned below.

#### 5.1.3.1 National Surveillance system

Liberia has a National Integrated Disease Surveillance and Response (IDSR) framework which keeps surveillance on priority public health diseases. At the national level, the Division of Disease Prevention and Control (DPC) of MoHSW is the designated division responsible for all disease surveillance activities. Weekly data on cholera are collected and analysed by the DPC and published through weekly Epidemiological Bulletin. In situations where there is unusual occurrence in priority diseases, the bulletin informs stakeholders on actions to be taken to avert any epidemic.

At the county level, the County Health and Social Welfare Teams through the Surveillance Officers and the District Health Officers are engaged in active surveillance of the priority diseases including cholera (Figure 9). A County Epidemic Management Committee is in place in all 15 counties and the committee is expected to monitor the trend of priority public health diseases through review of the weekly surveillance data.

Figure 9: National Surveillance System Information Flow



Source: LMoH 2013a

### **5.1.3.2 Cholera surveillance**

Cholera cases are reported by county origination from all health facilities at the community level. Data are collected by District Health Officers and submitted to the County Surveillance Officers who on a weekly basis submit data to the central ministry of health where these cases are compiled and a weekly epidemiological bulleting is published with cases and deaths only reported by county; and not by age, sex, or community or occupation of the individuals with cholera (LMoH 2013a).

The challenge the current surveillance system poses to cholera prevention and control is the limited information on spatial and demographic characteristics of cases. Reported cases are analysed based on national and county levels only and not on districts or sub-district levels. Cholera case analysis based on district and sub-district levels as well as demographic characteristics of cases provides public health authorities with better information for effective response (CCPC 2013).

Another problem with the current surveillance system is the fact that cases are reported by field personnel through manual (paper base) collection of data. In a country where communities are sparsely settled and roads are almost impassable all year, timeliness of reported cholera cases is hampered and this affects early detection of a potential outbreak (CCPC 2013).

As shown above, novel methods in timely notification of cholera cases are now becoming increasingly common. Mobile phones have been used in some countries to inform health authorities on cases occurring at the community level but Liberia is yet to adapt such strategies in its cholera prevention and control programme. Another issue with the current surveillance system is the fact that it is reactive rather than proactive. Environmental surveillance using GIS tools can enhance early warning in cholera surveillance but its use is limited in the country, although such initiative can provide useful information on the predictability of a potential outbreak.

## **5.2 Laboratory services**

In Liberia, the national strategy on cholera prevention and control has adopted cholera confirmation by a laboratory diagnosis through stool culture. There is only one National Reference Laboratory in the country, situated in Margibi County, where all specimens from suspected cases of cholera are meant to be brought for Laboratory confirmation. This laboratory

has been used to confirm a number of cases thereby providing information for better decision making regarding prioritisation of intervention for cholera prevention and control. Cholera kits are supplied by the WHO Liberia country office (LMoH, 2013a).

Although the national reference laboratory is conducting stool culture to confirm cholera cases, stool samples from suspected cases of cholera in other counties do not get the same level of attention as samples from patients from Monrovia. The system most times faces logistical constraints in collecting and transporting samples from hard to reach cholera hotspot counties resulting in untimely detection of cholera and underestimation of the true burden of the disease as suspected cases are often categorised as Acute Watery Diarrhoea (AWD) because laboratory confirmation for these cases is not available in remote counties. It is worth mentioning that the use of clinical case definition to diagnose cholera cases is recommended but laboratory confirmation of the first case is required to declare an outbreak of cholera in Liberia (LMoH 2013a).

Another issue with the current approach is that there is usually delay in obtaining test results as results are often not available on time as the required timeframe for a stool culture is 48 hours. This situation ill informs the public health system in responding timely to cholera situation (CCPC 2013). Although the national strategy states that in cases of outbreaks, private institution laboratories such as Firestone and Catholic Hospitals are negotiated to support the national laboratory in conducting confirmatory test for suspected cholera this has not been practiced (LMoH 2013a).

Rapid Diagnostic Test (Dipstick) for cholera diagnosis at the field level has not been introduced in Liberia. WHO recommends the use RDTs in settings where cholera is endemic and access to laboratory facilities is poor (WHO 2008).

### **5.3 Cholera case management**

Case management services for cholera in Liberia include the provision of easy access to Oral Rehydration Salt/Solution (ORS) therapy in hotspot communities through the establishment of Oral Rehydration Treatment (ORT) centres at community and Primary Health Care facilities, border points/ports, health stations, refugee and Internally Displaced Population (IDP) camps and affected communities. At the community level, Community Health Volunteers (CHVs) are used in the treatment of diarrhoeal diseases

by administration of ORS to patients including children under-fives as well as identification of dehydrated patients (moderate and severe) and referral to designated health facilities for appropriate treatment (LMoH 2013a).

According to the MoHSW report on progress made on the implementation of its policy and plan for the period 2012-2013, the Ministry in order to strengthen CHSWTs capacity in terms of cholera treatment, prepositioned over 19,000 litres of Intravenous fluid (ringer lactate), 3 million sachets of ORS and other essential drugs and medical supplies at the county level. But these emergency supplies most times do not reach communities (cholera hotspots) where the need is most. Additionally, cholera standard treatment guidelines were also distributed and over 300 health professionals from the 15 counties were trained in cholera case management (LMoH, 2013b). This is not regularly done.

Preliminary results of the 2013 Liberia Demographic and Health Survey showed that only 47% of children under-five with diarrhoea sought treatment from a health facility or health provider. Among those seeking treatment for diarrhoea, only 62% of children with diarrhoea received rehydration from ORS packet (LISGIS and MEASURE DHS, 2013). The low access to ORS treatment contributes to the recent high case fatality ratio (CFR >1%). This points to deficiencies in the current cholera case management approach in the country which is linked to overall low healthcare access in Liberia mentioned above (Onyango et al 2013; Loharikar et al, 2013).

#### **5.4 Immunization/Vaccination services**

The MoHSW Division on Expanded Programme on Immunization (EPI) is responsible for all vaccination services in the country launched in 1978. The EPI programme has been organised in a way to provide effective and proper management of immunisation services to eligible persons in the country. The levels of organisation in the EPI programme are at national, county and district levels. At the national Level, there is a manager, a logistics officer, data manager, communication, surveillance and routine immunization officers. County Health Officers oversee the planning and implementation of immunization services at both county and district levels. The EPI programme has in place a cold chain system to ensure vaccines potency is maintained both at national and sub-national levels and vaccinators are in all health

facilities in the country (LMoH 2010d). However, OCV use has not been introduced into the EPI programme.

## **5.5 Coordination**

There is a focus on coordination in the national cholera strategy. At the national level, there exists a National Cholera Control Taskforce which coordinates all cholera related activities, while at the county level; there are County Emergency Preparedness and Response Teams in all 15 counties who manage programmes related to emergencies including cholera outbreaks (as mentioned above). Private sector, civil society, local Non-governmental as well as International Organisations including WHO (Health Cluster lead), UNICEF (WASH cluster lead) actively participate in cluster coordination meetings during cholera emergencies. Despite the involvement of these international organizations and partners, coordination from the ministerial level is sometimes a challenge as units have multiple health crises to deal with resulting to over-stretched capacity in dealing with outbreaks (Said 2011). Coordination among cholera hotspot counties is not been done. Cross border coordination during cholera emergencies is not currently practiced in Liberia.

## **5.6 Summary of Liberia cholera strategy**

As mentioned in previous section of this thesis, a national cholera control strategy and plan should be comprehensive with a complete range of prevention and control strategies. This is essential in providing guidance to actors in responding to cholera emergencies. The Liberia cholera strategy and plan incorporates some essential elements in cholera prevention and control such as:

- Role of WASH in cholera prevention,
- Case management for cholera
- Early detection of cholera through surveillance;
- Coordination of partners

However, comparing it with other countries guidelines and plans (detailed in chapter 4) and fitted in the WHO framework (below) shows that there are several inadequacies in the current national strategy (see Table 6). It should be noted that other countries guidelines/plans also have limitations.

Table 6: Liberia cholera strategy and three countries cholera guidelines/plan

WHO cholera prevention and control components	Liberia Cholera plan	Kenya Cholera Plan	Zimbabwe Cholera Guideline	South Sudan Cholera Guideline
<b>Prevention</b>				
Prioritise Water sanitation and Hygiene	√	√	√	√
Promotes HWTS/PoU in cholera prevention	√	√	√	√
Promotes Hand washing with soap	√	√	√	√
Mentions (at least one) key sanitation approaches (CLTS, CHC, others)	√	√	√	√
Cholera communication	√	√	√	√
Uses mass media (radio, TV, posters) in cholera communication	√	√	√	√
Surveillance				
Mentions food safety (Street food) hygiene monitoring	X	√	√	√
Mentions monitoring for environmental contamination of water sources	X	√	√	√
Adopts Integrated Disease Surveillance and Response	√	√	√	√
Mentions mobile phone use in cholera surveillance	X	X	X	√
<b>Diagnostic capabilities</b>				
Mentions Rapid Diagnostic Test use	X	X	X	X
Mentions Laboratory Test (Stool Culture) use	√	√	√	√
<b>Case Management</b>				
Mentions ORS use as primary cholera treatment strategy	√	√	√	√
Mentions Set up of Cholera Treatment Units (Administer antibiotics and IV fluids) during cholera emergencies	√	√	√	√
<b>Cholera vaccination</b>				
Clarifies role of Oral Cholera Vaccines in cholera prevention	X	√	√	√
Adopts use of OCV in cholera prevention/emergencies	X	X	X	√
<b>Coordination*:</b> prioritises coordination	√	√	√	√

Source: Formulated by the Author (ZMoH 2011; KMoPH 2011; SSMoH 2012; LMoH 2013) Note:( \* not in WHO framework but important , X means it is not mentioned, √ means it is mentioned)

## **CHAPTER 6: DISCUSSION**

This chapter of the thesis discusses the inter-links between findings presented above in answering my research questions. I discussed the findings along strategies in cholera prevention.

### **Safe drinking water, safe hygiene and sanitation**

Cholera can be reliably prevented and controlled by breaking the contamination cycle-faecal oral route through improvements in WASH services and have been identified as priority activities in the Liberia draft cholera inter-sector strategy/plan as well as other countries national cholera guidelines and plans studied. Although WASH services are outlined in the Liberia national strategy, implementation is low.

Currently, WASH coverage is low in Liberia. This is a major factor contributing to cholera occurrence in the country. Piped water connections are limited and only available in certain parts of country, mostly Monrovia. Sewerage connection is also low in the country and populations in most parts of the country especially in urban slums and rural remote areas have very little access which results to people practicing open defecation. The Government of Liberia is taking important steps in the provision of improved sanitation and hygiene services in rural areas through the implementation of strategies such as Community-Led Total Sanitation (CLTS) but this strategy is ineffective as it struggles to maintain the sanitation coverage over time. It is also not feasible in urban areas as the strategy is traditionally applied in rural remote areas due to its facilitation techniques where community members rely on local materials to construct their sanitation facilities (latrines).

However, sanitation measures such as CHC approach can provide opportunity in addressing sanitation problems in urban areas where the CLTS approach is not feasible. Study found that the CHC approach proved effective in preventing cholera particularly in urban areas when club members undertook sanitation measures that go beyond latrine construction, such as garbage collection, safe water storage practices.

Also, while HWTS as an interim measure/strategy in ensuring that population without access to piped water connections use safe drinking

Water at the household level, the national coverage was found to be low in Liberia. Current PoU technologies are not scaled up particularly in cholera hotspot communities. The fact that hotspots exist is already mentioned/outlined in the current draft of Liberian cholera plan but these communities have not been clearly identified as priority intervention sites for WASH services. Identifying these communities as priority sites for intervention needs to be done because by targeting those with services such as free PoU technologies; can reduce the transmission of cholera through contaminated water sources, as PoU unavailability was found to be a barrier. These identified hotspots influence cholera in the country as they can be considered reservoirs of the disease from which future outbreaks are likely to stem.

Hygiene behaviour such as handwashing with soap and clean water was found to be an effective way to prevent cholera from multiple routes (faecal oral route). Currently handwashing practices are low among the population in Liberia. Cultural beliefs and practices around handwashing promotion messages as well as lack of handwashing technologies (soap and hand washing stations) are major hurdles to the practice of handwashing at critical times among the population. Study found that handwashing promotion using free soap among communities increase people's practice of handwashing, but this will require monitoring with electronic data loggers to reduce self reporting biases. Electronic data loggers use does not seem feasible in Liberia in the short term. Regular monitoring by hygiene promoters can be use.

Additionally, Food safety is not prioritised in the Liberia cholera guidelines compared to other countries guidelines and plans reviewed. It is also not deemed a priority by both donors and government which has led to poor regulation in the sale of street vended food and beverages. Street vended foods play key role in the spread of cholera. Regulation of street food requires trained personnel and logistics. In a country like Liberia where street food is widely consumed, cholera could persist unless the hygiene standards of such foods are monitored and regulated. By organizing a training programme for street food vendors and conducting regular inspections of food establishments in hotspot areas, the MoHSW will be able to minimize the likelihood of cholera spread through street food. This is an activity that needs to be highlighted in the Liberia guidelines, and it may be worthwhile starting both with communication activities as well as monitoring activities in hotspot counties and later scaled up in other counties.



Since WASH services are donor dependent, prioritisation of service provision will be based on donors' interest; unless national government increases its financial and political commitment to enhance WASH services. This will also require donor support to be initiated in Liberia.

At national programme level interim approaches (mentioned above) in scaling up WASH services in hotspot areas would require adequate human resources. Training of health staff (Environmental Health Technicians) to implement approaches such as CHC in urban areas could provide opportunity for the smooth pilot of such approaches.

### **Behavioral Change communication approach**

Behavioral change communication is significant in cholera prevention and control. Community mobilization as a behavioral change strategy in cholera communication is a priority activity found in Liberia cholera strategy and other country. The use of mass media (radio, television) is also part of national cholera communication approaches common to Liberia's strategy and other countries cholera guidelines and plan studied.

The current awareness level among the population on cholera is presumed to be low in Liberia. Mass media as a source of cholera prevention and control messaging was found to be higher than word of mouth (which was found to be more effective). This result in low cholera awareness among the population. This is a contributing factor to the persistence of cholera in the country. In Liberia where electricity is almost nonexistent and where most households lack television and radio, cholera prevention and control messages aired or televised is ineffective as messages do not reach populations particularly in hotspot areas who need such messages the most. This is a serious weakness in the cholera communication approach.

Involving communities in cholera communication is essential in ensuring that cholera messaging is not unidirectional or less interactive as is the case with current mass media approaches. Participatory discussions through informed designated community members who give repeated messages by word of mouth was found to enhance cholera communication in traditional settings.

Using community members in cholera communication will require training and logistics including information education and communication materials.

## **Cholera management at health facilities and community levels**

Cholera can be a fatal disease if people do not receive prompt diagnosis (clinical or laboratory) and treatment. The Liberia national cholera strategy similar to other countries cholera guidelines and plans reviewed place emphasis on the laboratory confirmation of cholera through stool culture, but clinical case definitions are used to diagnose the disease in remote settings. Rapid Diagnostic Test (RDT) has been used in hospitals settings and field base studies in cholera diagnosis. They are quick to conduct and do not require laboratory facilities, but RDT use in cholera diagnosis is not considered in Liberia as well as other country cholera guidelines/plans included in this study. This is something Liberia strategy could adopt in future as RDTs become widely available in the market and at lower price.

The MoHSW in its cholera prevention and control strategy has undertaken measures to provide prompt treatment to suspected and confirmed cholera cases through administration of ORS to less severe cases and among children under-five years old, adjunct treatment with zinc; while severe cases receive intravenous fluid replacement with antibiotics in cholera treatment centers.

There are still inherent gaps. There is however, limited access to ORS treatment among the population in Liberia. Population in remote areas of Liberia have poor access to healthcare services including cholera treatment services, similar to rural population in other cholera endemic countries studied. Access to health services is low in Liberia. Family members of patients with cholera travel long distances to Cholera Treatment Centres and health facilities; while early treatment of dehydration with ORS can save lives. In situations where patients with severe cholera reach the treatment facility, stock-out of drugs and medical supply affects prompt and effective treatment of patients. The stockout of drugs and medical supplies at rural health facilities is due to lack of prepositioning of cholera emergency materials to CTUs in hotspot areas by County Health Teams. Routine health service was found to reduce cholera mortality but this was low in Liberia. These factors influence the high cholera CFR recorded in the country.

As found in other countries guidelines, clearly indicating the importance of maintaining the cholera CFR below the 1% threshold informs health staff and partners in ensuring prompt treatment for cholera cases during cholera emergencies. This is not mentioned in Liberia strategy. Improving access to ORS treatment at community level particularly in cholera hotspots using

CHWs was found as a useful strategy, but this will require regular training of CHWs.

Refresher training of health staff on cholera case management (IV) fluid replacement is also not regularly done in Liberia. By promoting easy access to ORS particularly at the community level, the financial burden to the health system that is often associated with cholera epidemics can be avoided. The prepositioning of emergency stock materials in hotspot areas is significant for prompt treatment of cases. This is not done in Liberia on regular bases. But it is worth doing in the short term.

### **Surveillance and early warning system to monitor cholera spread and determine action**

Cholera surveillance relies on timely accurate and relevant information. Surveillance systems provide information on where the cases are occurring, who are affected and when the disease occurs and such information is critical in controlling the spread of cholera. In Liberia, the Integrated Disease Surveillance and Response (IDSR) strategy for cholera surveillance is used. This was similar to other countries strategies.

Currently, surveillance staffs are deployed in counties and suspected cholera cases are reported weekly from county to national level. However, weak surveillance system with paper base reporting system has been noted to hinder timely notification of cholera cases at the peripheral level in the country. Environmental surveillance for contamination of water and food sources is not a priority in the Liberia strategy.

Real time surveillance data predict occurrence of cholera especially in hotspot areas. The use of novel technology such as mobile phone and GIS technologies are recorded in some countries in cholera surveillance and this could increase the effectiveness of the surveillance system and enhance early warning for cholera outbreaks in Liberia. This was a gap identified in the Liberia strategy.

However, employing GIS tools/technologies and mobile phones in Liberia's national cholera surveillance systems require training of staff and initial investment in procuring and installation of equipment, this can be piloted. Without effective cholera surveillance systems which can inform operational research, epidemics of cholera can very easily decimate the already limited healthcare services in the country.

## **Oral Cholera Vaccines**

Oral Cholera Vaccines (OCV) is a new tool in cholera prevention and control that can be used in combination with other interventions as its long term effectiveness is still low. Understanding, when and where to most effectively use OCV is important. Liberia strategy has not adopted the use of OCV in cholera prevention, although some countries with similar context as Liberia also only mention its importance in cholera emergencies in their national guidelines and plans, most have not clearly adopted the use of OCV. OCV use in emergency situations was found to record high administrative coverage but long term protection against clinically significant cholera has not been recorded.

The Liberia EPI programme has logistics and human resources at various health facilities. But these logistics are limited. Regarding cholera immunization using OCV, the EPI programme does not have the experience.

Adopting OCV use in Liberia will require integration of such approach in the EPI programme. This will also require training of health staff (Vaccination teams), additional logistics including cold chain and the OCV is essential. In the short term, OCV use in Liberia is not feasible.

## **Coordination and engagement of partners**

Inter-Agency coordination and cluster mechanism is significant in maintaining consistency in the participation of stakeholders during cholera emergency. This is a priority undertaken in Liberia cholera strategy similar to other countries.

While coordination among agencies was been done at the national level, there is limited or no coordination among county health teams especially cholera hotspot counties. Coordination on cholera emergencies among member countries in Mono River Union is not done.

The region experiences cross border trade with migrant population and also refugee situation and coordination both at national and regional levels are essential. Cross border coordination was found to provide a platform for information exchange during cholera emergencies among countries. Political stability of the country is essential to cross border coordination.

## **CHAPTER 7: CONCLUSION AND RECOMMENDATION**

### **7.1 Conclusion**

Cholera has been persistent in Liberia for decades. Flooding; armed conflict resulting to massive displacement of the population as well as highly mobile population including mine workers are some risk factors impeding effective cholera prevention and control in Liberia. Although numerous actions have been undertaken by MoHSW and partners to prevent and control cholera, several gaps/factors were noted in the current cholera prevention and control strategy. The most important factors/gaps are related to limited WASH coverage among the population, weak cholera communication approaches, weak surveillance system and limited cholera case management.

Addressing the limited access to improved water sanitation and hygiene services is significant to the long term prevention and control of cholera in the country but this will require concerted efforts from both WASH and health sectors. Strategies such as scaling up PoU water treatment technologies, handwashing with soap promotion and community driven sanitation can contribute to prevention of cholera in the short term. Such strategies should target cholera hotspot areas.

Weak cholera communication approaches focusing on the use of mass media particularly radio and television contribute to low cholera awareness among the population as most people do not have radio and television. Interpersonal communications on cholera especially through community structures can improve behaviour change. The national cholera communication approaches should be strengthened to provide cholera prevention and control messages year round, especially during cholera peak seasons. This should use community members focusing on key practices and clear messages essential for cholera prevention.

Addressing the weak surveillance system is critical to early warning and prompt outbreak detection. The use of paper base system to report cholera cases affects the timeliness of cholera data from the community level. The use of novel approaches including mobile phones and GIS tools can enhance cholera early warning systems. Vulnerability mapping of cholera prone areas such as those lacking improved water sanitation and hygiene infrastructure (i.e. mines workers, refugees, slum dwellers), areas experiencing environmental disasters such as flooding, areas bordering cholera endemic countries can be enhanced through these approaches. As the country decentralisation process is under way, such systems will also be useful in the continued mapping of counties with cholera and these vulnerable

conditions will help inform public health programming both at the county and national levels.

Improving access to ORS as well as IV fluid treatment for less and severe cholera cases particularly among high risk populations in cholera hotspot areas is significant to the reduction in cholera case fatality. Prepositioning emergency stock materials at the community level where the need is most will enhance early case management effort. This can be done by using CHWs and health staff. Regular supplies of ORS packets and providing training and supportive supervision to the CHWs and health staff is essential.

As the MoHSW undertakes decentralization of its health services, there is a need for better coordination among County Health and Social Welfare Teams as this is critical in ensuring that cholera prevention and control activities at sub-national levels are optimal.

Finally, to improve implementation of the cholera prevention and control programme, increasing the political will and resource mobilization is of vital importance. Improved coordination and information exchange between the member countries of the Mano River Union particularly during cholera epidemics is essential. Further operational research is needed to study emerging issues around cholera in Liberia.

## **7.2 Recommendation**

Cholera prevention and control in Liberia needs to be based on a comprehensive strategy that incorporates all components of the WHO policy recommendations. Such plans and guidelines have to have a complete range of activities as mentioned in this thesis. At programme level the following actions can be undertaken within the short, medium and long term.

### **Short term**

1. MoHSW should increase access to Oral Rehydration Salt (ORS) among community residents from the current 62%.The use of CHWs and other community members is essential.
2. MoHSW should strengthen Behavioral Change Communications campaigns including word of mouth (person-to-person) on cholera prevention especially in hotspots areas by using CHWs.
3. MoHSW and partners should scale-up HWTS promotion and handwashing with free soap distribution among populations in cholera hotspots.

4. The MoHSW and Partners should strengthen community centered sanitation services by scaling up the implementation of CLTS ensuring sustainability in rural areas and pilot the CHC approach in cholera hotspots in urban and peri-urban areas.

### **Medium Term**

5. MoHSW should strengthen the monitoring of street vended food and beverages particularly in cholera hotspots counties through regular inspection and training of vendors.
6. MoHSW should enhance better coordination among its division as well as among ministries and agencies prior to cholera peak season and also among CHSWTs especially hotspot counties. At the international level, the MoHSW should engage its neighbours in information exchange on cholera epidemics.
7. The MoHSW should strengthen the national surveillance system by piloting the use of GIS tools and mobile phone technology in cholera surveillance in the country.

### **Long Term**

8. As the use of Oral Cholera vaccines in epidemic settings increases with high records of long term effectiveness, the MoHSW should include OCV use in conjunction with other cholera prevention and control strategies. It can be integrated into the EPI programme
9. The MoHSW and partners should improve access to public sewerage connections and pipe water systems particularly in cholera hotspots.

## Annex 1a: Number and percentage of cadres (detailed)

<b>CADRE</b> (Group and individual)	<b>Number</b>	<b>%</b>
<b>Clinical Health Workers</b>	<b>5346</b>	<b>62.5%</b>
Physician	90	1.1%
Physician	67	0.8%
Surgeon	23	0.3%
Nurse	1393	16.3%
Graduated Nurse	129	1.5%
Licensed Practical Nurse (LPN)	255	3.0%
Nurse Anesthetist	55	0.6%
Nurse Midwife	66	0.8%
Registered Nurse	824	9.6%
Scrub Nurse	64	0.7%
Certified Midwife	412	4.8%
Physician Assistant	286	3.3%
Nurse Aide	1589	18.6%
Traditional Midwife	243	2.8%
Traditional Midwife	50	0.6%
Trained Traditional Midwife	193	2.3%
Dentist	23	0.3%
Dental Surgeon	8	0.1%
Dentist	15	0.2%
Environmental Health Technician	173	2.0%
Environmental Health Technician	119	1.4%
Health Inspector	54	0.6%
Lab technician / assistant	376	4.4%
Lab Aide/Assistant	239	2.8%
Lab Technician	137	1.6%
X-Ray Technician	22	0.3%
Pharmacist	46	0.5%
Other	693	8.1%
Physiotherapist	6	0.1%
Social Worker	182	2.1%
Dispenser	505	5.9%
<b>Non-Clinical Health Workers</b>	<b>3207</b>	<b>37.5%</b>
Accountant	88	1.0%
Cleaner	707	8.3%
Field Worker	127	1.5%
Non-Clinical Professional	1285	15.0%
Registrar	457	5.3%
Security	515	6.0%
Surveillance	28	0.3%
<b>Total</b>	<b>8553</b>	<b>100.0%</b>

Source: LMoH 2010b



## Annex 1b: HW per 1000 population (detailed)

Cadre	Bomi	Bong	Gbarpolu	Grand Bassa	Grand Cape Mount	Grand Gedeh	Grand Kru	Lofa	Margibi	Maryland	Montserrado	Nimba	River Cess	River Gee	Sinoe	Total
Physician	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.02	0.04	0.04	0.01	0.01	0.00	0.01	0.03
Nurse	0.63	0.37	0.32	0.40	0.39	0.32	0.21	0.43	0.43	0.35	0.46	0.26	0.55	0.39	0.42	0.40
Certified Midwife	0.27	0.13	0.12	0.08	0.11	0.07	0.12	0.13	0.17	0.08	0.14	0.06	0.11	0.13	0.08	0.12
Nurse Aide	0.81	0.28	0.43	0.36	0.34	0.40	0.86	0.86	0.58	0.42	0.42	0.31	0.39	0.58	0.63	0.46
Physician Assistant	0.08	0.03	0.05	0.05	0.07	0.08	0.07	0.07	0.05	0.13	0.11	0.07	0.11	0.16	0.06	0.08
Traditional Midwife	0.00	0.01	0.12	0.06	0.03	0.07	0.29	0.21	0.01	0.07	0.02	0.09	0.18	0.13	0.34	0.07
Dentist	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01
Environmental Health Technician	0.07	0.01	0.08	0.06	0.02	0.05	0.09	0.02	0.03	0.09	0.07	0.02	0.10	0.09	0.11	0.05
Lab technician / assistant	0.14	0.07	0.07	0.08	0.06	0.10	0.12	0.12	0.15	0.07	0.11	0.14	0.03	0.12	0.16	0.11
X-Ray Technician	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01
Pharmacist	0.02	0.01	0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.02	0.01
Other Health Cadres	0.24	0.18	0.11	0.13	0.31	0.22	0.22	0.19	0.15	0.23	0.19	0.17	0.28	0.39	0.39	0.20
Non-Clinical Health Workers	1.37	0.73	0.66	0.78	0.92	0.92	1.86	1.00	0.81	1.18	0.94	0.69	1.12	0.96	1.61	0.92
<b>Total</b>	<b>3.65</b>	<b>1.85</b>	<b>1.99</b>	<b>2.03</b>	<b>2.27</b>	<b>2.28</b>	<b>3.87</b>	<b>3.10</b>	<b>2.43</b>	<b>2.66</b>	<b>2.55</b>	<b>1.82</b>	<b>2.88</b>	<b>2.96</b>	<b>3.82</b>	<b>2.46</b>
<b>Clinical HW per 1000 population</b>	<b>2.28</b>	<b>1.12</b>	<b>1.33</b>	<b>1.25</b>	<b>1.35</b>	<b>1.36</b>	<b>2.00</b>	<b>2.09</b>	<b>1.62</b>	<b>1.48</b>	<b>1.61</b>	<b>1.13</b>	<b>1.76</b>	<b>2.01</b>	<b>2.21</b>	<b>1.54</b>
<b>Physicians, Nurses and Certified Midwives per 1000 population</b>	<b>0.92</b>	<b>0.52</b>	<b>0.46</b>	<b>0.51</b>	<b>0.50</b>	<b>0.41</b>	<b>0.35</b>	<b>0.60</b>	<b>0.62</b>	<b>0.48</b>	<b>0.64</b>	<b>0.33</b>	<b>0.67</b>	<b>0.52</b>	<b>0.51</b>	<b>0.55</b>

Source: LMoH National Health Workers Census 2010

## Annex 2: WHO prequalified OCVs

<b>Commercial Name</b>	<b>Dukoral® (WC/rBS)</b>	<b>Shanchol® (Variant WC)</b>
Exclusion criteria	Children < 2 years	Children < 1 year
Presentation	Oral suspension (vaccine) and effervescent granules (buffer)	Oral suspension (Vaccine)
Shelf-life	3 years	2 years
Storage	Cold chain (+2-+8°C)	Cold chain (+2-+8°C)
Stability at ambient temperature	1 month at 37°C	Stability test ongoing
Administration course	2 doses min. 1 to max. 6 weeks apart	2 doses min. 1 to max 6 weeks apart
Amount of drinking water needed/dose	150 ml for adults and children > 6 years 75 ml for children aged 2-6 years	None
Current price Dec. 2010)	~€3.5 per dose	~US\$ 1.5 per dose
WHO prequalified	Yes	Not yet

Source: Adapted from WHO 2010

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