The Cholera Epidemic and Barriers to Healthy Hygiene and Sanitation in Cameroon

A Protocol Study

Malange Ernest Njoh

2010

Supervisor: Anna-Karin Hurtig
DEDICATION

To Tarkang Alertia Efeti neé Malange of blessed memory
Abstract

The cholera epidemic has been a huge burden in the world in recent times, with the disease still thriving with much energy in Asia, Africa and South America. Cholera is most commonly transmitted through the faecal-oral route via contaminated water or food. The consumption of high-risk food, impure water and poor sanitation correlate with low socio-economic status and poverty to promote cholera transmission. Common denominators in developing countries, where cholera is an endemic disease include aspects such as insufficiency of drinking water and sanitation, underemployment, reduced education and poor schooling. The occurrence and severity of cholera outbreaks in endemic areas is greatly enhanced by human behaviour with regards the practice of healthy hygiene and sanitation, and health education, aimed at behaviour change is of paramount importance to prevent and control cholera. Much of the prevention and control of cholera rest on the practice of healthy hygiene and sanitation, and health education has been advocated as the most cost-effective intervention to prevent cholera infections and transmission. However, information flow in the delivery of health education on the practice of healthy hygiene and sanitation in cholera-endemic regions, during or prior to cholera outbreaks has been a great handicap in the prevention and control of cholera. In addition, much of cholera prevention lies at the level of individual responsibility with regards to the practice of healthy hygiene and sanitation. Owing to these, there is great need to understand the barriers to the practice of healthy hygiene and sanitation, as well as the level at which individual characteristics will influence such practices.

In this light, a literature review has been conducted to understand the barriers to the practice of healthy hygiene and sanitation. Among these barriers issues of health education on cholera prevention and control, such as misinterpretations and misconceptions, especially during outbreaks in cholera-endemic regions stand out as key barriers to the practice of healthy hygiene and sanitation, as well as individual characteristics, societal norms and source of health education massages. In this regard, a study protocol has been designed to determine the barriers to the practice of healthy hygiene and sanitation by residents in Douala, a cholera-endemic region in Cameroon. The proposed study will be done in two phases. The first phase is a knowledge, attitude and practice (KAP) study to measure the knowledge, attitudes and practices of the residents in response to health education on cholera prevention and control. The second phase is a qualitative study to explore unclear concepts or phenomenon to understand particular aspects of actions and behaviour, while paying attention to the social mechanisms in the population that lead to risk behaviour. The KAP study will provide first hand information about possible disease determinants, leading to the formulation of a hypothesis that can be tested using an analytical study design. The results of this study will be useful for planning health care interventions on cholera prevention and control, and for investigating of trends in interventions over time.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHC</td>
<td>Community Health Clubs</td>
</tr>
<tr>
<td>CFA</td>
<td>Communauté Financier D’ Afrique</td>
</tr>
<tr>
<td>HEWs</td>
<td>Health Education Workers</td>
</tr>
<tr>
<td>KAP</td>
<td>Knowledge, Attitude and Practice</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>CT</td>
<td>Cholera Toxin</td>
</tr>
<tr>
<td>CTB</td>
<td>Cholera Toxin Binding Site</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1...........................................................................................................................4
Table 2...........................................................................................................................17
Table 3...........................................................................................................................25
Table 4...........................................................................................................................32
LIST OF FIGURES

Figure 1..............................................................2
Figure 2..............................................................3
Figure 3..............................................................13
Figure 4..............................................................23
Figure 5..............................................................26
Figure 6..............................................................34
CONTENTS

DEDICATION.................................................................................................................. ii

ABSTRACT................................................................................................................... iii

ABBREVIATIONS........................................................................................................ iv

LIST OF TABLES........................................................................................................ v

LIST OF FIGURES........................................................................................................ vi

1. INTRODUCTION....................................................................................................... 1

1.1 Background............................................................................................................. 1

1.2 Burden of Cholera............................................................................................... 1

1.3 Quick Facts about the Republic of Cameroon...................................................... 2

1.4 The Problem Area............................................................................................... 3

2. EPIDEMIOLOGY AND PATHOGENESIS OF CHOLERA...................................... 6

2.1 *Vibrio Cholerae*............................................................................................... 6

2.2 Mode of Infection and Transmission................................................................... 6

2.3 Clinical Description............................................................................................. 7

2.4 Diagnosis of Cholera........................................................................................... 8

3. TREATMENT AND CONTROL OF CHOLERA.................................................. 9

3.1 Treatment of Cholera.......................................................................................... 9
3.2 Control of Cholera

4. OBJECTIVES

4.1 General Objectives

4.2 Specific Objectives

5. LITERATURE REVIEW

5.1 Methods of Literature Search

5.2 Cholera Prevention and Control

5.2.1 Cholera Vaccine

5.2.2 Surveillance Systems

5.2.3 Strategies to Curb Cholera Transmission in cholera-endemic regions

5.2.4 Recommendations on Cholera Prevention and Control

5.3 Barriers to Cholera Prevention and Control

5.3.1 Steps Taken at Structural Level to Prevent and Control Cholera and Possible Barriers

5.3.2 Steps Taken at Individual Level to Prevent and Control Cholera and Possible Barriers

5.3.3 Local Practices

5.3.4 Individual Characteristics

5.3.5 Societal Norms
5.3.6 Short Comings in Cholera Prevention and Control.............................................21

5.4 Conclusion................................................................................................................22

6. STUDY PROTOCOL...........................................................................................24

6.1 Justification of the Study.........................................................................................24

6.2 Research Questions..................................................................................................24

6.3 Knowledge, Attitude and Practice (KAP) Study (First Phase).............................25

6.3.1 Study setting and location....................................................................................26

6.3.2 Study Process........................................................................................................27

6.3.3 Sampling...............................................................................................................27

6.3.4 Determinants and Outcomes...............................................................................28

6.3.4.1 Determinants.....................................................................................................28

6.3.4.2 Outcomes (Level of KAP)..................................................................................28

6.3.5 Variables...............................................................................................................29

6.3.5.1 Determinants.....................................................................................................29

6.3.5.2 Outcomes...........................................................................................................29

6.3.6 Analysis and Reporting........................................................................................30

6.3.7 Strengths and Weaknesses...................................................................................31

6.3.7.1 Strengths.............................................................................................................31

6.3.7.2 Weaknesses........................................................................................................32
1. Introduction

1.1 Background

During the 19th century, cholera spread repeatedly from its original reservoir or source in the Ganges delta in India to the rest of the world, before receding to South Asia. Six pandemics were recorded that killed millions of people across Europe, Africa and the Americas. The seventh pandemic, which is still ongoing, started in 1961 in South Asia, reached Africa in 1971 and the Americas in 1991. The disease is now considered to be endemic in many countries and the pathogen causing cholera cannot currently be eliminated from the environment, (World Health Organization [WHO], 2008). Regions of the world where Cholera is currently prevalent are Africa, Asia and parts of the Middle East. Imported cases occasionally occur in richer countries in travelers returning from endemic areas, (National Travel Health Network and Centre [NaTHNaC], 2007. The disease no longer poses a threat to countries with minimum standards of hygiene, but it remains a challenge to countries where access to safe drinking water and adequate sanitation cannot be guaranteed, (WHO, 2009).

In recent times, climate change and an increase in the incidence of diarrhoeal diseases has been an issue. Environmental factors contribute to approximately 94 percent of the 4 billion cases of diarrhoea that the World Health Organization (WHO) estimates to occur globally each year and increased weather extremes are one consequence forecasted to follow from climate changes predicted by the Intergovernmental Panel on Climate Change. Diarrhoeal diseases are a global burden and the major cause of childhood hospitalization, primarily for dehydration. The number of deaths due to diarrhoeal illnesses exceeds that of AIDS, tuberculosis and malaria combined, and every week, 31,000 children in low-income countries die from diarrhoeal diseases which are approximately 4,500 deaths every single day, (Fricas and Martz, 2009). Weather and climate are among the factors that determine the geographic range and incidence of several major causes of ill health, including diarrhoeal diseases, (Ebi, 2009). Water and sanitation play a crucial role in the transmission of diarrhoeal disease and the impact of climatologic fluctuations on water quality and supply must be examined to ensure continued reduction in diarrhoeal diseases. The mechanistic basis for a climate-cholera connection involves multiple pathways and the primary transmission from environmental reservoirs initiates seasonal outbreaks of cholera in endemic regions, (Pascual et al., 2002).

1.2 The Burden of Cholera

Cholera has been a substantial burden in the developing world for decades and it is endemic in Africa, Asia, South and Central America, (Figure 1).
Severe outbreaks usually occur in underdeveloped areas with inadequate sanitation, poor hygiene and limited access to safe water supplies, while in some countries, a seasonal relation for cholera epidemics has been observed. Several decisions which concern cholera prevention and control are based on surveillance reports. However, due to the limitations in existing surveillance systems, differences in reporting procedures and failure to report cholera cases to WHO, official figures are likely to greatly underestimate the true prevalence of the disease, resulting to uncertainty in the exact scale of the problem. These hinder the provision of adequate interventions in at-risk indigenous populations, as healthcare professionals and policy makers might underestimate the true risk and burden of cholera, (Zuckerman et al., 2007).

1.3 Quick Facts about the Republic of Cameroon

Cameroon was originally part of the German colony in West Africa, and became a republic in 1960. The country is in the shape of an elongated triangle and forms a bridge between West Africa and Central Africa. It is a developing country in Central Africa with a land area of 475,000 sq. km and a population of 18,879,301 (July 2009 estimate). The population density is highest in the large urban centers, the western highlands, and the northeastern plains. Douala, Yaoundé and Garoua are the largest cities. Although Yaoundé is Cameroon’s capital, Douala, the largest city, has the main seaport, and it is the main industrial and commercial center. Cameroon is bordered by Nigeria and part of the Atlantic Ocean to the west, Chad to the northeast, the Central African Republic to the east, and Equatorial Guinea, Gabon, and the Republic of the Congo to the south, (figure 2). It has a central Republic government, strongly dominated by the president. Cameroon is made up of about 200 ethnic groups who speak many different languages. However, French and English are the official languages and about 270 African languages and dialects, including pidgin. Education is compulsory between ages 6 and 14. School attendance is 65% and literacy is rated at 75%. Infant mortality rate and life expectancy as of 2009 are 63.34/1,000 live births and 53.69 years, respectively. The
economy of Cameroon is to a certain extent dependent on agriculture, which is the main occupation of about 70 percent of Cameroon’s population. The country has a rich resource of timber but the main source of revenue is generated through petroleum reserves. Its GDP and GDP per capita as of 2008 are estimated at $42.76 billion and $2,300, respectively. Cameroon is divided into 10 semi-autonomous regions, with each under the administration of an elected Regional Council. It is characterized by a seven months dry season with very little rainfall (about 500 mm) and the average temperature is around 28 °C. The average annual rainfall is about 4,060 mm, while on the slopes of Mount Cameroon and other peaks of the west, rainfall is almost constant. In the semi arid northwest region, annual rainfall measures about 380 mm. A dry season in the north lasts from October to April. The average temperature in the south is 25°C, on the plateau it is 21°C and in the north it is 32°C.

Figure 2: Map of Cameroon

Source: The World Factbook, 2002

1.4 The Problem Area

Since 1971, endemic cholera has been prevalent in Douala-Cameroon, with sudden outbreaks occurring approximately after every two or three years during the dry season, (Garrigue et al, 1986). Several factors contribute to the survival of the Vibrio sp in Douala, including its location at the mouth of the Wouri delta on the Atlantic Ocean. Other factors include the
sandy clay soil, shallow dirty polluted foul-smelling groundwater, the presence of vast expanses of swamps, streams or drainage ditches, infested with Algae, as well as high temperatures, with low rainfall and drought during certain periods of the year, (Guévant et al., 2006). The drains which pervade the entire city are the most important risk factors that influence the spatial distribution of cholera in Douala. These drains function as pathogen reservoirs and the use of water from these reservoirs for any household activity transmits the disease to man, (Dambach, 2007). Important risk factors for cholera are bathing in contaminated surface water or drinking from rivers, (Birmingham et al., 1997).

The most recent cholera outbreak in Cameroon was reported on the 2nd of September 2009, in the northern part of the country, affecting the cities of Garoua and Maroua. 144 cases were recorded, including 51 deaths. However, interventions were put in place by health officials to curb the spread of the outbreak. Another outbreak was experienced in Douala, in January 2004 and spread throughout the south of the country. In this situation, the Ministry of Health reported a total number of 2924 cases and 46 deaths in Cameroon from the 1st of January to the 9th of June 2004 in Littoral and West Regions. Of these total numbers of cases and deaths, 514 cases and 13 deaths were reported in Douala, with a case fatality rate of 2.5%. Also, *Vibrio cholerae* O1 El Tor was confirmed as the agent which causes the disease from laboratory analysis of stool samples from patients, (WHO, 2004). This outbreak raised the question of the adequacy of sanitary infrastructures in large cities, especially Douala, Yaoundé and Garoua. Table 1 below depicts the burden of cholera in Cameroon between 1996 and 2005.

### Table 1: Cholera cases and deaths in Cameroon notified to WHO between 1996 and 2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Total number of cases including imported cases/deaths</th>
<th>Deaths</th>
<th>Case Fatality Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>2 847</td>
<td>110</td>
<td>3.86</td>
</tr>
<tr>
<td>2004</td>
<td>8 005</td>
<td>137</td>
<td>-</td>
</tr>
<tr>
<td>2003</td>
<td>207</td>
<td>36</td>
<td>-</td>
</tr>
<tr>
<td>2002</td>
<td>66</td>
<td>8</td>
<td>12.12</td>
</tr>
<tr>
<td>2001</td>
<td>259</td>
<td>7</td>
<td>2.70</td>
</tr>
<tr>
<td>2000</td>
<td>123</td>
<td>29</td>
<td>-</td>
</tr>
<tr>
<td>1999</td>
<td>326</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>1998</td>
<td>4 603</td>
<td>316</td>
<td>-</td>
</tr>
<tr>
<td>1997</td>
<td>1 709</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>1996</td>
<td>615</td>
<td>11</td>
<td>-</td>
</tr>
</tbody>
</table>

**Source:** Adapted from WHO annual summaries

- 4 -
Most outbreaks often start in a residential area called Bepanda, which is a slum, built on a garbage dump in a swampy zone, fed by numerous drainage ditches carrying the faecal pollution from neighbouring upstream districts. The most affected areas are those resulting from recent unregulated urban sprawl in polluted swampy zones and garbage dumps. Since access to the portable water is inadequate, with only 65,000 people having access to the public water facility out of over 2,000,000 million inhabitants, dwellers in most areas fetch water for household activities from the about 70,000 urban wells (estimated in 2004), that are often not more than 1.5 meters deep. Also, sewage disposal facilities are insufficient to provide complete evacuation of solid and liquid waste. The network of rivers, streams and man-made ditches waste are poorly maintained and often overflow during the rainy season. The contents of latrines are often discharged directly into the environment. Furthermore, social factors such as the reformation of urban tribes and the persistence of traditional attitudes towards waste disposal and water use have not only led to high-risk behaviour, but have also created barriers to the practice of healthy hygiene and sanitation. Further still, with the existence of an inadequate sanitary inspection system and a highly disorganized private health sector, effective preventive measures are difficult to implement. The combination of these factors probably accounts for the reason why cholera is endemic in Douala, (Guévant et al, 2006).
2. Epidemiology and Pathogenesis of Cholera

2.1 *Vibrio Cholerae*

The genus *Vibrio* consists of Gram-negative straight or curved rods, which are motile by means of a single polar flagellum. Also, of the vibrios that are clinically significant to humans, *Vibrio cholerae*, the agent of cholera, is the most important, (Todar, 2009). The organisms have many similarities to the members of the Enterobacteriaceae but can be readily differentiated by their positive oxidation reaction and their ability to grow at a pH between 9 and 9.5, (Volk et al., 1991). Two serogroups of *V. Cholerae*, O1 and O139 are responsible for causing outbreaks. *V. cholerae* O1 causes the majority of outbreaks worldwide, (WHO, 2009). The O1 serogroup can be divided into different antigenic forms or serotypes, such as Ogawa and Inaba, as well as biotypes (genotypes), such as classical and El Tor, (Zuckerman et al., 2007). The serogroup O139 was first identified in Bangladesh in 1992. It possesses the same virulence factors as O1 and creates similar clinical symptoms. Currently, the presence of O139 has been detected only in South-East and East Asia, but it is still unclear whether *V. cholerae* O139 will extend to other regions of the world. Other strains of *V. cholerae* apart from O1 and O139 can cause mild diarrhoea but do not develop into epidemics, (Volk et al., 1991). *V. cholerae* produces several toxins, but the classical dehydrating diarrhoeal symptoms of cholera are caused by the cholera enterotoxin, which consists of a non-toxic B subunit and an enzymatically active A subunit, which is located in the middle of the B subunit, (Zuckerman et al., 2007). The main reservoirs of the bacterium are human beings and aquatic sources, such as brackish water and estuaries, often associated with algal blooms (plankton), (WHO, 2009). But the natural reservoir of the organism is not known. It was long assumed to be humans, but some evidence suggests that it is the aquatic environment, (Tador, 2009).

2.2 Mode of Infection and Transmission

Cholera is a disease with a short incubation period caused by the bacterium *Vibrio cholerae* and infection is acquired by ingestion of water or food contaminated with faeces. The organisms do not spread beyond the gastrointestinal tract, where they multiply to very high concentrations in the small and large intestines. Unlike Shigellas, they do not penetrate the epithelial layer but remain adhered to the intestinal mucosa and produces diarrhoea as a result of the secretion of an enterotoxin, called choleragen, (Volk et al., 1991). This leads to increased production of intercellular cyclic adenosine mono-phosphate, which causes the mucosal cells to pump out large amounts of water and electrolytes, (Zuckerman et al., 2007).

Cholera is most commonly transmitted through the fecal-oral route via contaminated water or food. Cholera transmission has been linked to contaminated drinking water drawn from shallow unprotected wells, rivers or streams, and even to bottled water and ice. Seafood has frequently been the source of cholera particularly raw or undercooked
shellfish. Also, the consumption of high-risk food, impure water and poor sanitation correlate with low socio-economic status and poverty to promote cholera transmission. Thus, socio-economic status of an area plays an important role in cholera transmission. *V. cholerae* spreads rapidly where living conditions are crowded, water sources unprotected and where there is no hygienic disposal of feces, such as refugee camps and countries that are environmentally underdeveloped, (Steffen et al., 2003). Recent evidence has provided some explanations for this, and suggests that the passage of *V. cholerae* through the human gastrointestinal tract leads to a short-lived hyper-infective state. However, transmission via faeces of an infected individual is likely to cause disease with a much lower inoculum if transmission were to occur within a few hours of exposure. The magnitude of bacterial inoculums required to give rise to severe infection with cholera is dependent on the health status of the individual. Although a high infectious dose of $10^5-10^8$ bacteria is necessary to produce disease in healthy individuals, a much smaller inoculum can result in disease in certain populations, such as those with low levels of gastric acid. Low gastric acid levels and low socio-economic status have been linked to cholera. Gastric acidity is a major determinant of the size of inoculum required to generate disease, because gastric acid acts as a natural barrier to *V. cholerae*. Individuals with gastric hypochlorhydria or achlorhydria have been found to be at greater risk of developing cholera after infection with a low inoculum. Furthermore, an association between *Helicobacter pylori*, linked to a reduction in gastric acid, and *V. cholerae* infection has also been observed, (Zuckerman et al., 2007). Common denominators in developing countries where cholera is an endemic disease include aspects such as insufficiency of drinking water and sanitation, underemployment, reduced education and poor schooling, (Kumate et al., 1998).

### 2.3 Clinical Description

WHO clinical case definition for acute diarrhoeal disease is an individual having acute watery diarrhoea (characterised by the passage of 3 or more loose or watery stools within 24 hours) with or without dehydration, while the clinical case definition for acute bloody diarrhoea is an individual having acute diarrhoea with visible blood in the stool, (WHO, 1999). WHO suggests that around 90% of episodes of cholera are of mild to moderate severity and are difficult to distinguish clinically from other causes of acute diarrhoea. Cholera begins with the sudden onset of massive diarrhoea and the patient may lose gallons of protein-free fluid and associated electrolytes, bicarbonates and ions within a day or two. This results from the activity of the cholera enterotoxin, which activates the Adenylate Cyclase enzyme in the intestinal cells, and converts them into pumps which extract water and electrolytes from blood and tissues. The water extract and electrolytes are then pumped into the lumen of the intestine, (Todar, 2009). Severe cases are characterized by profuse watery diarrhoea, often accompanied by vomiting and acidosis. Up to 1 litre of stools may be produced per hour, becoming colourless, odourless and flecked with mucous. These are often described as 'rice water stools', (Steffen et al., 2003). The most striking feature of severe cholera is the voluminous watery stool output, and the dehydration it causes, leading rapidly to hypotension, tachycardia and vascular collapse. The patient becomes lethargic, with sunken eyes, cheeks and dry mucous membranes. Decreased skin turgor (skin-pinch sign) is found in
all such cases. Urine flow is decreased or absent and serum specific gravity is consistently raised, (Sánchez and Taylor, 1997). 60% of untreated patients die as a result of severe dehydration and loss of electrolytes, (Volk et al., 1991).

2.4 Diagnosis of Cholera

The rapid diagnostic test (RDT), which can facilitate early warning and the detection of first cases, is a faster means of testing patients. The samples tested positive with the RDT are re-tested using classic laboratory procedures for confirmation, (WHO, 2009). In a typical classic laboratory procedure, the organisms can be viewed directly in the stools, particularly with a dark-field microscope. Additionally, because *V. cholerae* is able to grow at higher pH than other enterics, selective media at alkaline pH values are used. Fluorescently, labeled antiserum can be used to confirm the identification of the observed organisms, (Volk et al., 1991).
3. Treatment and Control of Cholera

3.1 Treatment of Cholera

Deaths from cholera can be prevented through simple treatment oral rehydration, and severe cases through intravenous rehydration, (Gaffga et al., 2007). The mortality rate of cholera can be reduced to less than 1% by the adequate replacement of fluids and electrolytes. The inclusion of glucose in the salt solution which allows oral replacement of electrolytes has made treatment of the disease (particularly in rural areas) much more effective. Also, the use of any metabolizable carbohydrate together with NaCl appears to be effective for electrolyte replacement. Thus, a well-cooked and salted rice soup is recommended for diarrhoeal patients who are unable to obtain a glucose-salt solution. The efficacy of the oral replacement therapy can be seen by comparing the mortality of an epidemic before and after such a therapy is used. Antibiotics, particularly Tetracyclines, can reduce the number of intestinal vibrios and should be used along with fluid replacement, (Volk et al., 1991).

3.2 Control of Cholera

Control of cholera requires proper sewage disposal and adequate water sanitation, as well as the detection and treatment of carriers or reservoirs. Owing to this, hygienic water supplies are considered crucial for the control of cholera transmission. The transmission of cholera and other diarrhoeal diseases can be controlled by providing safe drinking water, ensuring adequate disposal of excreta and changing hygienic practices of the population at risk. The implementation of these measures requires political decisions and heavy investment of significant financial resources, (Steffen et al., 2003). Also, the spread of cholera can be controlled through the use of vaccines and mass chemoprophylaxis with antimicrobials, (Seas and Gotuzzo, 1996).
4. Objectives

4.1 General Objectives

- To develop a study protocol to determine the barriers to the practice of healthy hygiene and sanitation by residents in a cholera-endemic region.

4.2 Specific Objectives

- To conduct a literature review on the prevention and control of cholera transmission during outbreaks in cholera-endemic regions of the world.

- To develop a study protocol to determine;
  - The barriers to the practice of healthy hygiene and sanitation by residents in Douala, Cameroon.
  - The level at which individual characteristics influence the practice of healthy hygiene and sanitation.
  - The extent to which health education messages can result to the practice of healthy hygiene and sanitation.
5. Literature Review

5.1 Methods of Literature Search

The primary database that was used to conduct this literature review is SCIRUS. Considering that the main focus of the literature search is on barriers to healthy hygiene and sanitation, as well as cholera prevention and control, the initial phase of the search began with the following broad categories entered as key words or phrases: “cholera and Cameroon”, “cholera prevention and control in cholera-endemic regions of the world”, “cholera interventions in cholera endemic-regions of the world”, “hygiene and sanitation in cholera-endemic regions of the world”, “barriers to healthy hygiene and sanitation in cholera-endemic regions of the world”, and “handling cholera outbreaks in cholera-endemic regions of the world”. Using these broad keys, articles, research reports, conference papers and conference publications were found, summing up to 5,258. The search was further narrowed down to 340, using specific key words or phrases, while considering the inclusion and exclusion criteria. The following specific key words or phrases were used: “Cholera interventions in Douala-Cameroon”, “hygiene and sanitation in Douala-Cameroon”, “handling cholera outbreaks in Douala-Cameroon”, “cholera interventions in Latin American countries”, “cholera prevention and control in cholera-endemic regions in Africa” and “cholera prevention and control in cholera-endemic regions in Asia”. The inclusion criteria for articles obtained from the search was that they should be addressing issues on cholera prevention and control, lived experiences in communities during cholera outbreaks, as well as health education on hygiene and sanitation. For the exclusion criteria, only articles or data published from the late 90s till date were considered and the literature search was restricted to Africa, Asia and South America, which represent cholera-endemic regions in the world. With these criteria in place, 86 articles were browsed. Among these, 22 articles which are actually addressing the research problem were considered, alongside other excerpts from websites, which have relevant data and information to the research problem.

5.2 Cholera Prevention and Control

5.2.1 Cholera Vaccine

The cholera vaccine is used to complement preventive and control strategies, like improved water supplies, adequate sanitation, health education, as well as an efficient and effective surveillance system. The vaccine is officially recommended by WHO for use in complex emergencies and not for outbreaks, because of the prescribed dosage, it’s expensive nature, time lap to attain protective efficacy and the enormous logistics related to its application.
There are two oral vaccines that have been licensed for commercial use: the heat killed whole cell *V. cholerae* plus recombinant B subunit of cholera toxin vaccine (rCTB-WC), referred to as Dukoral and manufactured by SBL Vaccin AB, Stockholm, Sweden, and
the live attenuated *V. cholerae* O1 strain CVD 103-HgR vaccine, referred to as Orochol and manufactured by Berna Biotech Ltd, Bern Switzerland. The latter is also known as Mutacholin Canada. Dukoral has been approved in countries in the European Union, (Hill, Ford and Laloo, 2006). Dukoral provides prophylaxis against infection with *V. cholerae* by eliciting a local intestinal protective immune response. It consist of inactivated *V. cholerae* serogroup O1 whole cells representing both Inaba and Ogawa serotypes, and El Tor and classical biotypes, as well as the non-toxic binding portion of the CT, i.e. the B subunit (CTB). The whole cell component induces secretory antibodies preventing the bacteria from adhering to the intestinal epithelial cells and the B subunit induces secretory antibodies preventing the CT from binding to the cells. The two components of Dukoral act synergistically in protecting against cholera. This vaccine had been marked in Sweden since 1991 and tested in field trials in Bangladesh. It had a protection efficacy of 85% in the general population for the initial six months follow-up, (Steffen et al., 2003). They also obtained similar results from a study conducted among military recruits in Peru during the cholera epidemic in 1991, (Per Arne, 2005). The oral cholera vaccine is suitable for travellers, available for individuals aged 2 and above, and is not recommended for mass vaccination campaigns. It should be administered in 2 doses, 10 to 15 days in 150 ml of clean water, (WHO, 2010). However, immunization with heat-killed cholera organisms appears to give some protection and recovery from the disease itself provides immunity of an unknown degree or duration, (Volk et al., 1991). Although dietary caution and careful use of some antibiotics have a role to play in the prevention of cholera, the standard medical approach is the use of vaccines (Steffen et al., 2003).

Recently, a more effective and cheaper cholera vaccine has been developed and it is referred to as the 'Indian Vaccine' because studies leading to its licensed status were carried out in an urban slum in India. This vaccine was initially licensed by the Vietnamese government and it can be considered as the first major step in the recommendation of a cholera vaccine for mass immunization in cholera-endemic regions. Following the transfer of technology from Sweden and funding from the Bill & Melinda Gates Foundation, scientists at the International Vaccine Institute in Seoul were able to work with the Vietnamese manufacturer, VaBiotech, to revise the strain composition of the vaccine. Then it was finally made available for international use by an Indian manufacturer, approved by the WHO. This vaccine is very easy to administer and cheaper than Dukoral, and these are the advantages the 'Indian Vaccine' has over Dukoral. With these advantages, this vaccine stands a high chance to be recommended as a public health approach in cholera-endemic regions, (Sridhar, 2009).

### 5.2.2 Surveillance Systems

Surveillance in public health is the continuous systematic collection, analysis and interpretation of data on specific health events affecting a population. It is associated with the prompt dissemination of these data to authorities responsible for prevention and control.
This definition focuses on health outcomes, surveillance of hazards and exposures but it is also vital for environmental public health practice. Figure 3 illustrates the levels at which public health surveillance can be implemented in a problem situation.

**Figure 3:** The process by which an environmental agent produces an adverse effect and the corresponding types of public health surveillance

![Diagram showing the process of adverse effect and surveillance](#)

**Source:** Thacker et al., 1996

Hazard surveillance involves assessing the occurrence, distribution and secular trends in levels of hazards responsible for disease and injury, for example toxic chemical agents, physical agents, biomechanical stressors, as well as biological agents. Exposure surveillance is the monitoring of individual members of the population for the presence of an environmental agent or its clinical effects that are not apparent. In order for a surveillance system to be useful in environmental public health, the system must enable measurement of specific hazards, exposures and health outcomes. It should also have the capacity to produce continuous data records that are representative and can be used in the planning, implementation and evaluation of public health activities, (Thacker et al., 1996).

The true prevalence of cholera in population is not easy to estimate due to the existing surveillance systems, faulty reporting procedures and under-reporting of cases. Disease surveillance is vital for providing adequate health care and interventions for populations at
risk, (Zuckerman et al. (2007). Only 5 to 10% of actual cholera cases are reported for fear of a bridge in international cooperation in aspects of trade and tourism. Cholera prevention and control rely very much on surveillance systems and adequate reporting of cases. This will facilitate the early detection of outbreaks and provide ample time for prompt action to be taken with regards to interventions to prevent the spread of the disease, as well as make efficient the processes of risk assessment for future cholera outbreaks. Cholera control measures have always experience pitfalls due to the reporting of laboratory confirmed cases, which does not reflect the true burden of the disease. This situation has been managed in some developing countries by the putting in place of integrated disease surveillance system in high risk areas after identifying vulnerable populations. Knowledge of seasonal variations and the physical structure of cholera-endemic regions can facilitate the designing of prevention and control activities, (WHO, 2010). Early detection of the epidemics can also be achieved by the investigation of severe cases and clusters of illness, (Sánchez and Taylor, 1997).

5.2.3 Strategies to Curb Cholera Transmission in Cholera-Endemic Regions

Cholera transmission and deaths as a result of diarrhoeal diseases can be prevented or at least reduced by ensuring adequate sanitation and improved hygiene practices. In Ghana, health education has been a vital tool in the preventive measures taken by the Ministry of Health in the event of cholera outbreaks. These health education messages on cholera prevention and control transmitted over the radio, on special health programs, during outbreaks have been a good option for improved healthy hygiene and sanitation practices by the population, (Einarsdóttir et al., 2001). Much of the prevention in rural Zimbabwe was rest on sanitary improvements in homes and behaviour change through the promotion of hygiene and sanitation by encouraging Community Health Club (CHC) activities. The members of such clubs are engage in activities like the covering of drinking water in the homes, use of a ladle to take water, the construction of a garbage pit in the neighborhood, the putting in place of a pot, drying rack and a hand washing facility. In addition, members were charged with the responsibility to visit each other at home to monitor one another’s progress. The different clubs also composed health songs which were sung at meetings, to remind the members of the measures of cholera prevention and control. Dramas and sketches addressing local health issues were developed and acted in the community and in schools. Considering behaviour change, most of the members of the club who have no latrines and were still using the bushes, streams and rivers for defecation, had to embark on the ‘Cat Sanitation’. This is the digging of a hole with a ‘badza’ (hoe) in the ground before defecation and then covering the faeces with ground afterwards like a cat. Another local innovation was the ‘badza stand’, a forked branch to hold the hoe, with a plastic container for hand washing and some soap. The ‘badza stand’ is erected by the homes of members of the CHC who have no latrines. The CHC function as a group and behaviour change is also group-oriented such that, changes are approved group decision rather than personal decisions. The whole philosophy behind club activities was that the activities should conform within the traditional society, and the use of subjective norms to influence behaviour change, (Waterkeyn and Cairncross, 2005). Before and during the cholera epidemic in 1994, in Guinea-Bissau, health
personnel were oriented about the symptoms and treatment of cholera, and health educational material for the Guinean public was developed and broadly disseminated in the country. The Ministry of public Health relied so much on educating the general public on the practice of healthy hygiene and sanitation. The health education messages for the prevention and control of cholera that were passed on to the general public through radio and television, as well as through the use of posters included aspects of hand washing, food handling (cooking and preserving food), water disinfection, water preservation, washing kitchen utensils and cutleries, keeping the compound clean, keeping children away from dirt and the building, cleaning and use of latrines or toilets. Also, if a case of diarrhoea was noticed in the neighborhood, the individual was urged to rapidly seek help at the nearest health center. These messages were also given in the local languages to make sure that everyone understood them. In addition, a group of popular musicians made these messages into songs that were frequently played on the radio and specially trained theater groups performed sketches on healthy hygiene and sanitation practices for the population, during health education campaigns. At the health centers, the health personnel were urged to give health talks on cholera prevention and control, (Einarsdóttir et al., 2001).

The cholera epidemic of 1991 in Latin America was attributed to socio-economic determinants such as poverty, lack of sanitation, poor hygiene and sanitary control of food handling and the consumption of food sold by street vendors. In poor countries with low socio-economic status and poor water supplies and sanitary infrastructure like Peru, Honduras, Guatemala, Ecuador and Bolivia, the control and elimination of cholera was carried out by several interventions primarily on the sanitary level. These include provision of potable water, sanitary regulations in food and beverages, appropriate disposal of human waste through latrines and sewer systems, sewage treatment plants and maintaining sewage-free harvest beds, as well as improvements in educating the population about preventive measures, (Kumate J. et al., 1998). During the cholera epidemic in Peru, in 1991, a survey was conducted in two communities on knowledge, attitude and practice. It was found that health education regarding the prevention and control of cholera had penetrated well into the two communities but had not translated into changes in practices, due to misconceptions and poor understanding of the health education messages, (Einarsdóttir et al., 2001). In these communities, the treatment of drinking water with chlorine was one of the recommendations prescribed in health education programs but chlorine tablets were not made available to many villages in these two communities. Another option was the use of bleach but still in many of the villages, bleach could not be obtained. In Brazil, noticeable taste in drinking water that was treated with chlorine, fear of toxicity and the belief that water treatment is not necessary are some pitfalls that came with the recommendation that water stored in homes should be treated with chlorine. Boiling which was considered as the alternative for the treatment of water stored in homes was not practiced because it is expensive and time consuming, (Quick et al., 1996). An example of misconceptions that come with the disease can be seen in Papua New Guinea, where a lady recounted her experience of how she suffered from stigma and ended up losing her job because she had cholera and recovered from it. There have also been cases of people dying by the roadside because they have nobody to take them to the hospital. In some communities, people have never heard of cholera and they share strange beliefs, e.g. some believe cholera is a disease that ‘jumps’ from one person to another. Even the nurses at the hospital in Papua New Guinea did not want to have physical
contact like handshakes with other nurses working in the cholera treatment centre, during the cholera outbreak in 2009. With these examples, you can imagine the degree of misconception which revolves around the disease in this community and other communities in cholera-endemic regions, (WASH news Asia & Pacific, 2009). Another example is reflected in how the disease is considered and interpreted. During the cholera outbreak in Papua, New Guinea, a citizen described the cholera situation as “a disgrace” and he further stressed that, “it is a national disgrace”. This remark was due to the cold attitude of the government to take some necessary steps to curb the spread of the disease but instead funded less priority projects. As a result, there were increased number of cases and deaths, (IRIN, 2009). This remark can be interpreted differently by the lay man and it may build negative issues in his mind with regards to the disease. In most Latin American countries, the eradication of cholera is considered as an insurmountable task and public health programs have embark on intensive control programs supported by active surveillance, prompt diagnosis, and health promotion activities to curb the spread of the disease, (Kumate et al., 1998).

In Japan, the control of cholera is through effective sanitary regulations, effective surveillance, early diagnosis and prompt treatment, abundant water supply in homes, effective disposal of human waste and sewage treatment. During the cholera outbreak in the eastern province of Nangahar in Afghanistan, the conducting of hygiene promotion sessions and the chlorination of public water sources, including over 2000 wells were measures used to stop the spread of the disease. This outbreak was caused by heavy rains which triggered flash floods that left thousands of people homeless in the province. Posters and hygiene training materials, including information on how to avoid contracting the disease were distributed by the International Rescue Committee to local volunteers, who helped in conducting the hygiene promotion sessions. Hygiene kits were also provided to the population and 250 latrines were constructed to prevent the spread of disease, (The International Rescue Committee, 2008).
### 5.2.4 Recommendations on Cholera Prevention and Control

**Table 2:** Recommendations from literature review and WHO standard recommendations on cholera prevention and control

<table>
<thead>
<tr>
<th>Recommendations (From Literature Review)</th>
<th>WHO Standard Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structural Level</strong></td>
<td></td>
</tr>
<tr>
<td>The construction and maintenance of sewage disposal facilities e.g. latrines</td>
<td>Promote the use latrines and they should be kept clean</td>
</tr>
<tr>
<td>Special health education programs on cholera prevention and control</td>
<td>Promote the use of a multi-sectoral and coordinated approach involving community participation</td>
</tr>
<tr>
<td>Preventive recommendations should be focused only on a few key practices essential for the prevention of cholera to make it easier for the masses to understand the message, (Einarsdóttir et al., 2001)</td>
<td>Improve communication and public information by providing information:</td>
</tr>
<tr>
<td>Disinfection of water sources, water for home use, chlorination of wells, provision, storage and protection of safe water supplies in homes and restaurants, (Sánchez and Taylor, 1997)</td>
<td>• on how to avoid cholera through simple messages</td>
</tr>
<tr>
<td>Effective surveillance, early diagnosis and prompt treatment, (Kumate et al, 1998)</td>
<td>• on outbreaks</td>
</tr>
<tr>
<td><strong>Individual Level</strong></td>
<td></td>
</tr>
<tr>
<td>The use of simple and inexpensive methods of disinfecting and storing water used in homes e.g. lemon juice should be used to</td>
<td>Only freshly cooked food should be eaten</td>
</tr>
<tr>
<td></td>
<td>Defecation near water sources should be</td>
</tr>
<tr>
<td>Guarantee safe water, (Sánchez and Taylor, 1997)</td>
<td>Behavioural changes on hand washing with soap. Washing the hands with soap can reduce the risk of diarrheal diseases by 42-47% and more interventions to promote hand-washing might save a million lives, (Curtis and Cairncross, 2003)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>The use of narrow-mouthed containers for storing water in households, (Birmingham et al., 1997)</td>
<td>Word-of-mouth (person-to-person conversation) should be encouraged as an important and indirect means to propagate messages on cholera prevention and control, (Einarsdóttir et al., 2001)</td>
</tr>
<tr>
<td>Water for home use should be boiled or disinfected with chlorine solution</td>
<td>Avoid eating in gatherings (Funerals)</td>
</tr>
<tr>
<td>Much care should be taken when handling stools, vomit and soiled clothes of patients because they are highly contagious</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Formulated by author, 2010

### 5.3 Barriers to Cholera Prevention and Control

#### 5.3.1 Steps Taken at the Structural Level to Prevent and Control Cholera and Possible Barriers

The governments of countries in cholera-endemic regions are making provisions for potable water in homes, improved sanitary regulations for food and beverage handling, active surveillance systems, prompt diagnosis, health promotion activities, appropriate disposal of human waste through latrines and sewer systems. A great handicap with these measures is the lack of finances and the political commitment or will of the government of the countries.

In most cholera-endemic regions, the governments of countries are using health education through mass media as the major prophylaxis against cholera. The strategy is to create awareness of the existence of the disease and also provide the masses with the basic knowledge in first aid to handle cases. Much is also being preached about improved sanitary conditions in homes and behaviour change with regards to hygiene and sanitation. The difficulty with this measure is the issue of ensuring that these messages reach remote areas with no electricity, as well as the understanding of these messages on the part of the populations.
CHC have also been formed in most rural settings and these clubs carry out many activities in their communities, mostly on a voluntary basis. Some of their activities include awareness and sensitization on cholera prevention and control, water preservation for home use, cleaning of the surrounding, construction of garbage pits and putting in place of a hand washing facility by latrines and toilets. A barrier here is the reluctance of people to practice healthy hygiene and sanitation. Most people assess the threat (risk) as irrelevant prior to the event (illness).

5.3.2 Steps taken at Individual Level Prevent and Control Cholera and Possible Barriers

Many individuals in the communities without toilets have developed a means of defecation which is referred to as ‘cat sanitation’. These individuals also have a forked branch pinned by their houses, on which a hoe and a plastic container with soap are hung for hand washing. This is referred to as a ‘badza stand’ in rural Zimbabwe. The problem here rest on the fact that residents of a particular community are strongly attached to their culture or way of life. Owing to this, some people see no reason why they have to stop defecation in bushes, streams and rivers. Others find it very embarrassing to have a ‘badza stand’ pinned by their houses, while some find it very humiliating to do ‘cat sanitation’. With these problems at hand, much is still left to be done with regards to cholera prevention and control at individual level and this is the main focus of this proposed study.

5.3.3 Local practices

In some local communities in Guinea-Bissau, many people are afraid of cholera, because many people suffered from the disease and it killed some very fast. Owing to these, the villagers believed that local ceremonial practices such as offerings to the spirits can help to remedy the situation. In such local ceremonials, chickens and alcohol are placed at entry points to the village, around the village and in every house, with the intention of preventing cholera. Other local practices include the designation of religious leaders of the area or women and men with special religious status to go to the most important shrines with offerings and requests for intervention from the gods. Also, women gather at the shrine of the deity, with offerings, dance naked in the night, seeking help from the gods. The men are not allowed to be present during the dancing and older women would sleep at the shrine until the epidemic was over. On the contrary in some areas of the world cultural practices instead help to promote the spread of cholera, (Einarsdóttir et al., 2001). For instance, in Latin America, water for domestic use is preserved in containers that promote contamination, making the risk of contracting cholera by drinking stored water 2 to 3 times higher than by drinking water from streams or rivers. Also, certain cultural practices encourage people to leave food that had been cooked permanently open, especially during funerals and pilgrimages to religious sanctuaries. This practice provides room for contamination as flies will settle on the food increase the risk infection if such food is eaten, (Kumate J. et al., 1998).
5.3.4 Individual Characteristics

The occurrence and severity of cholera outbreaks in endemic areas is greatly enhanced by human behaviour with regards the practice of healthy hygiene and sanitation, and health education, aimed at behaviour change is of paramount importance to prevent and control cholera, (WHO, 2010). In order to achieve the desired change in behaviour, the health educational message has to be accepted and the required enabling factors such as resources, skills, and time provided. The behaviour change advocated in a health education campaign should be relevant for the health problem in question and must lead to improvement in health, (Einarsdóttir et al., 2001). However, cholera can be prevented through adequate hand-washing before preparation of food, and by disinfection of drinking water and water that is used in preparing food, since behavioural changes are always difficult to effect, (Bignall, 1998). The use of contaminated surface water in households and bathing in rivers and streams are risk factors, (Sánchez and Taylor, 1997). The use of wide-mouthed containers to store water in homes is also a problem, as it does not prevent the hands and cups from contaminating the water in such containers. There is also a possibility of contaminating water collected from a safe source, if the same container is also used to fetch water from rivers and streams. In Muslim communities, the practice of rinsing the mouth with water before prayers is considered as a risk factor for cholera but mouth-rinsing and religion are not related to the disease. It is the use of contaminated water for rinsing the mouth that causes the disease, (Birmingham et al., 1997).

5.3.5 Societal norms

Norms and values in every society are very important for its existence and these norms and values may influence many aspects and issues in any particular society. The Pupuan tribe in Indonesia, which is composed of a group of indigenous people who are often marginalized by the Indonesian government, have different beliefs and attitudes towards cholera. These people, who have suffered years of violence and brutality at the hands of the Indonesian military, believed that they were affected by the cholera during the cholera outbreak because the Indonesian soldiers poisoned them. This made them to be very suspicious of any medical treatment that was offered by the authorities in Indonesia and this lead to increased number of cases and deaths during the cholera outbreak, (Survival, The Movement for Tribal Peoples, 2008). Some communities are very attached to their cultural values and norms and such practices have provided the route for cholera infections and transmissions. An example is seen in Guinea-Bissau, where the huts are constructed with clay thatch-roofs and dirt floors. The villagers also collect water for home use from dug-out wells in the compounds, the rice fields, or a natural spring. In rural Guinea-Bissau, the diet is typically rice and fish boiled in lemon and hot pepper and this is eaten from a common bowl by family members with the fingers. Water for daily consumption is neither treated with lemon nor boiled. This provides a possible route for cholera infection and transmission. In these communities, lemon juice has been shown to be effective in killing Vibrio sp. in food and having access to lemons at home is associated with less risk of cholera infection during outbreaks. In these communities,
sickness or the disease cholera is interpreted as a symbol of ritual failure or witchcraft that “comes with the wind”. With this interpretation, many villagers live with the misconception that cholera is transmitted through the air. In addition, there is no electricity or telecommunication in most villages. Owing to this, access to health education messages through radio and television on the prevention and control of cholera is almost impossible. Latrines are not constructed in most villages, contrary to repeated recommendation in the health educational messages transmitted by radio. Also, there are no televisions in these villages and not every home has access to a functional radio. More to that, ownership of radio sets is male dominated in these villages, consequently this is a huge barrier for women to receive adequate health educational messages on cholera prevention, (Einarsdóttir et al., 2001).

5.3.6 Shortcomings in Cholera Prevention and Control

Most of the times, the health educational messages on the cholera prevention were not correctly recalled or were poorly understood by individuals and when such messages were exchanged in conversations, they consisted mainly of misconceptions. Some health education messages were not accepted and were often misinterpreted by the massage bearer. These misconceptions have instead helped to increase the number of cases during outbreaks or contributed negligibly to a decrease in the number of cases, (Einarsdóttir et al., 2001).

Behaviour change in most individuals involved in CHC activities was strained by fear and the fact that the practice of ‘cat Sanitation’ in areas without latrines was shameful and embarrassing especially when practiced by adults. With group endorsement of an activity, individuals were prepared to undertake change without fear of failure. CHC sought to build self-efficacy and this gave members the ability to change with confidence, (Waterkeyn and Cairncross, 2005).

The health education massages provided most often did not describe cholera transmission with much clarity and the prevention messages placed undue focus on environmental hygiene and sanitation that might have contributed to the decrease in understanding how cholera is being transmitted. Owing to this, people in village communities especially, could not explain how cholera is transmitted in their casual conversations despite the massive health education campaigns. Also, the diversity of such prevention messages and their impracticalities for most of the intended audience are some factors which might have contributed to such an outcome. This is a huge barrier to the compliance with most of the recommended behavioural changes prescribed on the part of individuals.

Water disinfection using chlorine or by boiling in these rural communities was not an easy and inexpensive activity, (Einarsdóttir et al., 2001).
The lack of health education programs in most developing countries is a great handicap to personal and environmental hygiene, (Aiello and Larson, 2002).

The education of health care workers in certain communities is a big challenge especially when the people are strongly attached to their culture, (WASH news Asia & Pacific, 2009).

5.4 Conclusion

The standard advice with regards to the prevention of gastrointestinal diseases is to abstain from potentially contaminated food and beverages. But this is considered unsatisfactory due to the apparent barriers in the practice of healthy hygiene and sanitation. However, careful attention is needed and more importantly, compliance with very restrictive rules will minimize contamination, (Steffen et al., 2003). The WHO recommends improvements in water supply and sanitation as the most sustainable approach for protecting against cholera and other water-borne epidemic diarrhoeal diseases. But such an approach is unrealistic for the many impoverished populations most affected by cholera.

To say the least, much of cholera prevention rest on the practice of healthy hygiene and sanitation. Improving sanitary infrastructure, hygienic practices and advising persons with symptoms to promptly seek medical care are usually included in education messages during cholera epidemics, but with the high cost of improving sanitary infrastructure, health education has been advocated as the most cost-effective intervention to prevent cholera infections and transmission, (Einarsdóttir, Passa and Gunnluagsson, 2001). However, information flow in the delivery of health education on the practice of healthy hygiene and sanitation in cholera-endemic regions, during or prior to cholera outbreaks has been a great handicap in the prevention and control of cholera (Figure 4). In addition, much of cholera prevention lies at the level of individual responsibility with regards to the practice of healthy hygiene and sanitation. Owing to these, there is great need to understand the barriers to the practice of healthy hygiene and sanitation, as well as the level at which individual characteristics will influence such practices.
**Figure 4:** Theoretical Framework of Barriers to Healthy Hygiene and Sanitation

The figure below shows how the flow of health education messages on cholera prevention and control may be affected by the way they are presented and how issues within populations create barriers to the knowledge and practice of healthy hygiene and sanitation.

**Source:** Formulated by the author, 2010
6. Study Protocol

6.1 Justification of the Study

Cholera is a global threat to public health and one of the key indicators of social development, and with the consequent increase in the reporting of cholera cases in 2006, almost every developing country is facing either an outbreak or the threat of an epidemic. Cholera outbreaks bring fear and anxiety in populations and this may have adverse effects on the social and economic structure of communities, thereby blocking developmental growth in many sectors of a country, (WHO, 2010). Low-income countries are more affected by cholera epidemic than middle or high income countries. This difference in disease burden is expressed in the percentage of poor and rich countries, the number of cases reported, cases per 100,000 residents, and in the number of deaths reported. This has made cholera to be referred to as “a disease of the poor.” In the implementation of regional economic development, aspects of the environment, climate, culture, medical management, political intention and individual behavioural patterns, as well as important factors in the morbidity and mortality of cholera must be considered because they are related, (Talavera and Pérez, 2009). Nevertheless, cholera will continue thriving in endemic regions, survived by its strong links to maritime environment, alongside social determinants of poverty and poor sanitary conditions, if the situation is not addressed with much urgency.

6.2 Research Questions:

1) What are the levels of knowledge, attitude and practice in the Bepanda community?
2) How do the sources of health education message interplay to influence the knowledge, attitude and practice of healthy hygiene and sanitation?
3) How are health education programs carried out and what form does the dialogue take during interpersonal conversations?
4) How do the sources of health education massages complement each other in the delivery of health education massages on cholera prevention and control?
5) What background characteristics of the homes are most closely related to the practice of healthy hygiene and sanitation?
6.3 KAP Study (First phase)

The proposed research study is a cross-sectional study and it will be done in two phases, the first phase will be a knowledge, attitude and practice (KAP) study and the second phase will be a qualitative study. A detailed description of the study design for the first phase of this proposed study is presented in table 3.

**Table 3: Study design to be used in the KAP study**

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Study Design</th>
<th>Informants</th>
<th>Method of data collection</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) What are the levels of knowledge, attitude and practice in the Bepanda community?</td>
<td>Cross-sectional study</td>
<td>Females of every home who are charged with responsibilities of upkeep of the home</td>
<td>- Interviews using structured questionnaire with items on knowledge, attitude and practice (KAP)</td>
<td>- The Epi-Info software will be used to analyze the data</td>
</tr>
<tr>
<td>2) How do the sources of health education message interplay to influence the knowledge, attitude and practice of healthy hygiene and sanitation?</td>
<td>- A sample size of 632 will be used and this is representative of the population</td>
<td>- Chi² test will be used to understand the association or the relationship between the variables. Statistical significance will be considered when P value is &lt; 0.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each KAP study is unique to a particular setting and designed for a specific issue and they focus specifically on the knowledge, attitudes and practices (behaviours) for a certain topic. KAP studies are primarily descriptive and descriptive studies are necessary for the provision of first hand information about possible disease determinants, leading to the formulation of a hypothesis that can be tested using an analytical study design. Such studies involve
describing the general characteristics of a disease, relating it to person, place and time, (Hennekens and Buring, 1987). Knowledge questions will be testing the participants’ understanding of the measures of prevention and control recommended by the WHO, as well as the way these measures are being promoted in the neighbourhood. Attitude questions will be determining whether the participants believe that these measures can actually help prevention and control of cholera, while practice questions will be checking whether the participants follow these recommended measures always, almost always, sometimes or never, (Eckman and Walker, 2008).

6.3.1 Study Setting and location

This study will be conducted in the Littoral region of Cameroon, precisely in Douala, the economic capital. The region is divided into four departments: Mouno, with its capital at Nkongsamba, Nkam, with its capital at Yabassi, Sanaga-Maritime, with its capital at Édéa and Wouri, forming the area around the major city of Douala, (figure 5). This region has a total surface area of 20,239 km² and a population of about 2,202,340 inhabitants, in 2004. Of this total population, 1,494,700 people are resident in Douala. The city of Douala has seven hospitals/clinics, namely General Hospital of Douala, Laquintinie Hospital, Centre Medical des Roseaux, Clinique Bel-Air, Clinique Le Maimonide, Clinique Soppo Priso, Polyclinic Bonanjo. Of these hospitals/clinics only one is being run by the Cameroon government, the rest are involved in private practice. The study location for this study will be Bepanda, a slum built on a garbage dump in a swampy zone in the city of Douala. It is a residential area which is densely overcrowded as a result of uncontrolled urbanization, generated by the influx of poor city new-comers who live without adequate access to clean water or basic sanitation facilities. About 11,000 people reside in Bepanda with a broad spectrum of cultures, including Christians and Muslims.

Figure 5: Map of the Littoral region of Cameroon

Source: http://en.wikipedia.org/wiki/Littoral_Region_(Cameroon)
6.3.2 Study process

In the first step of this study, will be the construction of the KAP questionnaire. In this regard, focus group discussions will be carried out to help the researcher in exploring and understanding the study setting, as well as to have a clearer idea of how to measure the influence of societal norms on the understanding of health education messages on cholera prevention and control, and in the practice of healthy hygiene and sanitation. The participants in the focus group discussion will be traditional authorities and they will be selected using purposive sampling, wherein similar types of participants are selected to facilitate group interviewing and to ease analysis. The words and phrases from the focus group discussions will be transcribed and analyzed thematically.

In the second step, the results from the focus group discussions and findings from the literature review will be used to construct a questionnaire with items on KAP. The items on the questionnaire will be drafted and the content and wording revised.

The third step involves pre-testing the questionnaire in a pilot survey, and then administering it in a house-to-house survey, to determine the knowledge, attitude and practice of the residents of Bepanda with regards to the application of healthy hygiene and sanitation.

6.3.3 Sampling

The target audience for this KAP study will be the females of every home who are charged with responsibilities of upkeep of the home. A probability sample procedure will be used and the sampling method will be the simple random, to give room for every female who is in charge of the upkeep of a home in the study population to have a chance of being selected. The reason for the choice of females of every home who are charged with responsibilities of upkeep of the home is because, previous studies on the effectiveness of cholera prevention have shown that this group of persons are more knowledgeable in hygiene and sanitation matters at the level of the home, since they are charged with the responsibilities of the upkeep of their homes, which involves most household and kitchen activities. Statcalc in Epi Info has been used to calculate a sample size which is representative of the population. Since the KAP study is primarily descriptive, the sample size will be calculated at the level of a population survey. The population size of the study area is about 11,000, so the number of females charged with responsibilities of upkeep of homes in the study area can be estimated to be 3,000. The assumption here is that, if the true proportion of females charged with responsibilities of upkeep of homes actually engaged in good practice is 75%, an error of 3% can be accepted, at a 95% level of significance. Therefore, the sample size of 632 will be used in the study.
6.3.4  Determinants and outcomes

6.3.4.1  Determinants:

- Educational level
- Source of health education messages
- Socio-economic status
- Age

6.3.4.2  Outcomes (level of KAP):

Knowledge

- Hand washing
- Food handling (cooking and preserving food)
- Water disinfection
- Water preservation
- Use and cleaning of latrines or toilets
- Washing kitchen utensils and cutleries

Attitude

- Care of cholera patients and relationship with persons who have recovered from cholera

Practice

- Washing of hands with soap after using toilets and latrines, before preparing food and before eating
- Use of latrines and toilets
- Cleaning of latrines and toilets


- Care of cholera patients
- Eating freshly cooked food
- Covering stored food
- Boiling water for home use or disinfected it with chlorine
- Disinfection of water sources with chlorine solution

6.3.5 Variables

6.3.5.1 Determinants

- Level of education (distributed in to three levels: Primary education and less, secondary education, tertiary education and more)
- Source of health education messages (fragmented in to three levels: Community Health Clubs, mass media, peers/ family)
- Socio-economic status (divided in to low, average and high)
  
  Low – Parents’ monthly salary ≤ 100,000 CFA
  
  Average – Parents’ monthly salary ≥ 101,000 CFA to ≤ 200,000 CFA
  
  High – Parents’ monthly salary ≥ 201,000 CFA
- Age (Distributed in to three levels: 0-10, 11-64, 65+)

6.3.5.2 Outcomes (Level of KAP)

Knowledge

- Hand washing (divided in to duration of hand washing activity, procedure of hand washing activity, frequency of hand washing activity, use of soap, use of clean water)
- Food handling (divided in to eating cooked food hot, covering stored food, washing of fruits and food stuff)
- Water disinfection (spliced in to treatment of water with chlorine or bleach, treatment of water with lime, boiling of water for home use)
- Water preservation (divided into preservation in narrow-mouthed containers or wide-mouthed containers)

- Use and cleaning of latrines or toilets (separated into frequency of cleaning the toilet, use of detergents in cleaning the toilet, type of toilet used)

- Washing kitchen utensils and cutlery (divided into cleaning utensils in treated water, washing utensils with soap)

**Attitude**

- Relationship with cholera patients and persons who have recovered from cholera (fragmented into close and distant)

**Practice**

- Hand washing (divided into duration of hand washing activity, procedure of hand washing activity, frequency of hand washing activity, use of soap, use of clean water)

- Food handling (divided into how food is cooked, how food is preserved and how food is washed)

- Water disinfection (method is used for disinfection - boiling, use of chlorine, bleach or lime)

- Water preservation (container used to preserve water - narrow-mouthed containers or wide-mouthed containers)

- Use and cleaning of latrines or toilets (separated into frequency of cleaning the toilet, use of detergents in cleaning the toilet, type of toilet used)

- Washing of utensils and cutlery (divided into cleaning utensils in treated water, washing utensils with soap)

### 6.3.6 Analysis and Reporting

After collection, the data will be analyzed to determine the KAP level of the participants. The Epi-Info software will be used to analyze the data. Descriptive analysis will be done by calculating frequencies (response rates) of the KAP questions. Reporting of findings will be done by presenting frequencies in tables for each dimension (knowledge, attitude and practice), and these will be explained in detail in the result and discussion sections of the proposed study. Further analysis will be done using the chi² test to understand the association or the relationship between the variables. Statistical significance will be considered when P value is < 0.05. The importance of knowledge as a determinant of the attitude and practice will also be determined.
6.3.7 Strengths and Weaknesses

6.3.7.1 Strengths

- Descriptive studies are necessary for the provision of first hand information about possible disease determinants and such data provides health care providers and administrators with the relevant information to embark on efficient and effective prevention and educational programs.

- KAP studies are relatively cheap and easy to since there is no follow-up.

- KAP studies are resource conserving because they are highly focused and limited in scope.

6.3.7.2 Weaknesses

- It may be difficult to get a good time perspective, since all the variables will be checked at the same time.

6.4 Qualitative Study (Second Phase)

In the second phase of the proposed research study, the researcher seeks to explore unclear concepts or phenomenon to understand particular aspects of actions and behaviour, while paying attention to the social mechanisms in the population that lead to risk behaviour. A detailed description of the qualitative study design for the second phase of this proposed study is presented in table 4.
### Table 4: Study design to be used in the qualitative study

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Study Design</th>
<th>Informants</th>
<th>Method of data collection</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>3) How are health education programs carried out and what form does the dialogue</td>
<td>Qualitative study</td>
<td>- Health Education workers</td>
<td>- Focus group discussion using a thematic interview guide, a</td>
<td>- Content analysis of interview text and observational</td>
</tr>
<tr>
<td>take during interpersonal conversations?</td>
<td></td>
<td>- Youths</td>
<td>tape recorder and note taking</td>
<td>notes</td>
</tr>
<tr>
<td>4) How do the sources of health education massages complement each other in the</td>
<td></td>
<td>- Females of every home who are charged with responsibilities of upkeep of</td>
<td>- Observation and writing of observational notes</td>
<td></td>
</tr>
<tr>
<td>delivery of health education masses on cholera prevention and control?</td>
<td></td>
<td>the home</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) What background characteristics of the homes are most closely related to the</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>practice of healthy hygiene and sanitation?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The qualitative study will involve an enquiry process of understanding, which is based on distinct methodological concepts that explore the problem by creating a complex, holistic picture through the analyses of words and opinions of participants, as well as the behaviour of the study subjects, (Dahlgren, Emmelin and Winkvisk, 2004). The focus group discussions will be based on specific topics which are related to the research questions, while observation will involve the studying of social interactions, behaviours and perceptions that take place within groups of the study subjects in the Bepanda neighborhood. The main objective in the observation is to have a thorough holistic understanding of the views, actions and nature of the home surrounding of the study subjects.
6.4.1 Sampling

In the focus group discussions, Health Education Workers (HEWs), youths and females of every home who are charged with responsibilities of upkeep of the home will be the participants. These group will be small enough for everyone to have an opportunity to share experiences and large enough to give room for diversity of perceptions. The study subjects will be selected using purposive sampling, wherein similar types of participants are selected to facilitate group interviewing and to ease analysis. The HEWs are chosen as one group of study participants because they will be able to provide a detailed procedure of how health education programs are organized and carried out. The reasons behind the choice of youths and females of every home who are charged with responsibilities of upkeep of the home as study participants is that, with the youths, a broad spectrum of social interactions and aspects of behaviour can easily be discussed and observed, as they form one of the most active groups in the population. Also, females of every home who are charged with responsibilities of upkeep of the home are chosen as another group of study participants because, previous studies on the effectiveness of cholera prevention have shown that this group of persons are more knowledgeable in hygiene and sanitation matters at the level of the home, since they are charged with the responsibilities of the upkeep of their homes, which involves most household and kitchen activities. Owing to this, several different ways of how hygiene and sanitation are ensured at the level of households will be observed. In the observational study, only the youths and the females of every home who are charged with responsibilities of upkeep of the home will be involved.
6.4.2 Thematic Interview Guide

**Figure 6:** Themes on the interview guide that will be used in the focus group discussions.

The main topic of the discussion is at the center, with 16 themes surrounding it. The first 8 themes are targeting the HEWs and last 8 themes are targeting the youths and females of every home who are charged with responsibilities of upkeep of the home.

**Source:** Formulated by the author, 2010
6.4.3 Observational Guide

The observational guide will be composed of cholera prevention and control practices, such as:

- Washing of hands with soap after using toilets and latrines, before preparing food and before eating
- Effective and efficient use latrines
- Chlorination of water for home use and water sources
- Water disinfection and preservation
- Washing kitchen utensils and cutleries
- Food handling (cooking and preserving food)

6.4.4 Study Process

Considering the focus group discussion, the HEWs will be contacted through the Delegation of Public Health in the Littoral region and the focus group discussion will take place in one of the rooms at the Delegation of Public Health in the Littoral region. The youths will be contacted through the principal of the secondary school, while the females of every home who are charged with responsibilities of upkeep of the home will be contacted through the Quarter Head of the study setting. The focus group discussion with the youths will take place in a hall in the school campus, while that with the females of every home who are charged with responsibilities of upkeep of the home will take place at the Quarter Head’s residence. During the discussion, the researcher will stimulate the participants to react more spontaneously and to explore their different point of views more freely, while guiding them to develop and express their opinion. The researcher poses questions using the thematic interview guide, while recording the discussion with a tape recorder. The note-taker will be charged with the responsibility of taking down important points as the discussion proceeds. At the end of the discussion, the tape and the notes are preserved in a safe place for later analysis.

In the case of observational study, the two groups of study subjects will be observed separately and the observation will be overt. The study subjects will be observed in their homes and around the Bepanda neighbourhood to measure the level at which they practice healthy hygiene and sanitation. The observational measures/ variables will be cholera prevention and control practices, such as; washing of hands with soap after using toilets and latrines, before preparing food and before eating, effective and efficient use latrines, chlorination of water for home use and water sources, water disinfection and
preservation, washing kitchen utensils and cutleries, and food handling (cooking and preserving food). During the observation, the researcher evaluates different aspects of behaviour on cholera prevention and control, and tries to access tacit knowledge, while capturing different phenomena and their component parts. The researcher will have to stop the observation when no new phenomenon is being observed. Observational notes will be taken by the researcher and preserved for further analysis.

6.4.5 Data Analysis

Data analysis will be done using content analysis which is characterized by the selection of an appropriate unit of analysis and the development of meaning units. It also involves processes such as condensation and abstraction of text, leading to the creation of categories and sub-categories. Finally, themes and sub-themes will be created to link the underlying meaning in the categories, (Graneheim and Lundman, 2004). In this qualitative study, the unit of analysis in the focus group discussions will be the interview text transcribed from the tape-recorded discussions and notes on cholera prevention and control/hygiene and sanitation, while that of the observations will be the observational notes.

In analysing the data from focus group discussions, the interview text will be sorted into content areas and read through several times to develop a sense of whole. The text will then be divided into meaning units that will be condensed, abstracted and labelled with codes. The various codes will then be compared based on differences and similarities, and finally sorted into sub-categories and categories. These categories will be discussed with co-researchers and revised if necessary to have the underlying meaning of the text.

In analysing the data from observations, observational notes will be transcribed verbatim and the text will be read several times to obtain a sense of whole. The observational notes from the two separate observations will be divided into meaning units. Considering context, each meaning unit will be condensed into a description close to the text, and if possible, the meaning unit will be further condensed into an interpretation of the underlying meaning of the text. The condensed meaning units will then be abstracted into sub-themes that will be merged into themes, after discussing with co-researchers and consulting the literature that was reviewed in this study.

6.4.6 Advantages of Qualitative Study

- It provides depth and details on the practice of healthy hygiene and sanitation, since it looks deeper than analysing ranks and counts by recording attitudes, feelings and behaviours.

- It creates openness as encouraging participants to expand on their responses can open up new topic areas not initially considered.
A detailed picture can be built up about why people act in certain ways and their feelings about these actions.

It attempts to avoid pre-judgements especially if it is used alongside quantitative data collection and it can explain why a particular response was given.

6.4.7 Disadvantages of Qualitative Study

Usually fewer people are studied and collection of qualitative data is generally more time consuming, therefore unless time, staff and budget allow, it is generally necessary to include a smaller sample size.

It is not possible to generalise results to that of the population because fewer people are generally studied.

It is difficult to make systematic comparisons, for example, if people give widely differing responses that are highly subjective.

It is dependent on skills of the researcher, particularly in the case of conducting interviews, focus groups and observation.

6.5 Trustworthiness of Qualitative Study

1) To ensure credibility of the study, the participants have been chosen in such a way that a broad spectrum of experiences can be assessed to obtain answers to the research questions. The assumption here is that with the selection of different groups of study participants, a richer variation of the phenomena under study could be obtained. Also, in the data analysis the most suitable meaning unit will be selected, and the categories and themes will be developed in such that no relevant data will be excluded or irrelevant data included. In addition, discussions with co-researchers in judging the similarities within and differences between categories will help to improve on the credibility of the study.

2) To ensure transferability the study, the participants and their characteristics have been clearly defined. Also, the clear and distinct description of the nature, culture and context of the study setting from the literature review revealed that it is quite similar to most settings in cholera-endemic regions.
6.6 Ethical Considerations

Ethical clearance to carry out the study will be taken from the Delegation of Public Health in the Littoral region and the participants will be informed about the health risks with regards to the disease in their society.

In this proposed study, the consent of the participants will be sought before the study actually commence. The researcher will pay a visit to the Quarter Head of the study setting and he will clearly explain to him and the residents about the importance of carrying out the study. He will further stress the fact that participating in the study will not exposed participants to any risks and that every participant has the right to withdraw from the research study at any point in time if he or she deems it necessary.

The participants will also be treated equally and confidentiality will be maintained by ensuring that the responses provided by participants about their life styles, experiences and behaviour with regards to the practice of healthy hygiene and sanitation will not revealed to a third party and will be use solely for this research study.
ACKNOWLEDGEMENTS

I thank the Almighty God for all His blessings throughout this research work.

My gratitude goes to my supervisor, Anna-Karin Hurtig for all her effort, encouragement and support to see to it that this thesis is a success.

Special thanks to the staff at the Department of Epidemiology and Public Health, Umeå University, for their kind attention during my course work studies.

I want to thank my colleagues at the Department of Epidemiology and Public Health, Umeå University, for the enriching experiences we shared during our course work studies. I very much appreciate that.

Many thanks to my dear mom, for all her love, prayers, encouragement and support throughout my studies.

I equally thank the Malange family, most especially my siblings Magdalene, John and Bertilla for all their love, encouragement and support during my studies.

I wish to thank the Ekonde family for all the love and concern throughout my academic life.

My sincere gratitude to Mbah Mbole Anastasia, for all her love, prayers and kind attention throughout my studies abroad.

My deep appreciation goes to my friends, Joel Ekabe, Barnabas Njohzing, Maureen Mbake, Ayuknchong Manasseh, Etutu Shalman, Nchia Carine, John Njie, Bopda Seraphin, Nkowa Elvis, Mbah Wilfred and Chingang Daniel for their words of encouragement throughout this research study.
References


## Appendix A

### Time plan

<table>
<thead>
<tr>
<th>Activity</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase I (KAP Study)</strong></td>
<td></td>
</tr>
<tr>
<td>- Seeking ethical clearance</td>
<td>Dec 2010 - Mar 2011</td>
</tr>
<tr>
<td>- Focus group discussions with traditional authorities</td>
<td></td>
</tr>
<tr>
<td>- Analysis of data from focus group discussion</td>
<td>Apr 2011 - Jun 2011</td>
</tr>
<tr>
<td>- Structuring of KAP questionnaire</td>
<td></td>
</tr>
<tr>
<td>Pilot study of KAP questionnaire</td>
<td>Jul 2011 - Sep 2011</td>
</tr>
<tr>
<td>Interviews/ Administration of KAP questionnaire</td>
<td>Oct 2011 - Dec 2011</td>
</tr>
<tr>
<td>Analysis of data from interviews</td>
<td>Jan 2012 - Apr 2012</td>
</tr>
<tr>
<td><strong>Phase II (Qualitative Study)</strong></td>
<td>May 2012 - Sep 2012</td>
</tr>
<tr>
<td>- Focus group discussions with health care personnel</td>
<td></td>
</tr>
<tr>
<td>- Observation of youths and females of every home who are charged with responsibilities of upkeep of the home</td>
<td></td>
</tr>
<tr>
<td>Analysis of data from focus group discussions</td>
<td>Oct 2012- Feb 2013</td>
</tr>
<tr>
<td>Analysis of data from observation</td>
<td>Mar 2013- Aug 2013</td>
</tr>
<tr>
<td>Report writing and dissemination</td>
<td>Sep 2013 - Feb 2014</td>
</tr>
</tbody>
</table>
## Appendix B

The table below show the articles that have been used in this literature review and methods used in the various studies

<table>
<thead>
<tr>
<th>No.</th>
<th>Author, Year</th>
<th>Title</th>
<th>Aim</th>
<th>Method/ Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Curtis Val and Cairncross Sandy, 2003</td>
<td>Effect of washing hands with soap on diarrhoea risk in the community: a systematic review</td>
<td>To determine the impact of washing hands with soap on the risk of diarrheal diseases</td>
<td>Intervention studies, Case-control, Cross-sectional, and Cohort studies</td>
</tr>
<tr>
<td>2.</td>
<td>Aiello Allison and Larson Elaine, 2002</td>
<td>What is the evidence for a causal link between hygiene and infections?</td>
<td>To examine and assess the epidemiological evidence for a causal relation between hygiene practices and infections</td>
<td>Literature review</td>
</tr>
<tr>
<td>3.</td>
<td>Seas Carlos and Gotuzzo, Eduardo, 1996</td>
<td>Cholera: overview of epidemiologic, therapeutic, and preventive issues learned from recent epidemics</td>
<td>To study recent cholera outbreaks in Latin America and Asia, focusing on epidemiological, clinical, therapeutic and preventive issues to prevent or control future epidemics</td>
<td>Literature review</td>
</tr>
<tr>
<td>4.</td>
<td>Zuckerman Jane, Rombo Lars and Fisch Alain, 2007</td>
<td>The true burden and risk of cholera: implications for prevention and control</td>
<td>-</td>
<td>Literature review</td>
</tr>
<tr>
<td>5.</td>
<td>Einarsdóttir, J., Passa A., and Gunnluagsson, G., 2001</td>
<td>Health Education and Cholera in Rural Guinea-Bissau</td>
<td>To explore local ideas about cholera and the diffusion of official health educational messages for cholera prevention and to assess whether such messages contributed to changed behavior in the population</td>
<td>Qualitative using interviews</td>
</tr>
<tr>
<td>8.</td>
<td>Pascual Mercedes, Bouma Menno and Dobson Aadrew, 2002</td>
<td>Cholera and climate: revisiting the quantitative evidence</td>
<td>To review the current quantitative evidence for the influence of</td>
<td>Literature review</td>
</tr>
<tr>
<td></td>
<td>Author(s)</td>
<td>Title</td>
<td>Methodology</td>
<td>Literature Type</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>10.</td>
<td>Sánchez José and Taylor David, 1997</td>
<td>Cholera</td>
<td>-</td>
<td>Literature review</td>
</tr>
<tr>
<td>12.</td>
<td>Waterkeyn Juliet and Cairncross Sandy, 2005</td>
<td>Creating demand for sanitation and hygiene through community health clubs: a cost-effective intervention in two districts in Zimbabwe</td>
<td>To use proxy indicators of safe practices to quantify effectiveness of interventions, developing community cohesion and a ‘culture of health’</td>
<td>Literature review</td>
</tr>
<tr>
<td>13.</td>
<td>Talavera Arturo and Pérez Ela, 2009</td>
<td>Is cholera disease associated with poverty?</td>
<td>To analyse the results obtained when contrasting the reports of the World Health Organization (WHO) about cholera disease with those of the World Bank List of economies (countries)</td>
<td>Literature review</td>
</tr>
<tr>
<td>14.</td>
<td>Sridhar Saranya, 2009</td>
<td>An affordable cholera vaccine: an important step forward</td>
<td>-</td>
<td>Literature review</td>
</tr>
<tr>
<td>15.</td>
<td>Ebi Kristie, 2008</td>
<td>Adaptation cost for climate change-related cases of diarrheal diseases, malnutrition, and malaria in 2030</td>
<td>-</td>
<td>Literature review</td>
</tr>
<tr>
<td>16.</td>
<td>Garrigue et al., 1986</td>
<td>Antibiotic resistance of strains of <em>Vibrio cholera</em> eltor isolated in Douala (Cameroon)</td>
<td>-</td>
<td>Literature review</td>
</tr>
<tr>
<td>17.</td>
<td>Guévart et al., 2006</td>
<td>Factors contributing to endemic cholera in Douala, Cameroon</td>
<td>-</td>
<td>Literature review</td>
</tr>
<tr>
<td>No.</td>
<td>Author(s)</td>
<td>Title</td>
<td>Method(s)</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Dambach Peter, 2007</td>
<td>Cholera in West Africa - current approaches to the study of physical, climatic and socio-geographic determinants explained using the example of Douala, Cameroon</td>
<td>Case report</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Quick Robert, Gerber Micheal, Palacios Ana, Beingoela Rodolfo, Mujica Oscar, Moreno Dafne et al., 1996</td>
<td>Using a knowledge, attitude and practice survey to supplement findings of an outbreak investigation: cholera prevention measures during the 1991 epidemic in Peru</td>
<td>KAP Study</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Eckman Karlyn &amp; Walker Rachel, 2008</td>
<td>Knowledge, attitudes and practice (KAP) survey summary report for the Duluth Lakeside Stormwater Reduction Project (LSRP)</td>
<td>KAP Study</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Graneheim U. &amp; Lundman B., 2004</td>
<td>Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness</td>
<td>Literature review</td>
<td></td>
</tr>
</tbody>
</table>