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Melissa Dominique Etheart Date

Evaluation of
"Community Health Worker Training Materials for Cholera Prevention and Control in Haiti"
developed by CDC/MSPP after the cholera outbreak in Haiti in 2010

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An abstract of
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"Community Health Worker Training Materials for Cholera Prevention and Control in Haiti" developed by CDC/MSPP after the cholera outbreak in Haiti in 2010
By Melissa Dominique Etheart

Over the past two centuries, seven cholera pandemics have been documented worldwide. During Ancient times cholera was found in many parts of the world but today, the disease is restrained to developing countries. The main clinical manifestation of cholera is a "rice-water" like profuse watery diarrhea that can lead to severe dehydration and death within days if untreated. The disease is spread through ingestion of contaminated food or drinking water by feces of a person infected with *Vibrio cholerae*.

Before the introduction of cholera in Haiti in October 2010, the disease was not present in the country in over a century. Within days after the appearance of cholera symptoms, Haitian authorities isolated *Vibrio cholerae* from stool specimens of suspected cholera patients. The outbreak was then confirmed by LNSP and CDC on October 21, 2010 who partnered with other organizations to developed training materials on cholera control and prevention as a response to the outbreak. The CHW training materials are available in three languages and are widely used in Haiti. A series of evaluation activities were conducted by CDC to assess the impact of the training and the resources on the CHWs education activities. Subsequently, a review process of the training resources was launched to control for errors, inconsistencies and inaccuracies. During the review process, suggestions from the evaluation activities; and inconsistencies identified in the training manual were recorded.

From this evaluation, our main recommendations to CDC and MSPP are to: 1) revise CHW training manual; 2) pilot test various Haitian Creole words used to describe safe water to gather more information about the population's understanding of safe water terms; 3) conduct an in-depth comparison of CHW training manual developed by CDC/MSPP with other documents and messages published by partner institutions; and 4) compose a revision committee board to assist the communication team in the development of subsequent versions of the CHW training material. Although cholera had dramatic effect on several populations, the disease has also contributed to medical progresses and behavior changes.

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In memoriam of my cousin Christine Legagneur

who succumbed to the 2010 earthquake in Haiti.

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Special Study Project

Evaluation of
"Community Health Worker Training Materials for Cholera Prevention and Control in Haiti"
developed by CDC/MSPP after the cholera outbreak in Haiti in 2010

Source: www.cdc.gov

by
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May 2012

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TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION 1

CHAPTER 2 – LITERATURE REVIEW 3

2.1 ORIGIN OF THE WORD CHOLERA 3
2.2 CHOLERA PANDEMICS 4
2.2.1 Before the cholera pandemics 4
2.2.2 Cholera pandemics 5
2.3 OVERVIEW OF CHOLERA 10
2.3.1 Molecular biology 10
2.3.2 Physiopathology 11
2.3.3 Descriptive Epidemiology 11
2.3.3.1 Case definition 11
2.3.3.2 Disease trends 12
2.3.3.3 Distribution 13
2.3.3.4 Demographic characteristics 14
2.3.3.5 Predisposed conditions 14
2.3.3.6 Risk factors 15
2.3.4 Clinical manifestations 15
2.3.5 Diagnosis 16
2.3.6 Cholera control and prevention 17
2.3.7 Treatment of cholera 19
2.4 CHOLERA IN HAITI 20
2.5 ROLE OF COMMUNITY HEALTH WORKERS IN HAITI CHOLERA OUTBREAK 25

CHAPTER 3 – BACKGROUND 27

3.1 TRAINING PURPOSE AND AUDIENCE 28
3.2 TRAINING MATERIALS 28
3.2.1 Development of training materials 28
3.2.2 Design and format of training materials 30
3.2.3 Content of training materials 30
3.2.4 Available languages of the training materials 34
3.3 TRAINING IMPLEMENTATION 34
3.4 TRAINING EVALUATION ACTIVITIES 35
3.4.1 Evaluation Phase 1 – Focus group 35
3.4.2 Evaluation Phase 2 – Field evaluation 35

CHAPTER 4 – METHODS 38

4.1 METHODOLOGY 38
4.2 DELIVERABLE 40
4.3 ETHICAL CONSIDERATIONS 40

CHAPTER 5 – FINDINGS AND RECOMMENDATIONS 41

5.1 FEEDBACK RECEIVED FROM MASTER TRAINERS DURING THE FOCUS GROUP 41

5.1.1 Design *41*
5.1.2 Format or presentation *43*
5.1.3 Content *43*
5.1.4 Language *45*
5.2 COMMENTS GATHERED FROM COMMUNITY HEALTH WORKERS DURING THE FIELD EVALUATION **46**
5.2.1 Design *46*
5.2.2 Format or presentation *46*
5.2.3 Content *46*
5.2.4 Language *46*
5.3 SUGGESTIONS MADE BY PARTNER INSTITUTIONS **47**
5.3.1 Design *47*
5.3.2 Format or presentation *48*
5.3.3 Content *48*
5.3.4 Language *48*
5.4 THESIS PROJECT REVIEW **50**
5.4.1 Design *50*
5.4.2 Format or presentation *50*
5.4.3 Content *53*
5.4.4 Language *55*
5.4.5 Post hoc review around the term safe water *57*
CHAPTER 6 – CONCLUSION **59**
REFERENCES **62**
APPENDIX **67**
APPENDIX 1 – LIST OF PARTNERS INSTITUTIONS PRESENTED DURING EVALUATION ACTIVITIES **67**
APPENDIX 2 – LIST OF LANGUAGE INCONSISTENCIES FOUND AROUND THE TERM "SAFE WATER" **68**

LIST OF FIGURES

FIGURE 1. MAP BY JOHN SNOW SHOWING HOUSEHOLDS 7
FIGURE 2. GLOBAL SPREAD OF THE CHOLERA DURING THE SEVENTH PANDEMIC 8
FIGURE 3. CHOLERA PANDEMICS AND STRAINS OF VIBRIO CHOLERAE 9
FIGURE 4. ANTIGENIC TYPES OF VIBRIO CHOLERAE 10
FIGURE 5. REPORTED CASES OF CHOLERA WORLDWIDE, 2004-2010 13
FIGURE 6. MICROSCOPIC STRAIN OF VIBRIO CHOLERAE AND THE CULTURE GROWTH OF BACTERIA IN TCBS AGAR 16
FIGURE 7. REHYDRATION TREATMENT PLAN OF CHOLERA ACCORDING THE DEHYDRATION STAGE 19
FIGURE 8. MAP SHOWING GEOGRAPHIC LOCATION OF HAITI 20
FIGURE 9. MAP OF HAITI SHOWING ADMINISTRATIVE BOUNDARIES 21
FIGURE 10. MAP SHOWING COUNTRIES REPORTING CHOLERA OUTBREAK, 2010 - 2011 22
FIGURE 11. CUMULATIVE NUMBER OF CASES OF CHOLERA REPORTED OVERALL 23
FIGURE 12. MAP OF HAITI SHOWING CHOLERA ATTACK RATES BY DEPARTMENT, FEBRUARY 2012 24
FIGURE 13. ACTIVITIES AND TIMELINE - SCHEMATIC REPRESENTATION OF CDC'S CHOLERA OUTBREAK RESPONSE IN HAITI 27
FIGURE 14. FRONT COVERS OF CHWS TRAINING MANUAL IN THREE LANGUAGES AVAILABLE 29
FIGURE 15. SERIES OF COMMUNITY EDUCATION CARDS DEVELOPED FOR USE IN HAITI, 2011 30
FIGURE 16. OVERVIEW OF THE TABLE OF CONTENTS OF THE CHW TRAINING MANUAL 31
FIGURE 17. EXAMPLE OF LIST OF OBJECTIVES AND SUPPLIES NEEDED FOR A TRAINING MODULE 33
FIGURE 18. CASCADING APPROACH USED FOR CHWS TRAINING 34
FIGURE 19. MAP OF HAITI SHOWING LOCATION OF CDC'S FOLLOW-UP ACTIVITIES, JUNE-JULY 2011 37
FIGURE 20. EDUCATIONAL CARD ON HOW TO USE ORAL REHYDRATION 42
FIGURE 21. POSTER USED BY MSPP ON "HOW TO PREPARE ORS" 44
FIGURE 22. EDUCATIONAL CARDS ON MAKING DRINKING WATER SAFE WITH HOUSEHOLD BLEACH 45
FIGURE 23. EDUCATIONAL CARDS ON SAFE DRINKING WATER 47
FIGURE 24. DISCREPANCY IN TABLE OF CONTENTS 51
FIGURE 25. TABLE OF CONTENTS SHOWING TITLES OF MODULES ON "SAFE DRINKING WATER" 52
FIGURE 26. SHOWING EDUCATIONAL CARD ON HOW TO WASH YOUR HANDS 54
FIGURE 27. COMPARING POSTERS USED BY MSPP AND CDC ON KEY MESSAGES TO CONTROL AND PREVENT CHOLERA 56
FIGURE 28. POSTERS USED BY DINEPA ON KEY MESSAGES TO CONTROL AND PREVENT CHOLERA 57
FIGURE 29. POSTER USED BY PARTNERS IN HEALTH ON KEY MESSAGES TO CONTROL AND PREVENT CHOLERA 58

LIST OF TABLES

TABLE 1. CHARACTERISTICS OF CURRENTLY AVAILABLE VACCINES 18
TABLE 2. SUMMARY OF CDC EVALUATION ACTIVITIES 36
TABLE 3. SUMMARY OF SUGGESTIONS MADE BY SAVE THE CHILDREN ON CHW TRAINING MANUAL 49

LIST OF ACRONYMS

AIDS : Acquired Immunodeficiency Syndrome

Biv-WC : Bivalent-killed Whole Cell of cholera toxin

cAMP : cyclic adenosine 5′-monophosphate

CDC : Centers for Disease Control and Prevention

CHW : Community Health Workers

CT : Cholera enterotoxin

CTC : Cholera Treatment Center

DFWED : Division of Foodborne, Waterborne, and Environmental Diseases

DINEPA : Direction Nationale de l'Eau Potable et Assainissement (National Haitian Drinking Water Association)

EIS : Epidemic Intelligence Service

HIV : Human Immunodeficiency Virus

ICDDR, B : International Centre for Diarrheal Disease Research, Bangladesh

ICD-10-CM : International Classification of Diseases, Tenth Revision, Clinical Modification

I-TECH : International Training and Education Center for Health

LNSP : Institut National de Santé Publique (National Public Health Laboratory)

MPH : Master of Public Health

MSPP : Ministère de la Santé Publique et de la Population (Haitian Ministry of Public Health and Population)

NCEZID : National Center for Emerging and Zoonotic Infectious Diseases

OCHA : United Nations Office for the Coordination of Humanitarian Affairs

OCV : Oral Cholera Vaccine

ORP : Oral Rehydration Point

ORS : Oral Rehydration Salt

PAHO : Pan American Health Organization

PCR	: Polymerase Chain Reaction
PIH	: Partners in Health
rBS-WC	: Recombinant B Subunit-killed Whole Cell of cholera toxin
RSPH	: Rollins School of Public Health
TCBS	: Thiosulfate-Citrate-Bile Salts-Sucrose
TOT	: Train-the-Trainers
WDPB	: Waterborne Disease Prevention Branch
WHO	: World Health Organization

Chapter 1 - Introduction

In January 2010, Port-au-Prince the capital of Haiti was struck by a 7.0 magnitude earthquake destroying most vital infrastructures including basic utilities and health facilities. The Haitian authorities reported that the earthquake demolished more than 97,000 homes and damaged over 188,000 others[1]. After the disaster, many houses and buildings collapsed leading to a high death toll due to severe physical trauma and injuries. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) the disaster claimed the lives of 217,300 people and injured more than 300,600 others; harmed nearly 3 million people of whom the Haitian Government estimated approximately 1.9 million were homeless and more than 511,000 migrated to other cities[2]. The earthquake amplified the preexisting precarious living conditions of the country, and as a result, the capacity to respond to medical needs was severely compromised. Urgent humanitarian assistance became a priority after assessing the health needs which included the launch of medical rescue and search operations. Health priorities included providing immediate care to the injured and wounded, removing confined survivors under the rubble; and distributing safe water, food items, and non-food items such as temporary shelters, to the population[3].

On October 19, 2010, nine months after the earthquake, an unusual number of cases of acute watery diarrhea and severe dehydration were reported from patients seen in the Artibonite and Centre Departments and some patients died from the unidentified disease[4]. This devastating situation was similar to the first cholera outbreaks described in Ancient times. Shortly after these symptoms were reported to the Haitian Ministry of Public Health and Population (MSPP), the National Public Health Laboratory (LNSP) isolated *Vibrio cholerae* as the causal pathogen of the deadly diarrheal disease[5, 6]. The cholera outbreak was identified within two days after the disease onset by the Haitian government and then confirmed by the Centers for Disease Control and Prevention (CDC) on October 21, 2010[4]. According to CDC reports, cholera infection was reported in Haiti for the first time in over a century, and within the first months of the outbreak, all ten geographic departments (provinces) were affected[7].

By December 17, 2010 a total of 121,518 cases of cholera had been reported by MSPP[8]. The lack of safe water, poor sanitation and hygiene conditions already established in most parts of Haiti accelerated the spread of the disease [9-11]. Immediately after the confirmed cases, CDC deployed resources to respond to the cholera outbreak in Haiti and assist the Haitian Ministry of Health in the implementation of cholera control and prevention strategies in the country[4]. In November 2010, CDC's response activities included training of clinical staff on cholera; and developing education materials on cholera control and prevention to strengthen capacity building in the community[12]. Following the implementation of these public health strategies, in March 2011, CDC conducted trainings on cholera for master trainers who would in turn train community health workers (CHW). Subsequently, from June to July 2011, CDC launched a series of evaluation activities to assess the impact of the CHW training and the materials on CHWs' knowledge and educational community activities.

With the high mortality rate of cholera observed in Haiti after the introduction of the pathogen, the cholera outbreak identified in the country was recognized as a complex humanitarian emergency that required immediate response especially since it occurred nine months after the devastating earthquake that interrupted the existing public health infrastructure of the country. Due to the urgent nature of the cholera epidemic, the training materials that were developed were not previously tested in the field before distribution and use[13]. Therefore, inconsistencies that may contribute to errors and confusing messages may exist. For this particular reason, after the evaluation activities in Haiti during June and July 2011, a comprehensive review of the "CHW Training Materials for Cholera Prevention and Control" was proposed as a Master of Public Health (MPH) thesis project in partial fulfillment of the requirements for a master's degree in public health at Emory University in Atlanta, Georgia. The thesis work was conducted to help ensure continuous improvement of the CHW educational tool developed by CDC and MSPP in response to the cholera outbreak.

Chapter 2 – Literature Review

The literature review summarizes general information, facts and medical details on cholera gathered from different sources including published scientific articles, public domain materials, medical textbooks, non-scientific books, and other web-based readings. The goal of this section is to provide the readers with a substantial background on cholera.

We can retain from the literature review that cholera is a well-known disease; it has been around for centuries; different words are used in different languages to describe cholera; and authors agreed on India as the country where cholera originated but they did not quite agree on the date intervals of the seven pandemics[14].

2.1 Origin of the word cholera

Although the etymology of the word cholera is not well known, several authors have tried to explain the origin of the word. For some, the word has a Latin origin meaning bilious diarrhea; and for others the word cholera comes from two Greek words *cholē* meaning "bile" and *rein* meaning "to flow"[15]. Another hypothesis suggests a more pictorial description referring to a "gutter" to define the word cholera. Here, the metaphor is used to illustrate the analogy between the "large amounts of water flowing on roof gutters during thunderstorms" and the "excessive amount of body fluids expelled from the body" by patients infected with cholera[16]. The image of "water flowing down a gutter during heavy rains" describes watery diarrhea, known to be the chief complaint of cholera patients. As the disease evolved and more outbreaks were observed in several parts of the world, the word cholera was then used in the late nineteenth century to refer mainly to gastroenterological diseases manifested by vomiting and diarrhea[17]. During the literature search on the origin of the word cholera it was noticed that most of the definitions provided pertained to diarrhea, known as the main clinical manifestation of the disease. Today, the word cholera has a universal definition and is reserved exclusively to describe waterborne infections caused by *Vibrio cholerae* serogroups O1 and O139[18].

2.2 Cholera pandemics

Cholera has affected populations in many places over the world. Over a century, cholera outbreaks have not been reported in industrialized countries where access to safe water and the level of sanitation and hygiene are not a public health concern. However, the infection is still present in many developing countries mainly India and sub-Saharan Africa and remains a threat to at risk populations[13]. Cholera was described to have evolved from an endemic to an epidemic disease. Nonetheless, in countries affected by an outbreak, cholera infection may appear as an endemic or epidemic illness.

2.2.1 Before the cholera pandemics

Cholera is an ancient disease. The infection may have been around since 500-400 B.C., because many diarrheal cases described during that time were potentially cholera cases. Since then, it was qualified as a life-threatening diarrheal disease that occurred during hot seasons more specifically in the summer. During Ancient times, the clinical signs reported were similar to those described today as cholera infection. Although an exact case definition for the disease was not provided in Ancient times, cholera has been described in many published documents, in different locations and throughout time. Below is an extract from the Clinical Infectious Diseases journal, showing how Hippocrates portrayed in his writings a case that he called cholera[16]:

> "*At Athens a man was seized with cholera. He vomited and was purged and was in pain, and neither the vomiting nor the purging could be stopped; and his voice failed him, and he could not be moved from his bed, and his eyes were dark and hollow, and spasms of the stomach held him, and hiccup from the bowels. But the purging was more than the vomiting. The man drank hellebore with juice of lentils; and he again drank juice of lentils, as much as he could, and after that he vomited. He was forced again to drink, and the two (vomiting and purging) were stopped but he became cold*".

After Hippocrates, a contemporary Arab writer, Avicenna, was acknowledged after describing the typical aspect of the stools of cholera patients. This is the first time the term “rice water like” was used in the literature[16]. Furthermore, detailed narrative passages describing the onset of cholera infection during Ancient times helped significantly in the categorization of the illness. Clinical findings recorded suggest that the disease originated in the Asian continent precisely in India; emerged in the early nineteenth century; was a sporadic disease but occurred mostly during the summer.

But some authors from Modern times have stated that cholera was not present in the world before 1817; and other contemporary sources reported that cases of cholera were found since the late sixteenth century[19]. We can refer to one article published by Lacey *et al.*, in the journal of Clinical Infectious Diseases, describing that the first cholera outbreak took place in 1781; and at that time, cholera was reported to be an endemic disease restrained to India before it continued to spread to other countries in the world, mainly in Europe[20].

2.2.2 Cholera pandemics

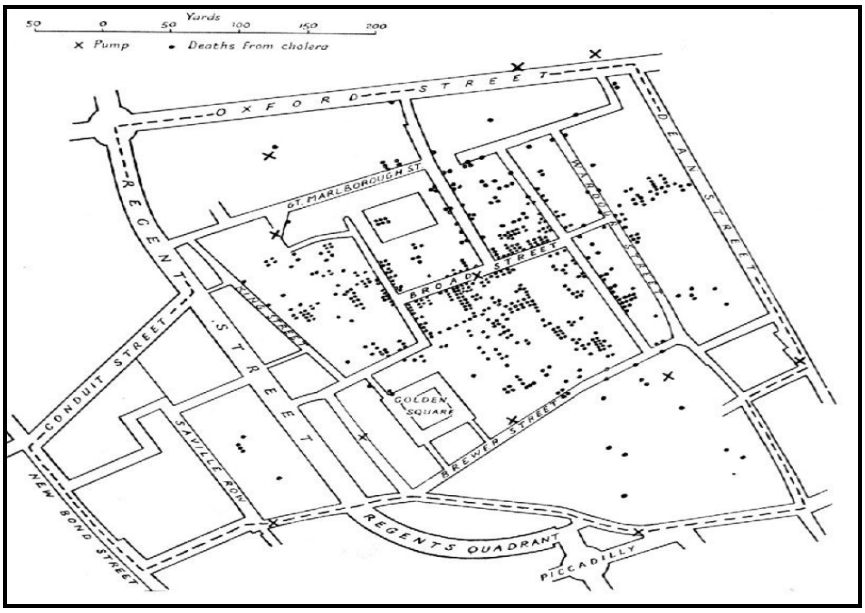
Over the past two centuries, cholera has produced fear in many countries; deaths due to cholera infection have been reported on all continents; and from 1817 to 1923, there have been a total of six major cholera outbreaks. The seventh cholera pandemic started in 1961 and is still ongoing. This section summarized key findings, obtained from different sources, on the seven major cholera pandemics observed in the world.

- 1817-1823: the first documented cholera pandemic occurred in India in 1817. The infection broke out near the Granges River; spread to most countries in Southeast Asia and reached other countries in the world by 1820[14]. In 1823, although the transmission of cholera ceased in most affected countries, sporadic cases remained in the Bengal Bay area showing evidence that the disease may persist for decades in a country even after the occurrence of an outbreak.

- 1829-1849: a second pandemic started in India. Cholera entered Russia in 1830 and continued to spread out across European countries. By 1832, the disease reached countries in the Middle East, Africa and North America, mostly through trade, population migration, and traveling *i.e.* epidemics have occurred among pilgrims moving to Mecca and British troops sailing to India were likely to have introduced the disease in other parts of the world[21]. Later during that same period, a second outbreak was reported in England killing thousands of people.

- 1852-1859: the third pandemic originated in India and traveled throughout many places in Asia, Europe, Africa and North America. This pandemic was recognized as the most devastating cholera outbreak with nearly 23,000 deaths in London in 1854. At that time, cholera was believed to be caused by air pollution or "miasma". John Snow, a British physician living in London and concerned about the re-emergence of cholera in the city, investigated the outbreak near Golden Square and Soho Square. He traced the source of the outbreak to a water pump in Broad Street by conducting a household survey and mapping out deaths due to cholera[22]. Although he did not have evidence that the water was contaminated, he asked local authorities to remove the handle of the pump which was followed by a decrease in the number of cholera cases in London within days[23]. Since then, Snow was acknowledged as the "Father of Epidemiology" after solving the mystery of cholera and mapping out the deaths (Figure 1). These large outbreaks lead to some medical progress around the issue including the utilization of intravenous fluids to treat severe dehydration among cholera patients.

Figure 1. Map by John Snow showing households in which cholera deaths occurred in London, 1854



Credit: Wikimedia Commons

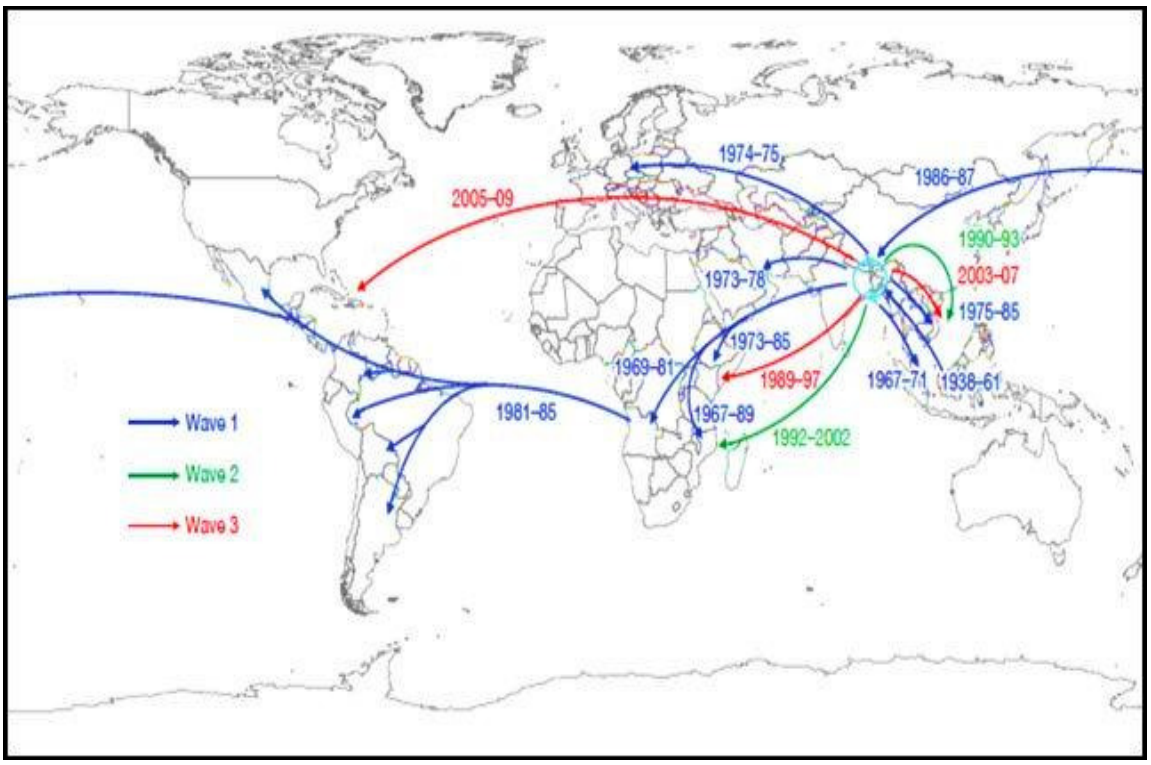
- 1863-1879: these years mark the appearance of the fourth pandemic. The disease continued to spread rapidly across many countries and in every continent[20]. The number of deaths increased as many perished from cholera. Although cholera cases continued to increase, public health and medical practitioners became more aware of the disease leading to a better collaboration; and encouraging environmental and sanitary improvements[22].

- 1881-1896: India was the emerging point of the fifth cholera pandemic. Many continued to die from the disease mainly because of overcrowding population, poor sanitation and contaminated water sources. Whereas, Great Britain and the United States have not reported new cholera outbreaks because of environmental cleanliness and improved living conditions[14]. Additionally, two great discoveries occurred during this pandemic: in 1884, Robert Koch discovered *Vibrio cholerae* as the causative agent; and in 1892 the first human cholera vaccine was developed by Waldemar Haffkine[23].

- 1899-1923: the sixth cholera pandemic originated in India and spread out to other continents. During this pandemic, it occurred that another strain of the bacteria was discovered. *Vibrio cholerae* El Tor was identified as a causative agent of the infection raging the world. By 1923, cholera vanished from most countries of the world but remained present in India[16].

- 1961- to present: there has been a change in the trend of where the pandemic emerged (Figure 2). The seventh cholera outbreak started in Indonesia before spreading to other parts of the world reaching South America, Central America and Africa. However, most symptomatic cholera cases identified during this pandemic were found in West and Central African countries[24-26].

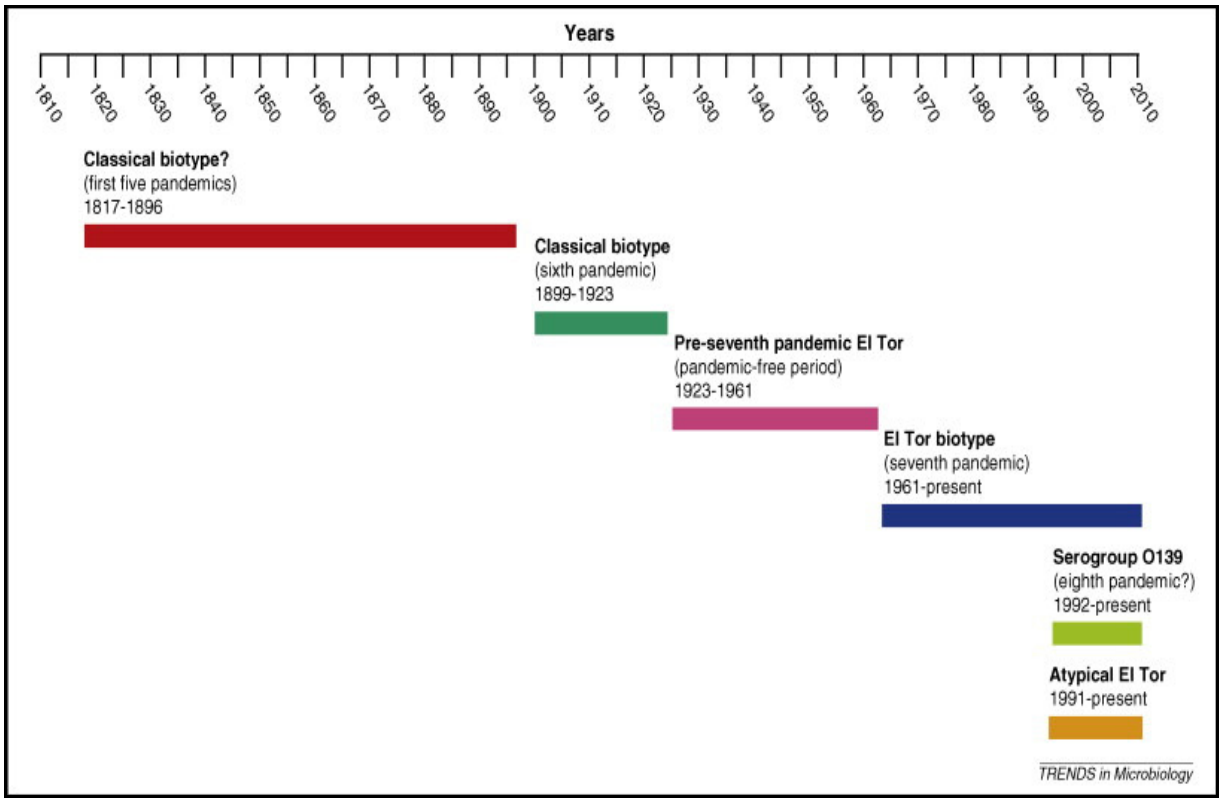
Figure 2. Global spread of the cholera during the seventh pandemic



Credit: Ankur Mutreja *et al.*, Nature 2011 [27]

In the twenty-first century, many developing countries in the world are still recording deaths from cholera infection. Outbreaks have occurred among refugees living in camp settlements in Africa; and in countries with deteriorating infrastructure, limited access to water, and lack of hygiene and sanitation. More recently, within the past two years, cholera outbreaks took place in in Haiti, Dominican Republic, Democratic Republic of Congo and Somalia[28]. During the seventh pandemic, significant medical progress was made around cholera treatment with the development of oral rehydration solution (ORS) in the late 1960s and early 1970s[16, 22]. Furthermore, in 1992 the discovery of *Vibrio cholerae* O139, as a new strain of the bacteria in Bangladesh and eleven other countries, has raised the possibility of an eighth pandemic (Figure3).

Figure 3. Cholera pandemics and strains of Vibrio cholerae



Credit: Ashrafus Safa et al., Trends in Microbiology 2010 [29]

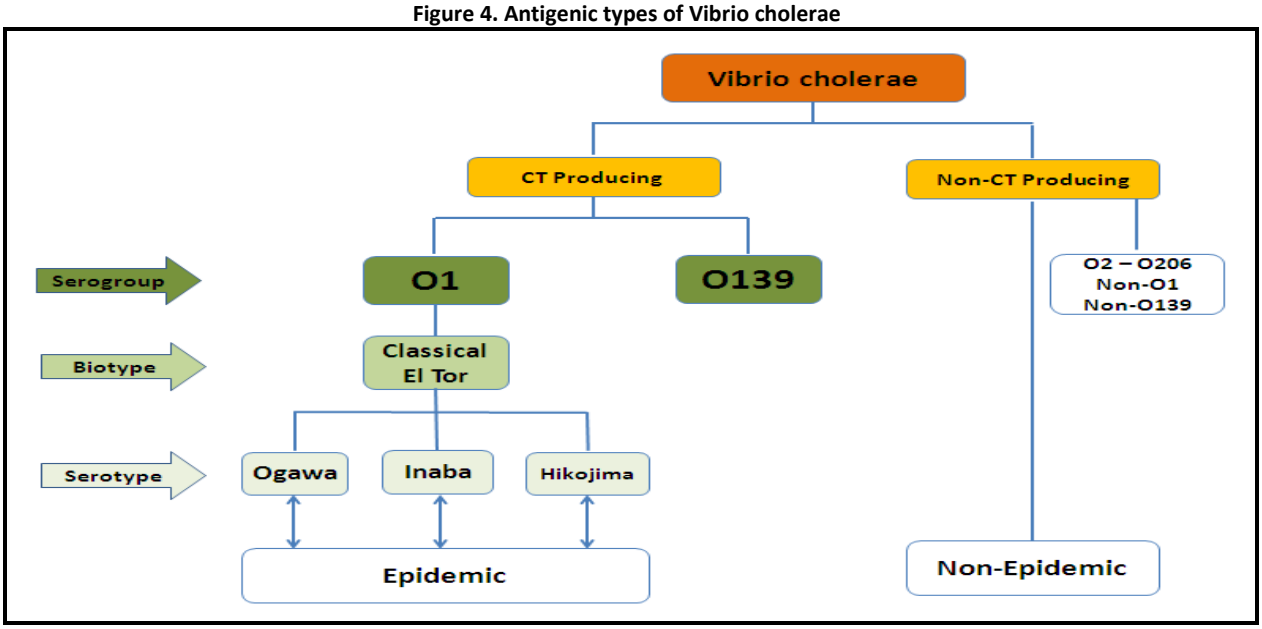
2.3 Overview of cholera

The seven pandemics have revealed much about cholera infection. Although cholera is a well-known disease and it has been around for many years, it is still causing deaths in many parts of the world. This section compiled medical characteristics of cholera from different sources.

2.3.1 Molecular biology

Cholera is caused by *Vibrio cholerae*, a single flagellum, rod-shaped, gram-negative, and highly motile bacteria. The microorganism can tolerate an alkaline environment that usually annihilates most living intestinal organisms, but is very sensitive to acid; can survive in aquatic environment depending on the chemical, biological and physical characteristics of the water; and is viable in surface waters from 1 hour to 13 days[30, 31]. Vibrios can be identified by agglutination and are classified by their ability to produce toxin (Figure 4). Among vibrios producing cholera enterotoxin (CT), there are two serogroups: O1 and O139[32]. The toxigenic vibrio serogroup O group 1 is divided into two biotypes, classical and El Tor, including three serotypes: Inaba (AC), Ogawa (AB) and rarely Hikojima (A, B, C)[33].

Figure 4. Antigenic types of Vibrio cholerae



Adapted from the Final Report of the Independent Panel of Experts on the Cholera Outbreak in Haiti [34]

2.3.2 Physiopathology

Cholera is an acute diarrheal infection of the intestines caused by consumption of food or water contaminated with certain types of *Vibrio cholerae*. Fecal-oral transmission route remains the principal source of contamination. The hallmark of cholera is profuse watery diarrhea. The mechanism of diarrhea is explained, by Finkelstein in a section of the Textbook of Medical Microbiology, as follows: surviving organisms may adhere to the intestine walls and colonize the small bowel where the bacteria secrete the cholera enterotoxin (CT or choleragen); the toxin binds to the plasmatic membrane of the intestinal cells and releases an active enzyme that causes a rise in the production of cyclic adenosine 5'-monophosphate (cAMP). An increase in the level of cAMP in the human body produces a massive secretion of electrolytes and water into the intestinal cavity; and gastric acid, mucus secretion and bowel movement are nonspecific natural defenses against *V. cholerae*[30].

2.3.3 Descriptive Epidemiology

Cholera was the first disease that had an organized public health surveillance system. Although cholera is listed as a notifiable disease internationally, the actual number of cases reported does not reflect the number of cases occurring because of underreported cases[18, 32].

2.3.3.1 Case definition

The case definition of cholera used for surveillance purposes varies depending on the endemicity of the region[18]. According to the WHO, cholera cases are classified as suspect (clinical) or confirmed (laboratory). In a non-endemic region, a suspect case is defined as "a patient, 5 years of age or older, develops severe dehydration or dies from acute watery diarrhea". Whereas, if cholera occurs in an endemic region, an individual is identified as a suspect cholera case when "patient is 5 years or older develops acute watery diarrhea, with or without vomiting". A confirmed case is determined by the laboratory isolation of toxigenic *Vibrio cholerae* O1 or O139.

2.3.3.2 Disease trends

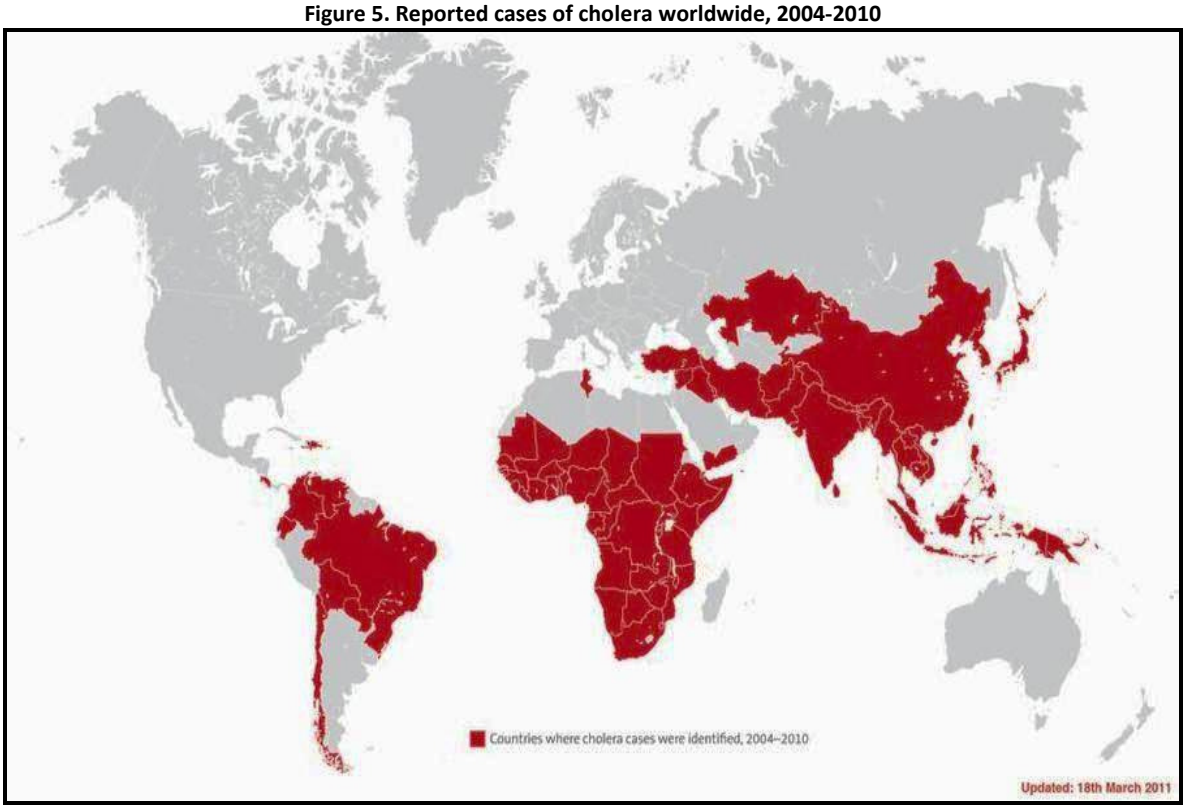
Cholera is a major public health concern. During the seventh pandemic, new outbreaks occurred in countries where the disease have not been reported for many years [35]. Cholera is now endemic to fifty countries worldwide[36] and according to estimates, 3-5 million cases of cholera with 100,000-120,000 deaths occur each year worldwide[13]. The incidence of the disease depends on the presence of the causal bacteria, the environmental conditions and the population's immunity, but it increases in overcrowded areas with poor sanitation[18]. Cholera can be found at an endemic, epidemic or pandemic state; or can occur sporadically in developed countries[30]. In developed countries, sporadic cases are unusual and are often associated with travel to developing countries or consumption of undercooked, contaminated shellfish produced in a natural reservoir; localized outbreaks are due to the ingestion of a common food source contaminated; and secondary infection is rare. In developing countries, transmission of cholera is sustained mainly by drinking contaminated water.

The presence of a small subset of the bacteria in the environment is sufficient to cause an outbreak that can lead to a larger epidemic. The evolution of cholera depends on the size of the affected population. In a small population the spread of the disease may cease after several weeks, if cases are controlled or effective preventive measures are implemented; in a larger scale the epidemic may last several months[32]. It is sometimes possible to identify the original source of the infection; it may be from an asymptomatic traveler shedding the bacteria, someone bringing back contaminated food items, or the body of someone who died from cholera being brought back to the country of origin for burial[18]. Cholera is rarely transmitted person-to-person because of a large number of organisms needed to cause the disease. The fecal-oral pathway, from contaminated food or water, remains the primary transmission route of cholera infection[33]. Controversially, caregivers are not at risk of infection if preventive measures are carefully followed when managing a cholera patient.

2.3.3.3 Distribution

In 2007, fifty-three countries reported cholera cases to WHO and most of them were reported from African countries (Figure 5). Most countries with low-income were affected by cholera infection during the seventh pandemic. In some countries, strains of *Vibrio cholerae* O1, biotype El Tor are found in environmental reservoirs; in other countries such as Bangladesh, both strains of *Vibrio cholerae* O1, biotype classical and El Tor strains, are present. The spread of *Vibrio cholerae* O139 Bengal, is limited to Asia[18]. The appearance of the disease is seasonal. The seasonality of cholera varies across continents and locations: rare or undetectable in cooler months; increases during summertime; and there is an inconsistent relation with rainy season, monsoon and water temperature[18, 32].

Figure 5. Reported cases of cholera worldwide, 2004-2010



Source: World Health Organization – Map gallery[37]

2.3.3.4 Demographic characteristics

Cholera can infect all age groups. Because gastric acidity decreases with age, elderly are more susceptible to develop a severe illness than people at a younger age. In countries where the disease is endemic, adults have acquired a natural immunity against the bacteria by frequent exposure and children are more likely to become infected with *Vibrio cholerae* O1[18]. With equal exposure, gender does not influence the outcome or the prevalence of the infection. Race is not specifically correlated with the disease. However, severe cases of cholera are strongly associated with blood group O. The reason remains unknown[38]. A few occupational activities are linked with cholera outbreaks: fisherman and harbor workers are the most at-risk. Controversially, cases are rare or absent among health care personnel caring for infected patients or handling contaminated stools or vomit which emphasizes the impact of preventive measures and the large dose of *Vibrio cholerae* necessary for causing the disease.

2.3.3.5 Predisposed conditions

Discontinuation of sanitation infrastructure, overcrowding of population, temporary gatherings, refugee settlements, flooding, and recently complex humanitarian emergencies with interruption of infrastructure are characteristic settings for cholera outbreaks[31]. Natural disasters are rarely the cause of a cholera epidemic, except in Bangladesh when an epidemic occurred after typhoons flooded an endemic area; and in the United States sporadic cases reported in New Orleans after the Katrina hurricane were associated with the consumption of undercooked shellfish harvested in the Gulf Coast[18, 32].

2.3.3.6 Risk factors

The main risk factors for cholera include poverty, poor access to safe water, sanitation and hygiene; overcrowding of populations; and lack of safe food preparation and handling[39]. Other important risk factors for cholera are indirect causes: socio-economic status; political instability; unstable environmental conditions such as war, famines and floods that can lead to population displacement, interruption of infrastructure; and socio-economic impact[31].

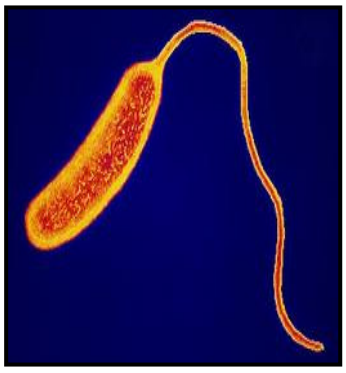
2.3.4 Clinical manifestations

Cholera is identified by code A00 in the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). The ICD is designed for international standardization in the collection, processing, classification, and presentation of mortality data[40]. Cholera symptoms include acute watery diarrhea defined as the occurrence of sudden diarrhea with profuse, watery stools with the aspect of rice water; vomiting; cramps in the lower extremities and abdomen; high temperature. Some authors have included as a clinical sign of cholera the fishy-smell of stools[41]. Cholera infection can lead to rapid severe dehydration resulting in hypovolemic shock, anuria, acidosis and death within 24 hours of onset without medical treatment[18, 38]. The short incubation period of the illness, from two hours to five days, increases the risk of disease outbreaks. Cholera infection may remain asymptomatic in 70 percent of cases[32]. Healthy carriers of *Vibrio cholerae* can shed the bacteria intermittently for less than 15 days, with a maximum period of pathogen discharge between 30-40 days; and chronic carriers may excrete vibrios intermittently over longer periods, from 4-15 months[18]. Additionally, cholera organisms may persist for a short time in polluted waters. However, fecal contamination from infected people and carriers may maintain the bacteria in the environment and cause the spread of the disease.

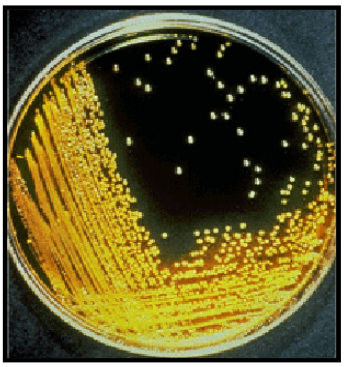
2.3.5 Diagnosis

The noticeable symptom of severe, watery diarrhea suggests the occurrence of cholera infection. Additionally, a large spectrum of laboratory tests are used to diagnose or confirm cholera infection. Cholera can be diagnosed microscopically by examination of liquid stool specimen obtained from patients suspected with cholera (Figure 6). Other laboratory tests used to isolate *Vibrio cholerae* from stool specimens are: culture of stool or rectal swabs using thiosulfate-citrate-bile salts-sucrose (TCBS) agar; non-sugar agar; slide agglutination; oxidase positive or fermentation test; enrichment in peptone broth; string test; and more recently, polymerase chain reaction (PCR) and genetic rapid tests[42].

Figure 6. Microscopic strain of Vibrio cholerae and the culture growth of bacteria in TCBS agar



Credit: Moredun Animal Health and Science Photo Library



Credit: www.cdc.gov[43]

2.3.6 Cholera control and prevention

The best way to prevent cholera is by drinking safe water; practicing good personal hygiene such has washing hands with soap; safe food preparation and handling; and by building improved sanitation facilities *i.e* latrine construction, to maintain safe disposal of human excreta. However, the construction of improved sanitation systems alone may not result in improved health outcome. In addition, health education or promotion is a vital component in cholera control and prevention. Messages delivered on cholera infection included: handwashing with soap before cooking and/or eating, after defecation, taking care of persons infected with cholera; and avoiding drinking untreated water[41].

Antibiotic prophylaxis is recommended for small groups and over a short period of time. However, the recommended control and prevention measures mentioned above are generally efficient in regard to reducing cholera transmission when they are put in place in timely manner and with sustainability[44].

Safe parenteral or oral cholera vaccines (OCV) for adults are now available and some countries have already used the vaccine to immunize most at-risk groups for cholera infection[41]. Hence, immunized adults can provide protection indirectly to children. Yet, parenteral cholera vaccine is not recommended by WHO because of low efficacy and severe adverse reactions; oral cholera vaccine has not been proven to be 100% effective and is not generally recommended by clinicians; and the use of cholera vaccines in endemic and epidemic situations still requires further investigation[43-45]. Therefore, vaccination should not replace food, hygiene and sanitation precautions[46]. There are two variants of safe OCV currently available[47]. According to the WHO, both vaccines confer the same level of immunity (66%-85%) against the toxigenic type of *Vibrio cholerae* although they do are different in composition. Both vaccines contain whole-cell killed bacteria; but one is combined with a protein recombinant cholera toxin B-subunit[48, 49]. Besides the distinctive composition of the products, other differences are found between the OCVs. The table below adapted from WHO summarizes the resemblances and the differences between the OCVs available on the market (Table 1).

Table 1. Characteristics of currently available vaccines

Characteristics	Product Name	
	rBS-WC **Recombinant B Subunit killed Whole Cell**	**Biv-WC** **Bivalent killed Whole Cell**
Commercial name	Dukoral®	SchanCol®
Manufacturer	SBL Vaccines in Sweden	Shantha Biotec in India
Presentation	Oral suspension vaccine and effervescent granules	Oral suspension vaccine
Requires bicarbonate buffer	Yes	No
Shelf-life	3 years	2 years
Type	Monovalent inactivated vaccine	Bivalent inactivated vaccine
Contains dead whole cells of *Vibrio cholerae*	Yes	Yes
Contains a protein recombinant cholera toxin B-subunit	No	No
Exclusion criteria	Children < 2 years old	Children < 1 year old
Protection against	*Vibrio cholerae* O1 for >50% for 2 years and travelers' diarrhea	*Vibrio cholerae* O1 and O139 for >50% for 2 years
Protection over 50%	Yes	Yes
Immunity coverage the first year following administration	52%	52%
Immunity coverage the second year following administration	62%	62%
Duration of protection	Short-term among all age groups	Long-term in children under-five years old
Doses administration: 2 doses between seven days and six weeks apart	Yes	Yes
Safe drinking water needed for vaccine administration	Yes	No
Current vaccine price per dose (2010)	USD 4.70	USD 1.85
WHO prequalified	Yes and licensed in over 60 countries	Yes*
**** Note:*** SchanCol® vaccine was licensed in sold in India since 2009. It had been prequalified by WHO in November 2011[50].		

Source: Adapted from the WHO manual – Oral cholera vaccine in mass immunization campaigns, 2010 [48]

2.3.7 Treatment of cholera

Although cholera can be life-threatening, it can be treated[43]. Rehydration, which consists of the replacement of body fluids and electrolytes lost through severe diarrhea and vomiting, is the most important treatment in the event of cholera. According to the clinical signs and the patients' dehydration status (A, B, C) different rehydration therapy will be initiated (Figure 7). Early rehydration can save the lives of persons infected with cholera and presenting mild to moderate dehydration[41]. According to the WHO 80% of cholera patients can successfully be treated with oral rehydration salts (ORS) and if solution is administered promptly to anyone presenting with acute watery diarrhea, regardless of their dehydration stage[51]. Therefore, all cholera patients should be treated accordingly with large intake of ORS solution. In case of severe dehydration, intravenous therapy should be combined with ORS intake. Nonetheless, monitoring of the patient is important during the acute phase of illness[52].

Figure 7. Rehydration treatment plan of cholera according the dehydration stage

Dehydration stage	Signs	Treatment
Severe	Lethargic, unconscious, floppy Very sunken eyes Drinks poorly, unable to drink Mouth very dry Skin pinch goes back very slowly No tears (only for children)	IV therapy + antibiotics + ORS
Mild	Restless and irritable Sunken eyes Dry mouth Thirsty, drinks eagerly Skin pinch goes back slowly No tears (only for children)	ORS + very close surveillance
No dehydration	None of the above signs	ORS at home

Source: WHO manual – Cholera outbreak: assessing the outbreak and improving preparedness, 2004[53]

Antibiotics are recommended in individual cases of severe cholera to shorten the course of the disease and reduce carriage of pathogen[44]. Nevertheless, rehydration remains the principal treatment for cholera.

2.4 Cholera in Haiti

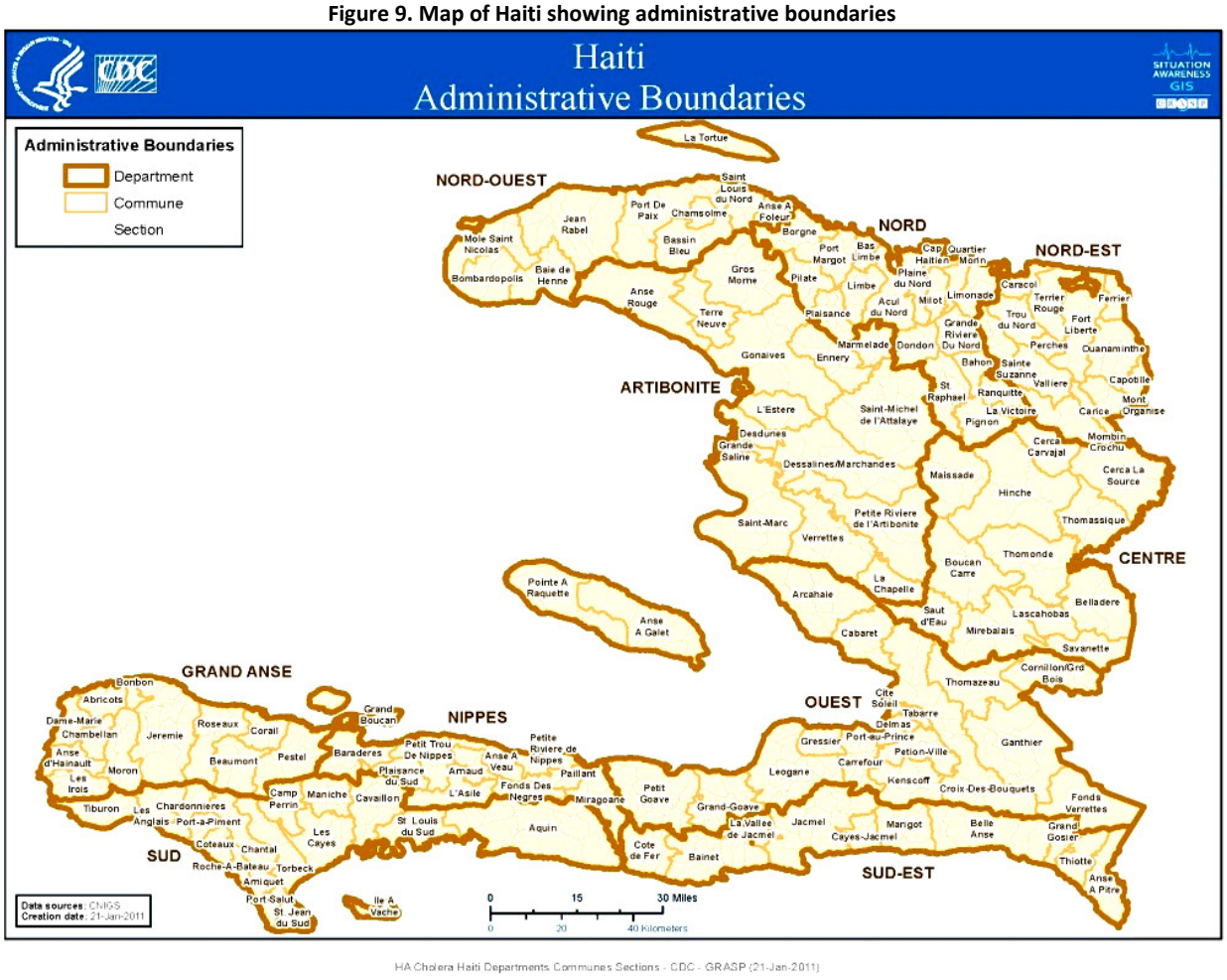
Haiti, officially called Republic of Haiti, is a Caribbean country with a total area of 27,750 square kilometers. It occupies the western one-third of the Hispaniola Island, between the Caribbean Sea and the North Atlantic Ocean, which it shares with the Dominican Republic (Figure 8). According to the Central Intelligence Agency estimates, Haiti's population was about 9,719,932 inhabitants in 2011. The capital of the country is Port-au-Prince[54]. Haiti has two official languages: French considered as an administrative language; and Haitian Creole, the informal language spoken by most people living in the country. Haitian Creole is influenced by other languages and was recognized as an official language by the Haitian Constitution in 1987[55].

Figure 8. Map showing geographic location of Haiti

Credit: Central Intelligence Agency - Country profile

Haiti is the poorest country in the Western Hemisphere with more than fifty percent of the population living below poverty line and below standard conditions. Administratively, the country is divided into ten geographical departments: Artibonite, Centre, Grand'Anse, Nippes, Nord, Nord-Est, Nord-Ouest, Ouest, Sud-Est, and Sud. The departments are further divided into second-level (arrondissements) and third-level (communes) administrative divisions (Figure 9).

Figure 9. Map of Haiti showing administrative boundaries

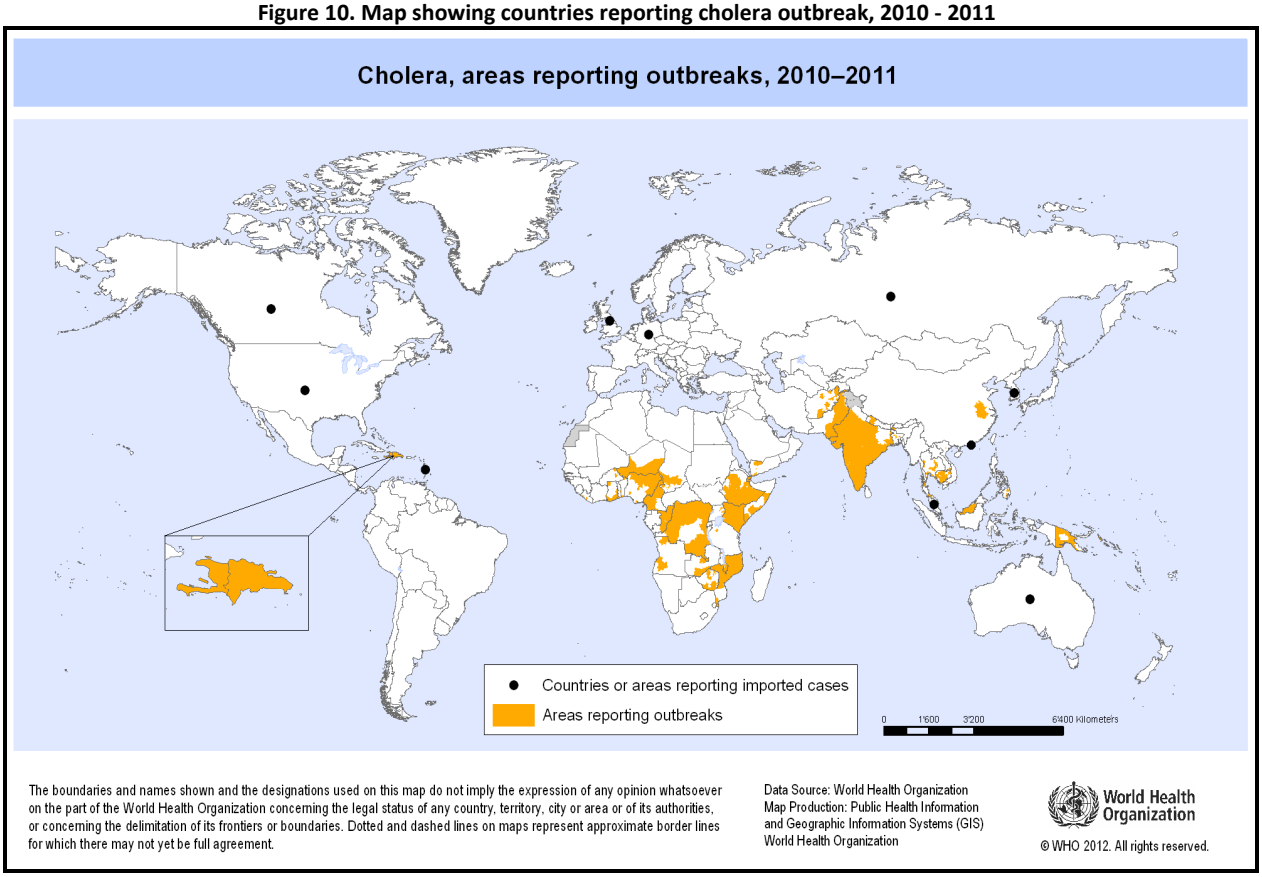


HA Cholera Haiti Departments Communes Sections - CDC - GRASP (21-Jan-2011)

Source: www.cdc.gov

On October 19, 2010, nearly ten months after the devastating January 2010 earthquake in Haiti that claimed the lives of more than 200,000 people and displaced over 1 million, MSPP was notified of a sudden increase in the number of people presenting with watery diarrhea and dehydration in the Artibonite and Centre Departments. Within 4 days, the National Public Health Laboratory (LNSP) in Haiti isolated the pathogen causing the unusual cases of diarrhea in the country. *Vibrio cholerae* serogroup O1, serotype Ogawa, was identified from stool specimens obtained from suspected patients in the affected areas. Selected specimens were sent to CDC for confirmation and after additional analyses the first cholera outbreak, over decades, was officially announced in Haiti (Figure 10) [4, 13].

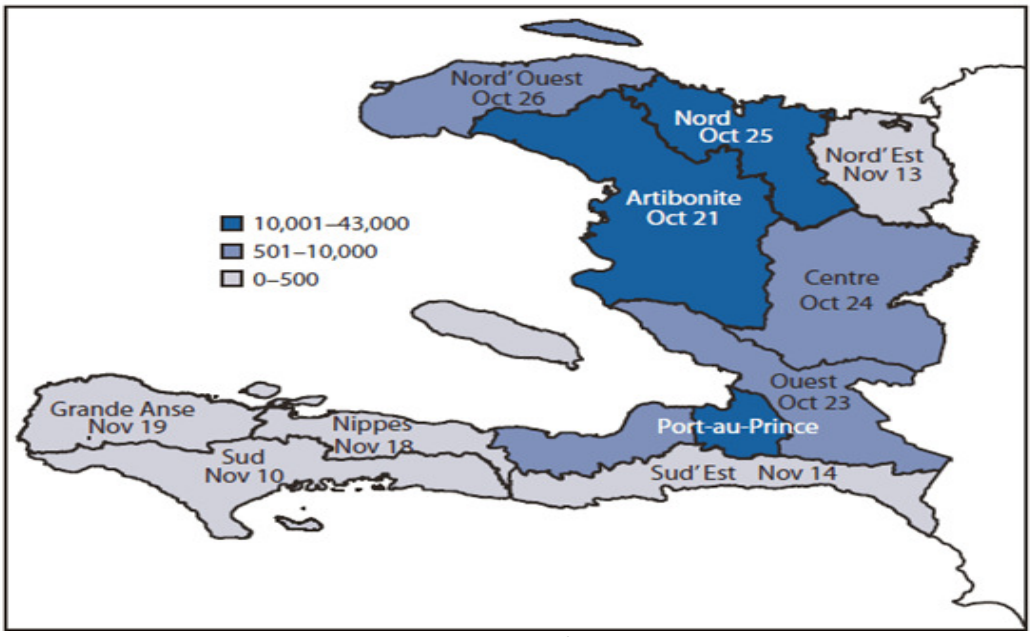
Figure 10. Map showing countries reporting cholera outbreak, 2010 - 2011



Source: World Health Organization

In response to the cholera outbreak in Haiti, CDC has worked closely with MSPP to reduce the transmission of cholera in Haiti. According to CDC National Cholera Monitoring System, more than 90,000 cases were reported within the first two months of the outbreak (Figure 11)[5].

Figure 11. Cumulative number of cases of cholera reported overall and date of first laboratory-confirmed case, by department and in Port-au-Prince CDC National Cholera Monitoring System, Haiti, December 3, 2010

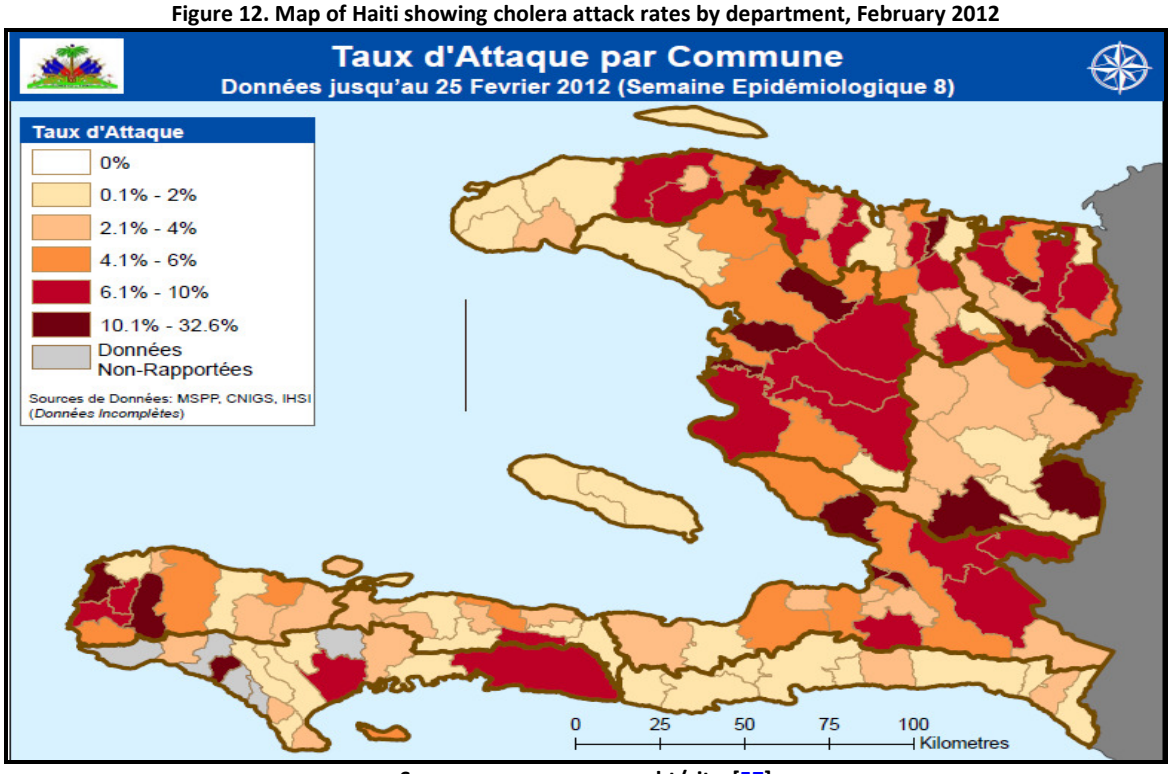


Source: www.cdc.gov

At the confirmation of the cholera outbreak, MSPP established a national surveillance system to accelerate cholera case-findings. After further investigations, using pulse field gel electrophoresis (PFGE) testing on 13 bacterial isolates obtained from patients diagnosed with cholera in Haiti, laboratory results demonstrated that the *V. cholera* serogroup O1 strain isolated in the outbreak in Haiti is similar to cholera strains found in South Asia[4, 5]. Many focused on the hypothesis that cholera was introduced in Haiti from United Nations (UN) Peacekeepers who had arrived from Nepal, because on September 23, 2010, a recent cholera outbreak had occurred in Kathmandu, the capital city of Nepal, shortly before the UN military troops left for Haiti[23].

Furthermore, the Nepalese UN peacekeepers arrived in Haiti the first week of October 2010 and were based in a camp in Mirebalais which was near a river bank that feeds into the Artibonite River[56]. According to MSSP cholera report, cumulative data have shown 534,647 cases of cholera, 287,656 hospitalized cases, and 7,095 deaths due to cholera, have been reported in Haiti as of April 10th, 2012[57]. The last MSPP cholera report on incidence and attack rates dates back to February 25th, 2012 (Figure 12). This ongoing epidemic with a high number of cases has been classified by CDC as "the worst cholera outbreak in recent history" in terms of magnitude of the problem; and as "the best documented cholera outbreak" in Modern times[6].

Figure 12. Map of Haiti showing cholera attack rates by department, February 2012



Source: www.mspp.gouv.ht/site [57]

During the acute phase of the cholera outbreak, despite the high number of cholera cases diagnosed, CDC and the Pan American Health Organization (PAHO) did not recommend MSPP to vaccinate the population, primarily because of challenges and constraints regarding vaccine distribution and administration[49]. With improvement of cholera case management and OCV manufacturers indicating that a larger stock of cholera vaccines could be made available, previous recommendations on vaccination strategies were reconsidered by public health officials and WHO approved the use of SchanCol®, the dollar-a-dose vaccine, in Haiti[9]. About 200,000 ready-to-use doses of OCV were distributed to Partners in Health (PIH), a health care organization established in a rural area in the Centre department; and Centres GHESKIO, a Haitian non-governmental organization located near an urban slum in Port-au-Prince[9, 49]. These two health facilities were about to launch a vaccine trial in March 2012 when the ethic committee at MSPP requested more clarifications on the study protocol to ensure that ethical principles were attained. According to news broadcast from the National Public Radio and The New York times, MSPP has withdrawn the hold on the launch of the vaccine trial in the beginning of April 2012 and some participants have already received their first doses of OCV[58].

2.5 Role of Community health workers in Haiti cholera outbreak

In many countries, lack of health care providers and access to care has always been an obstacle to effective delivery of adequate health services. In such situations, CHWs can bring valuable contribution to their communities. To effectively undertake actions that lead to better health outcomes, they need to be appropriately trained, adequately equipped and continuously supported[59]. Prior to the cholera epidemic, Haiti was facing a shortage of health care workers and CHWs were involved in community-based prevention and care in regards to other disease burden including tuberculosis and Human Immunodeficiency Virus (HIV) / Acquired Immunodeficiency Syndrome (AIDS).

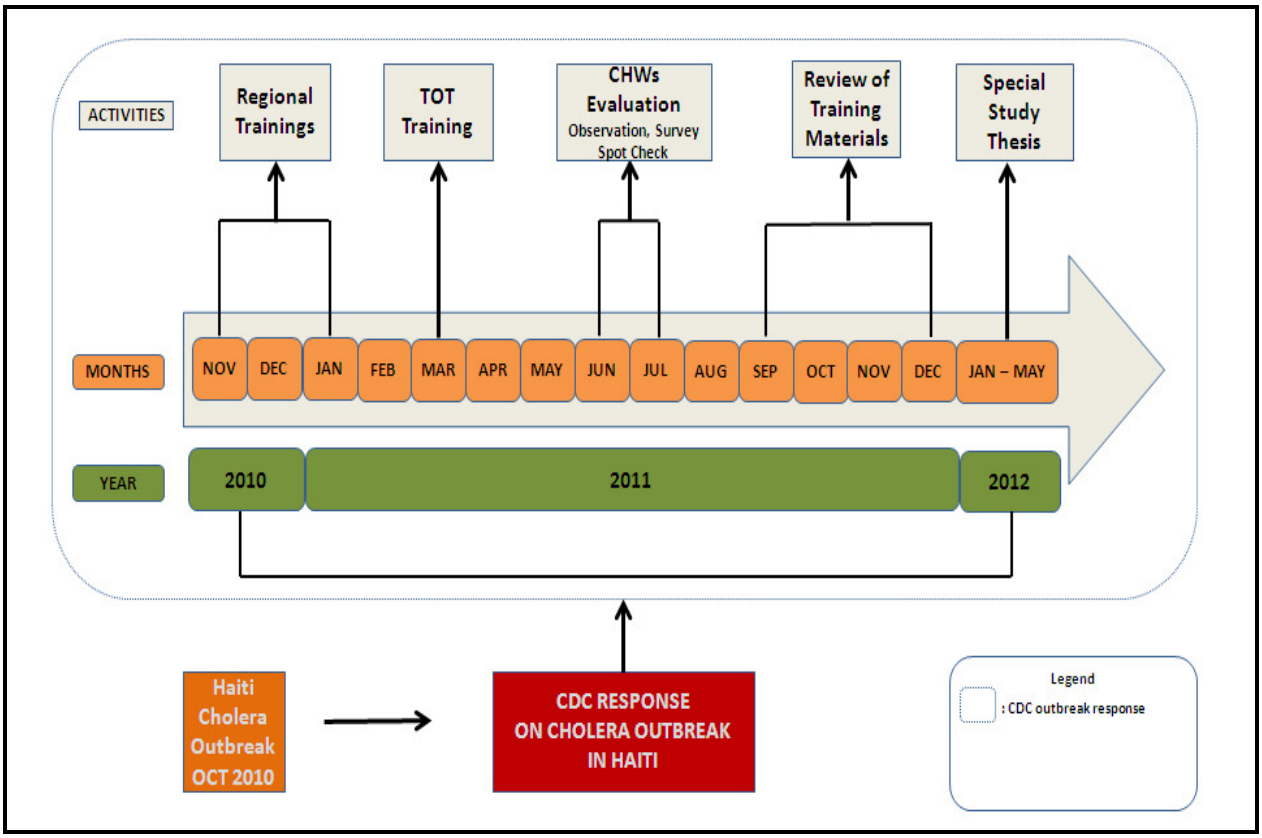
In response to the cholera outbreak, CDC, MSPP and other organizations developed training materials on cholera control and prevention measures, trained more than 500 health care workers in all ten departments of the country. Master trainers will educate CHWs on cholera control and prevention measures. As the epidemic continued in the country, trained CHWS played an inherent role in implementing prevention strategies and educating the community during household visits in their catchment area. Subsequently, CDC and other US government agencies helped with allocated in-country resources to increase the number of cholera treatment centers (CTC) and oral rehydration points (ORP) [6, 13]. These interventions greatly contributed to the reduction of initial cholera-specific mortality rate from 4% of all cases to less than 1%.

Furthermore, MSPP rapidly provided to the Haitian population guidelines on "how to prevent cholera". The key messages included five basic prevention measures: 1) drink and use safe water; 2) wash your hands often, using soap and water; 3) use latrines or bury feces and do not defecate in any body of water; 4) cook food well, keep it covered, eat it hot, and peel fruits and vegetables; 5) clean up safely in the kitchen and in places where the family bathes and washes clothes. In addition to these basic preventive measure, instructions on "How to treat cholera and other forms of acute watery diarrhea", "Diagnosis and testing" and "Clinical presentation and management of cholera" were made available to provide more guidance[13].

Chapter 3 – Background

CDC's response to the cholera outbreak in Haiti was immediate (Figure 13). CDC's Waterborne Disease Prevention Branch (WDPB)–an entitiy of the Division of Foodborne, Waterborne, and Environmental Diseases (DFWED) and the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)–MSPP, and other partners including the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B) conducted Train-the-Trainers (TOT) trainings and developed support training materials, ''Community Health Worker Training Manual for Cholera Prevention and Control", to better prepare CHWs.

Figure 13. Activities and Timeline - Schematic representation of CDC's cholera outbreak response in Haiti



Timeline created by M. Etheart and adapted from CDC Trip report (unpublished work) and CDC website, 2012

3.1 Training purpose and audience

The purpose of the Train-the-Trainers (TOT) training is to strengthen capacity building of CHWs in Haiti with 1) knowledge on cholera control and prevention after the outbreak; 2) effective communication skills to encourage behavior changes to reduce the occurrence of cholera and save lives in their communities. The master trainers who participated in the TOT meeting represent many different partner-organizations (Appendix 1), and current MSPP employees or contractors. In addition to CHWs training, the manual was also used to train a wide range of community leaders and other community workers.

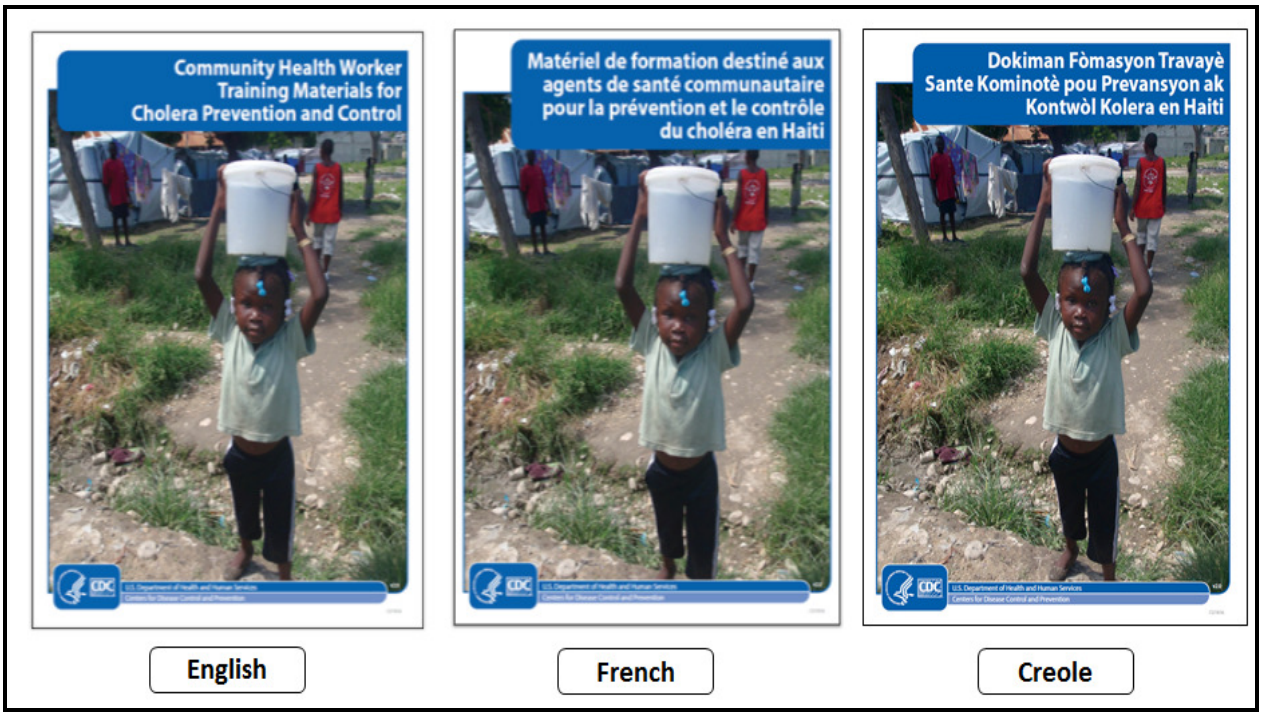
3.2 Training materials

During a cholera outbreak, for CHWs to effectively educate their communities on cholera control and prevention measures, appropriate training and adequate materials are required[60].

3.2.1 Development of training materials

A series of training and educational materials intended to train CHWs were developed by a multidisciplinary team at CDC and in collaboration with the MSPP in response to the emerging cholera outbreak in Haiti[60]. In November 2010, the "CHW Training Materials for Cholera Prevention and Control" was developed in English and translated into French and Haitian Creole. An updated version was available by March 2011 for a Train-the-Trainer workshop conducted by MSPP, CDC, and International Training and Education Center for Health (I-TECH) on cholera prevention and control held in Port-au-Prince, Haiti (Figure 15).

Figure 14. Front covers of CHWs training manual in three languages available



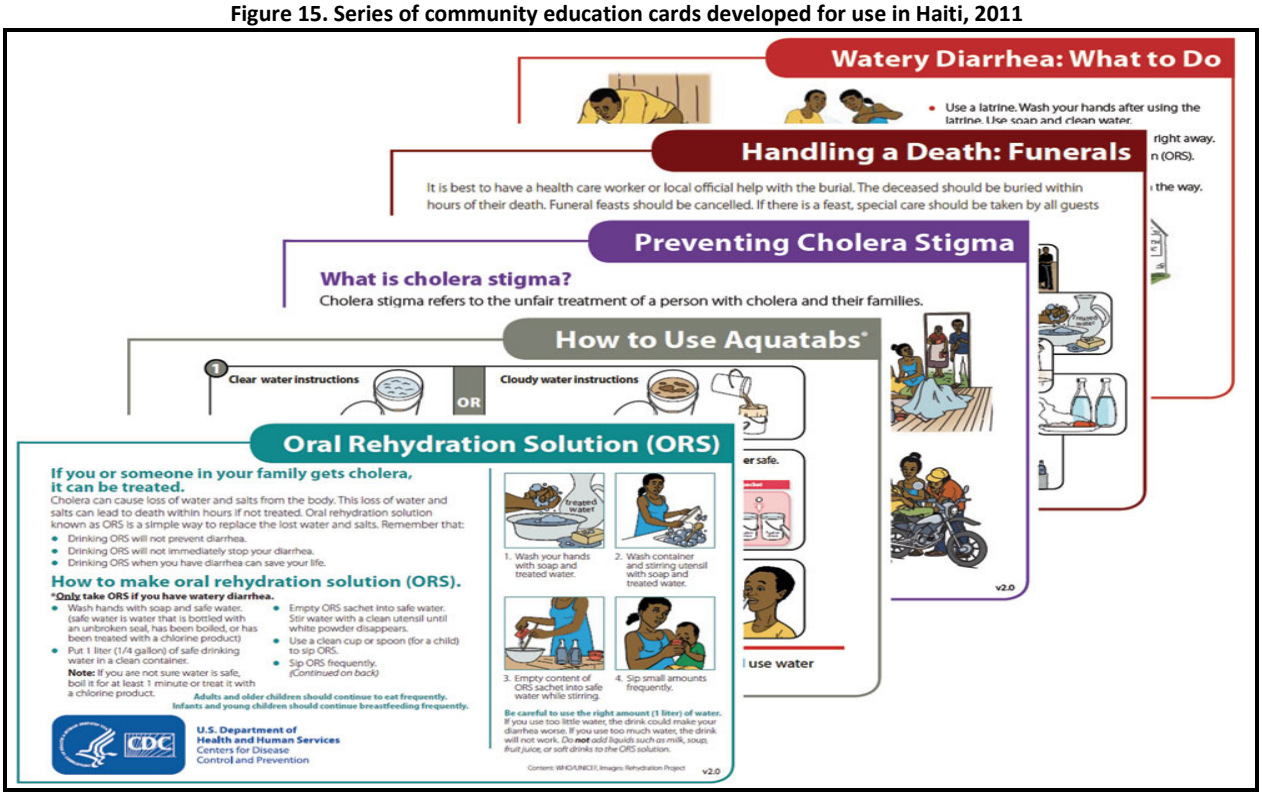
Source: www.cdc.gov

The training modules were written in a simple language that would be understood by lower literacy users. The content selected for the training materials were appropriate for the training purposes and covered the key messages on cholera control and prevention. In addition, the topics developed on cholera in the CHW training materials were inspired by technical and educational guidelines on cholera control and prevention published by other institutions. The themes were included after agreement and revision of the training tool[60].

3.2.2 Design and format of training materials

The training materials are formatted on a letter size paper and each training module or cholera topic is color coded (Figure 15).

Figure 15. Series of community education cards developed for use in Haiti, 2011

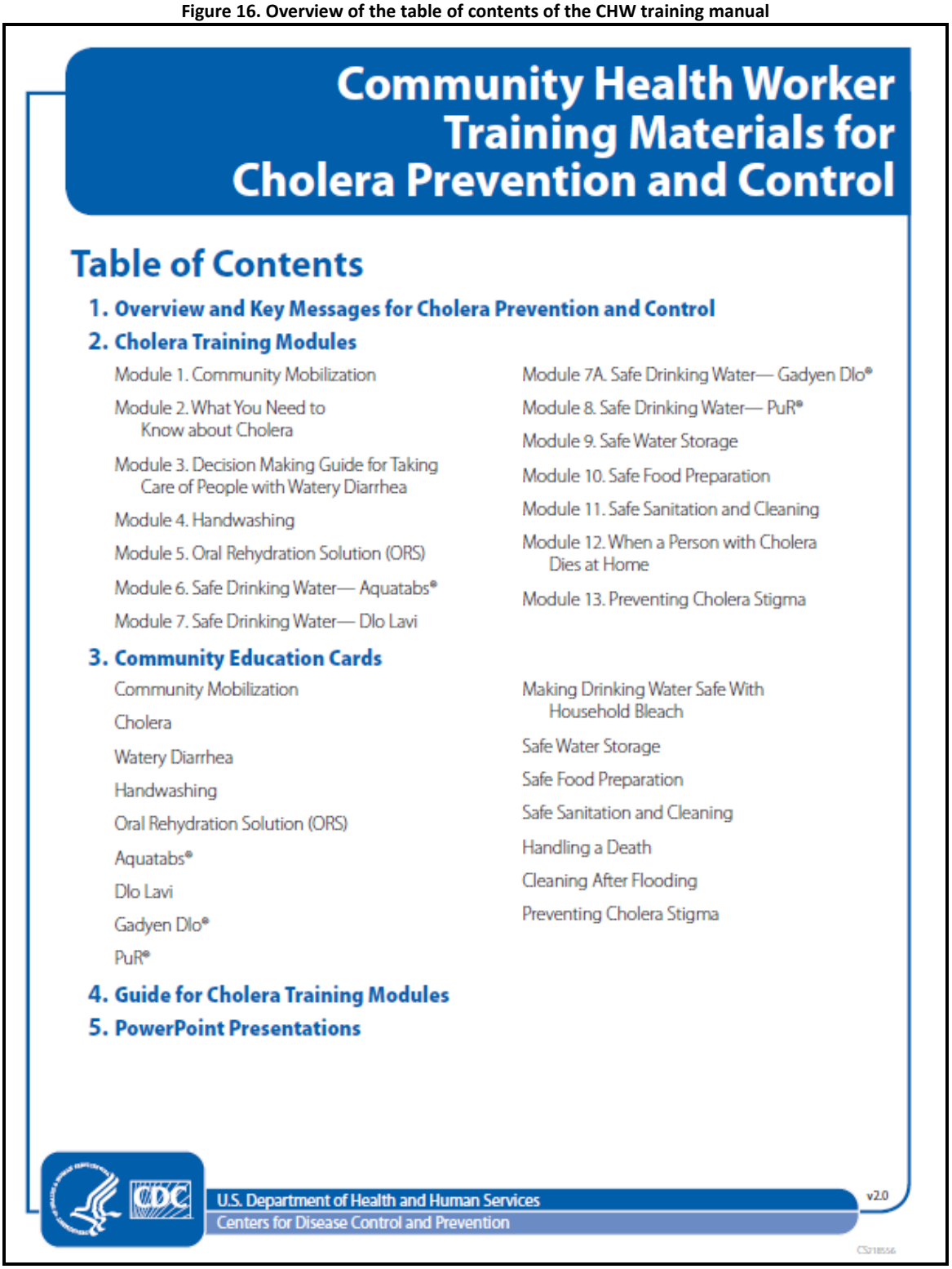


Source: www.cdc.gov[60]

3.2.3 Content of training materials

The training packet contains: two training tools and two documents for tutorial. The training tools are: 1 training manual containing 14 training modules on cholera control and prevention; and a set of 16 educational cards to use within the community. For tutorial use, the material includes 1 trainer's guide used in teaching CHWs and 1 set of 105 Powerpoint® presentation slides[60]. The document contains 108 pages, divided into five sections (Figure 16) as follows:

Figure 16. Overview of the table of contents of the CHW training manual



Community Health Worker Training Materials for Cholera Prevention and Control

Table of Contents

1. **Overview and Key Messages for Cholera Prevention and Control**
2. **Cholera Training Modules**
   - Module 1. Community Mobilization
   - Module 2. What You Need to Know about Cholera
   - Module 3. Decision Making Guide for Taking Care of People with Watery Diarrhea
   - Module 4. Handwashing
   - Module 5. Oral Rehydration Solution (ORS)
   - Module 6. Safe Drinking Water— Aquatabs®
   - Module 7. Safe Drinking Water— Dlo Lavi
   - Module 7A. Safe Drinking Water— Gadyen Dlo®
   - Module 8. Safe Drinking Water— PuR®
   - Module 9. Safe Water Storage
   - Module 10. Safe Food Preparation
   - Module 11. Safe Sanitation and Cleaning
   - Module 12. When a Person with Cholera Dies at Home
   - Module 13. Preventing Cholera Stigma
3. **Community Education Cards**
   - Community Mobilization
   - Cholera
   - Watery Diarrhea
   - Handwashing
   - Oral Rehydration Solution (ORS)
   - Aquatabs®
   - Dlo Lavi
   - Gadyen Dlo®
   - PuR®
   - Making Drinking Water Safe With Household Bleach
   - Safe Water Storage
   - Safe Food Preparation
   - Safe Sanitation and Cleaning
   - Handling a Death
   - Cleaning After Flooding
   - Preventing Cholera Stigma
4. **Guide for Cholera Training Modules**
5. **PowerPoint Presentations**

Source: www.cdc.gov[13]

- Overview and Key Messages for Cholera Prevention and Control. This section gives a brief overview of the disease including a general description of cholera infection, the transmission route; and mainly focusing on cholera prevention messages (*i.e*. use of safe water for drinking, washing hands with soap, avoiding open defecation etc.).

- Cholera Training Modules. This section describes the intent of the manual and presents guidelines on how the trainer should to be prepared for the training. A total of 14 modules are labeled in the manual and 11 health topics related to cholera control and prevention including information about community mobilization, cholera, solution of oral rehydration salts, safe drinking water preparation and storage, handwashing, sanitation, food preparation, handling a death that occurs at home, and stigma associated with cholera are presented. A list of training objectives and supplies needed for demonstration are presented at the beginning of each training module (Figure 17).

- Community Education Cards. The topics covered in the training modules are repeated with the community education card. The content is more succinct and images are used to illustrate the key messages. The color coding used for each module is maintained.

- Guide for Cholera Training Modules. This guide is designed for TOTs as a teaching tool to help them train CHWs about cholera disease and management. The guidelines are built around the 14 training modules.

- PowerPoint® Presentations. The presentation is an eighteen-page handout displayed horizontally with 6 slides per page. All the cholera topics covered in the previous training materials tools are repeated in the presentation.

Figure 17. Example of list of objectives and supplies needed for a training module

Source: www.cdc.gov[13]

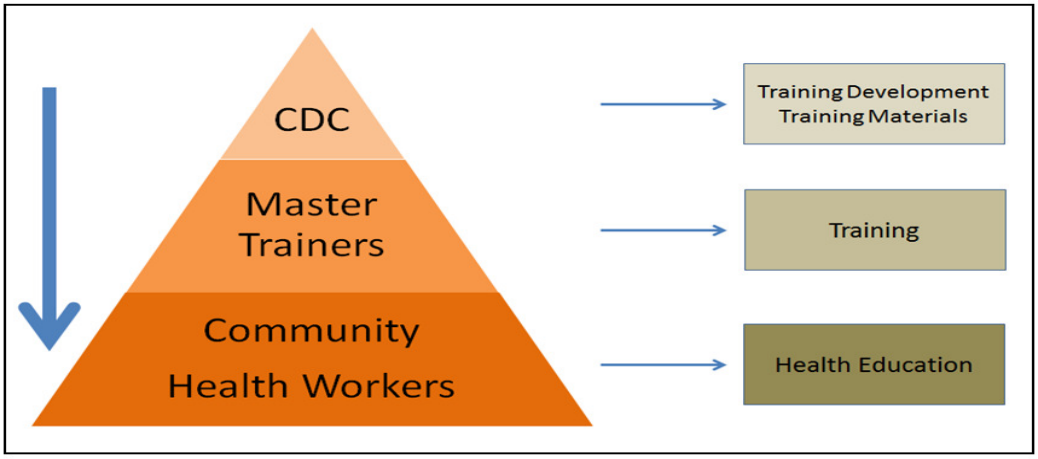
3.2.4 Available languages of the training materials

The second version of "CHW Training Materials for Cholera Prevention and Control" is currently available in English, French and Haitian Creole. The French version is not available online on the CDC Haiti cholera website.

3.3 Training implementation

In March 2011, CDC sponsored a TOT workshop to prepare a group of twenty-four master trainers representing institutions from all the ten departments of Haiti to train CHWs in their region. The TOT session focused on specific messages related to cholera by using educational cards to improve the community's understanding of the health messages delivered (Figure 13). Electronic versions of the training materials are made available to the public and can be downloaded on CDC's website using the following hyperlink CHW Training Resources[61]. Participants of the TOT session received at the end of the training a storage device which contained the CHW training materials for future reference and consultation[60]. Using a cascading approach, the trained CHWs would in turn provide to their communities educational messages about cholera control and prevention through community educational activities (Figure 18).

Figure 18. Cascading approach used for CHWs training



Created by M. Etheart and adapted from CDC Trip report (unpublished work) and CDC website, 2012

3.4 Training evaluation activities

Subsequent to the March 2011 training, CDC conducted a series of evaluation activities in Haiti targeting the master trainer's, the community health workers and the community (Figure 19). The evaluation team was composed of two CDC staff members and Melissa Etheart (M.E.) a MPH candidate at Emory University. The training evaluation activities included two phases, as described below (Table 2).

3.4.1 Evaluation Phase 1 – Focus group

In May 2011, CDC sent an invitation by email to the twenty-four of the master trainers who participated in the TOT workshop held in March 2011 to request their presence at the upcoming focus groups scheduled for the beginning of June 2011 in Port-au-Prince. Among the twenty-four master trainers, 17 (71%) accepted the invitation and confirmed their participation[62]. In June 2011, two focus group sessions were held in Port-au-Prince with seventeen master trainers who responded to the invitation. The purpose of the two-day workshop was to:

- gather constructive feedback on the TOT training;
- assess the effectiveness of the CDC/MSPP training materials among users;
- seek to interview trained CHWs in different geographical departments to assess their knowledge of cholera.

3.4.2 Evaluation Phase 2 – Field evaluation

During the second phase of the evaluation in July 2011, the evaluation team conducted site visits in three geographical departments (South, Southeast and North) selected from a convenience sample of attendees from the June's focus groups. The evaluation activities included:

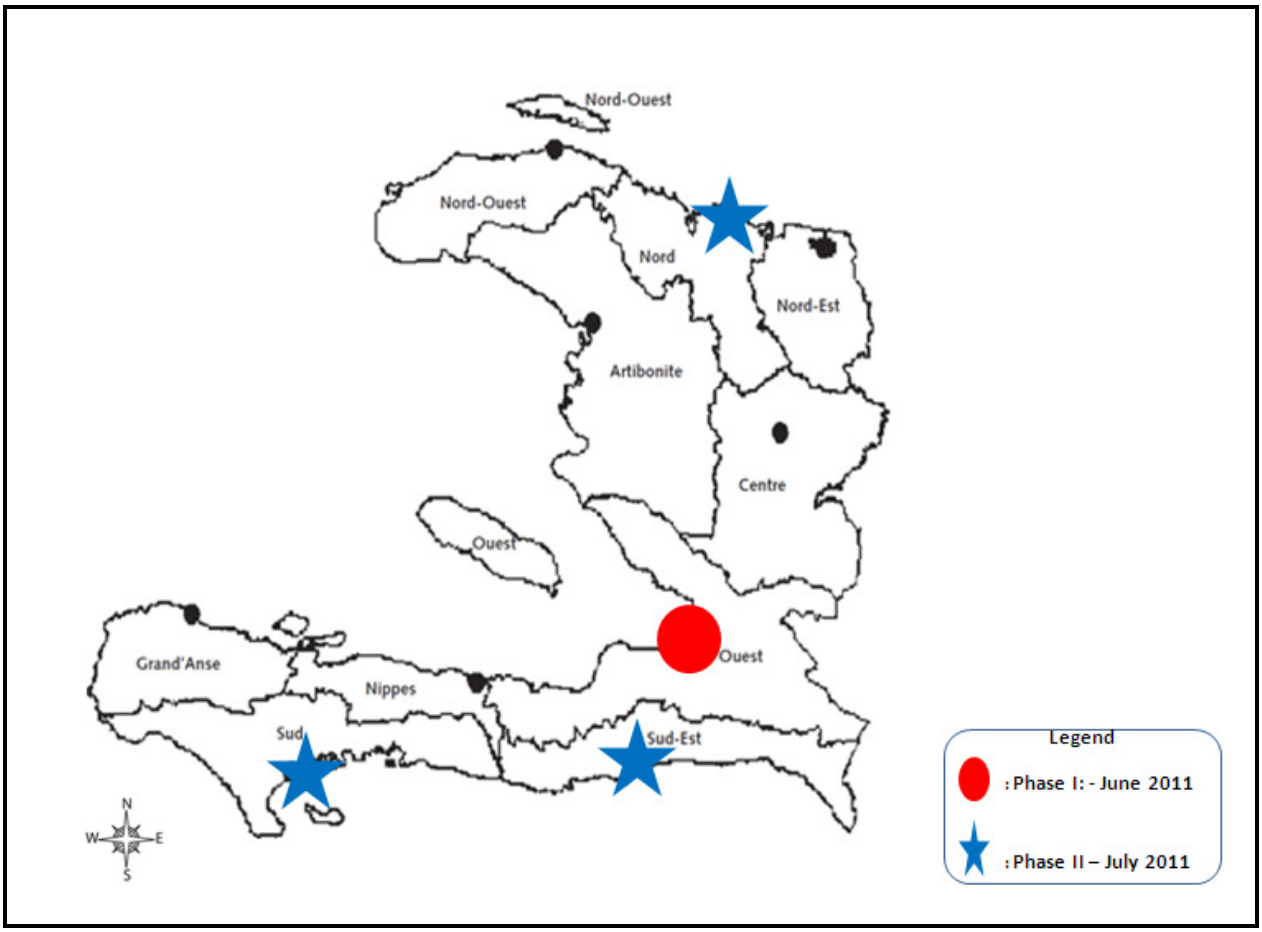
- observation of CHW's community activities related to cholera control and prevention conducted by trained CHWs to evaluate the knowledge of CHWs on cholera control and prevention and their performances during the activities;
- one-on-one interview with trained CHWs to gather constructive feedback on the CHW training and the training materials and assess the training needs of CHWs;
- household surveys in catchment areas of trained CHWs targeting those who attended the CHWs' educational sessions to evaluate the knowledge, attitude and practices of the community regarding cholera control and prevention.

Table 2. Summary of CDC evaluation activities

Phase of Evaluation	Period	Group targeted	Activities	Aim
Phase I Focus Group	June 2011	Master trainers	Focus group workshop	• To gather constructive feedback on the TOT training • To assess the effectiveness of the CDC/MSPP training materials among users • To seek to interview trained CHWs in different geographical departments to assess their knowledge on cholera
Phase II Field Evaluation	July 2011	Trained CHWs	Observation	• To evaluate the knowledge of CHWs on cholera control and prevention • To evaluate the performance of the CHWs
			One-on one interview	• To gather constructive feedback on the CHW training and the training materials • To assess the training needs of CHWs
		Household	Survey	• To evaluate the knowledge, attitude and practices of the community regarding cholera control and prevention

Table created by M. Etheart based on CDC Trip report (unpublished work), 2012

Figure 19. Map of Haiti showing location of CDC's follow-up activities, June-July 2011



Source: Map retrieved from the Annals of Internal Medicine. Legends were added on the map.

Chapter 4 – Methods

After the evaluation activities conducted in Haiti during June and July 2011, CDC debriefed MSPP in-person in July 2011 and provided a written report with key recommendations in December 2011. Subsequently, a comprehensive review of the "CHW Training Materials for Cholera Prevention and Control" was proposed as a Master of Public Health (MPH) thesis project for partial satisfaction of the requirements for a master degree in public health at Emory University. The review process was conducted by the MPH candidate (M.E.). It was initiated in September 2011 at CDC in Atlanta, Georgia and by March 2012 preliminary results were presented to the WDPB. The final document was submitted in April 2012.

4.1 Methodology

This special study thesis project consists of the provision of recommendations for an in-depth revision of the Haitian Creole version of the "CHW Training Materials for Cholera Prevention and Control" developed by joint efforts of CDC and MSPP, intended to be used in Haiti. This type of study method was selected for the thesis project because the procedure allowed us not only to carry out a thorough revision of the Haitian Creole version of the CHWs training tools on cholera control and prevention, but also to incorporate feedback received from TOTs during the focus group in June 2011; comments gathered from CHWs during the field evaluation in July 2011; and suggestions made by partner institutions. The reviewing activities and task were completed within eight months and included the following steps:

1) Literature Review. A comprehensive literature review was initiated on cholera and the cholera outbreak in Haiti using the internet to search for web-based search sources.

2) Proof-read. The training documents were printed for a second proof-read and the review was limited to identifying, in the training materials, the following communication inconsistencies:

- Design : referring to sketches, images or graphics used in the training materials
- Format : reviewing how the information was presented in the training tools
- Content : regarding subjects or topics covered in the training document
- Language : pertaining to terms, words, and translation used in the training.

The design, content, format and language need to be simple and understandable for a low-literacy population.

3) Record errors. Spelling errors, erroneous statements, inaccuracies and inconsistencies identified in the document were recorded on a spreadsheet, highlighted on the page of for future references and categorized by design, format, content, and language inaccuracies.

4) Collect external feedback. Comments from focus group, field evaluation and partner institutions were gathered, revised and compiled. After collecting feedback from external entities, a second proof-reading was conducted.

5) Sharing findings. This step consisted in listing all comments, feedbacks and suggestions to present to the CDC team for consolidation. Additionally, comments have been incorporated in the final thesis document.

4.2 Deliverable

In addition, from the findings of these different evaluative components, recommendations on how to make the training materials more useful to CHWs will be provided to the WDPB at CDC for their review and consideration. Thereafter, a third version with corrections and updates may be published and distributed to MSPP, partner organizations and the community health workers.

4.3 Ethical considerations

Interviews and household surveys used during the evaluation activities from June to July 2011 were submitted to the Institutional Review Board (IRB) for review at CDC. The proposed evaluation activities were determined to be non-research program evaluation. During the evaluation activities, interviews and household surveys were conducted per ethical regulations established for human subject research. Furthermore, key ethical issues of informed consent, discretion and confidentiality were ensured to the respondents who voluntarily accepted to proceed with interviews and/or household surveys; no incentives were offered for participation; consistency in the interview questions were maintained.

The special thesis project did not involve any interaction or intervention with human subjects. Therefore, IRB approval was not requested per Emory University requirement. The proposed project did not conduct human subjects research and was qualified for IRB exemption.

Chapter 5 – Findings and Recommendations

After the six-month review process of the training materials, findings and recommendations on inaccuracies found in the design, format, content and words or terms used, were compiled and reported to CDC for comments and consideration.

5.1 Feedback received from master trainers during the focus group

The focus group was an interactive session between the CDC evaluation team and participants from other institutions. During this event, participants provided recommendations regarding the training materials and shared experiences in the field. Evaluation forms were distributed to participants from partner institutions to gather feedback on CHW training and educational community activities[62]. The following comments and feedback on the CHW training manual were obtained during the TOT focus group in Port-au-Prince.

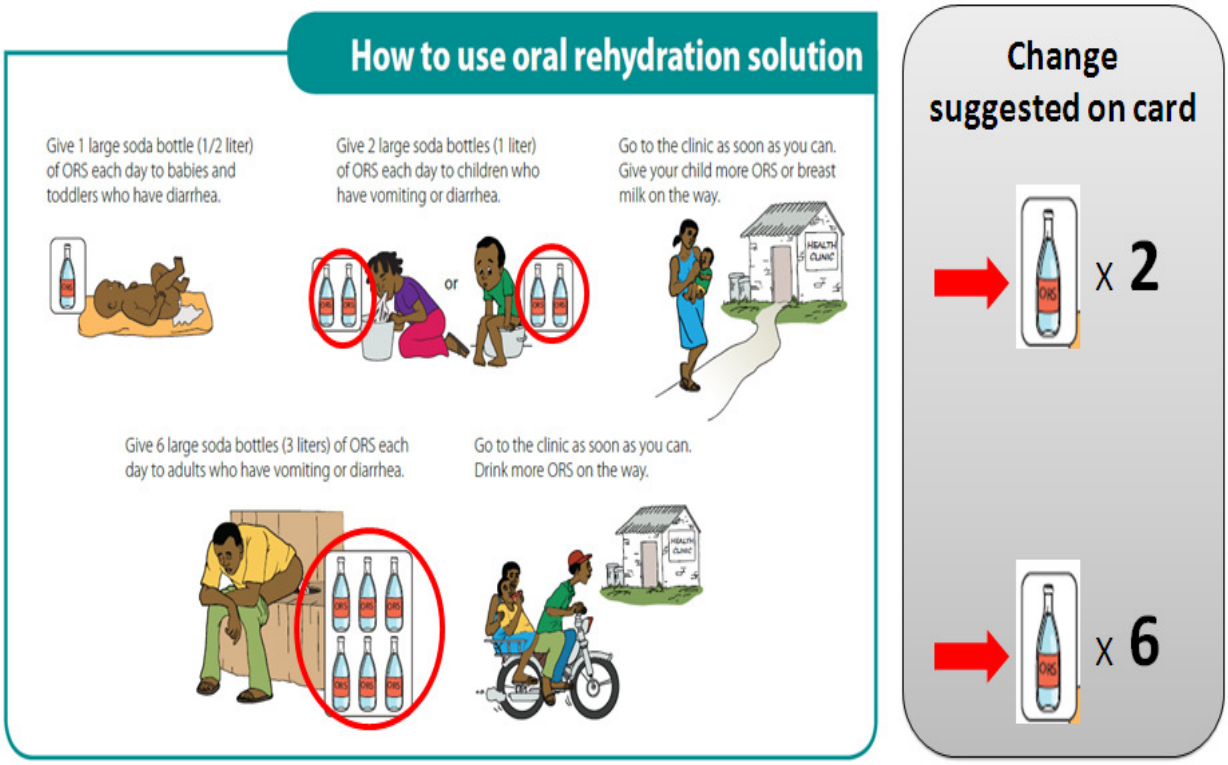
5.1.1 Design

The educational card on "How to Use Oral Rehydration Solution" shows how to properly prepare ORS in case of cholera infection. Instructions given on the educational card indicate the correct amount of safe water needed to dissolve the ORS packet using an empty, half liter soda bottle commonly used in Haiti as a measuring container (Figure 20). To dilute 1 packet of dry mixture (sodium and glucose) 1 liter of safe water is needed. ORS preparation is described for different age groups, as follows:

- for babies or toddlers who have diarrhea: 1 large soda bottle (1/2 liter) of ORS each day;
- for children who are vomiting or have diarrhea: 2 large soda bottles (1 liter) of ORS each day;
- for adults who are vomiting or have diarrhea: 6 large soda bottles (3 liters) of ORS each day.

During focus group meetings, it has been brought to our attention that the illustration card on "How to prepare ORS" lacks clarity in regards to using the empty soda bottle as a measuring vessel. As a result, CHWs reported to master trainers that in some cases ORS was not administered, as recommended, to patients presenting acute watery diarrhea at home or when traveling to a health facility. The reason why the instructions were not followed is because for some community members they did not have the total number of bottles shown on the card to prepare the solution. To prevent inadequate case management or limit potential errors when mixing ORS packets due to misunderstanding of messages, we suggest adding a numerical notation and a multiplication sign that may help understanding the factorial relationship between the bottle (a unit measure) and the amount of water needed to prepare ORS; and illustrate that the soda bottle is a measuring vessel and only one soda bottle is needed to measure the quantity of water needed to prepare ORS.

Figure 20. Educational card on How to Use Oral Rehydration



Source: www.cdc.gov[13]

5.1.2 Format or presentation

According to the June-July 2011 CDC trip report, 11 (84%) questionnaires were eligible for analysis. Respondents expressed the need of developing the CHW training materials in other formats for CHWs' use in the community to improve the quality of the community educational activities[62]. Suggested changes included:

- compilation of supplemental illustrative images on cholera control and prevention messages;
- development of water-proof laminated community education cards to prevent damages by water spills and/or rain when in the field, suggesting that a laminated format may be more sustainable and preserve the cards in better condition for a longer time;
- enlargement of educational cards into posters to facilitate visualization of educational materials during community activities on cholera control and preventive measures.

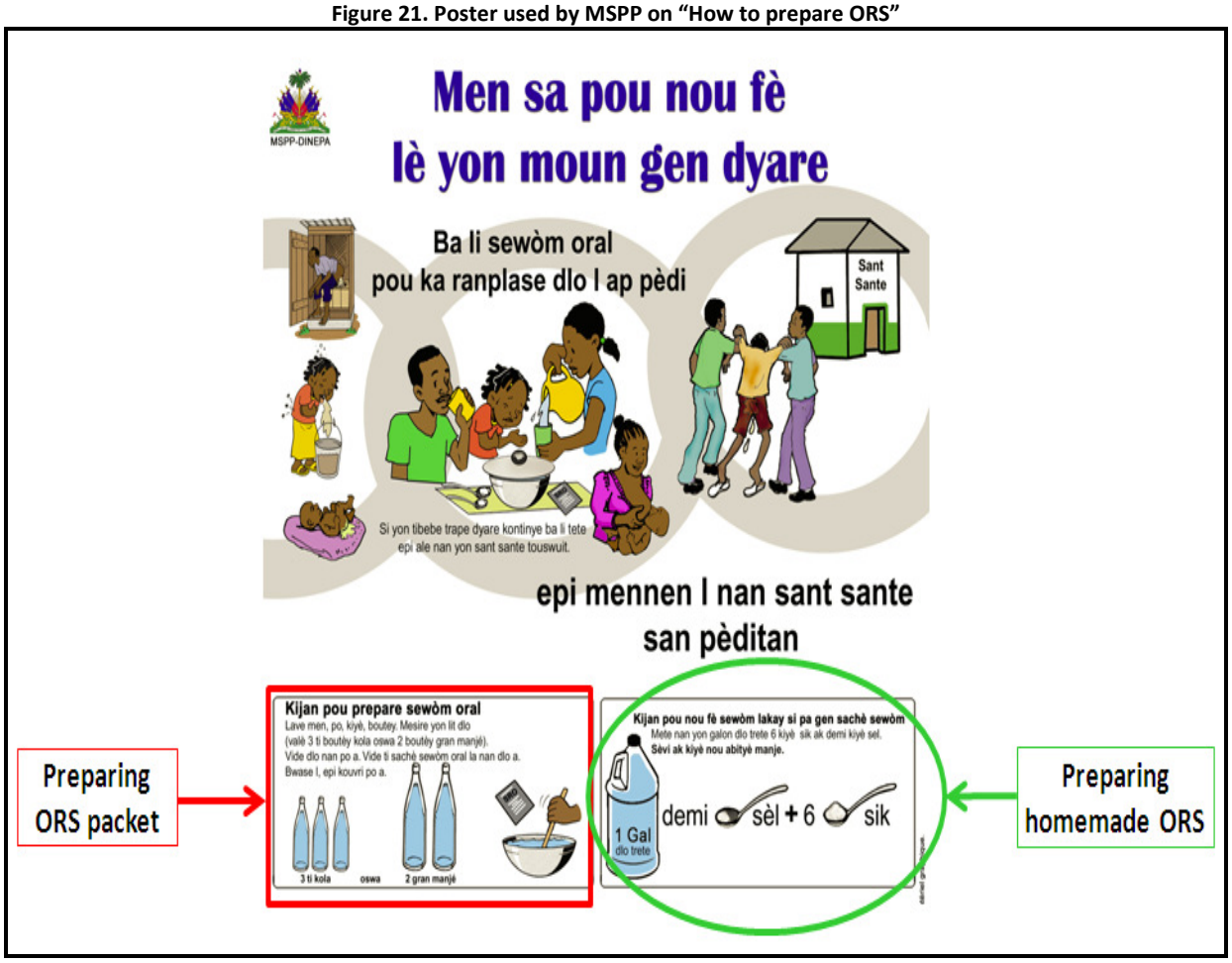
5.1.3 Content

Respondents provided recommendations suggesting to incorporate additional information to the training materials. Additional recommendations included adapting training materials for midwives; conducting additional training sessions for new CHWs; and including a brief history of cholera to help with demystifying the origin of the disease and to demonstrate that Haiti is not the only country experiencing cholera[62].

Although preparation of homemade ORS is not described in the CHW training materials, the master trainers reported having trained CHWs on how to prepare both homemade and commercialized ORS. Furthermore, they also emphasized on MSPP and the Haitian health minister at that time, Dr Alex Larsen encouraged health care providers, caregivers and the population to use the homemade ORS as an alternative, knowing that commercialized ORS is only sold in drugstores and the product is not always available in remote areas.

The homemade solution to drink is composed of three ingredients: salt, sugar and water; and obtained by mixing a half level teaspoon of salt and 6 level teaspoons of sugar and into one liter of clean water. MSPP also created a poster that is widely used in the community (Figure 21). Different theories or recommendations circulating around one issue may lead to confusion or non-compliance to the guidelines.

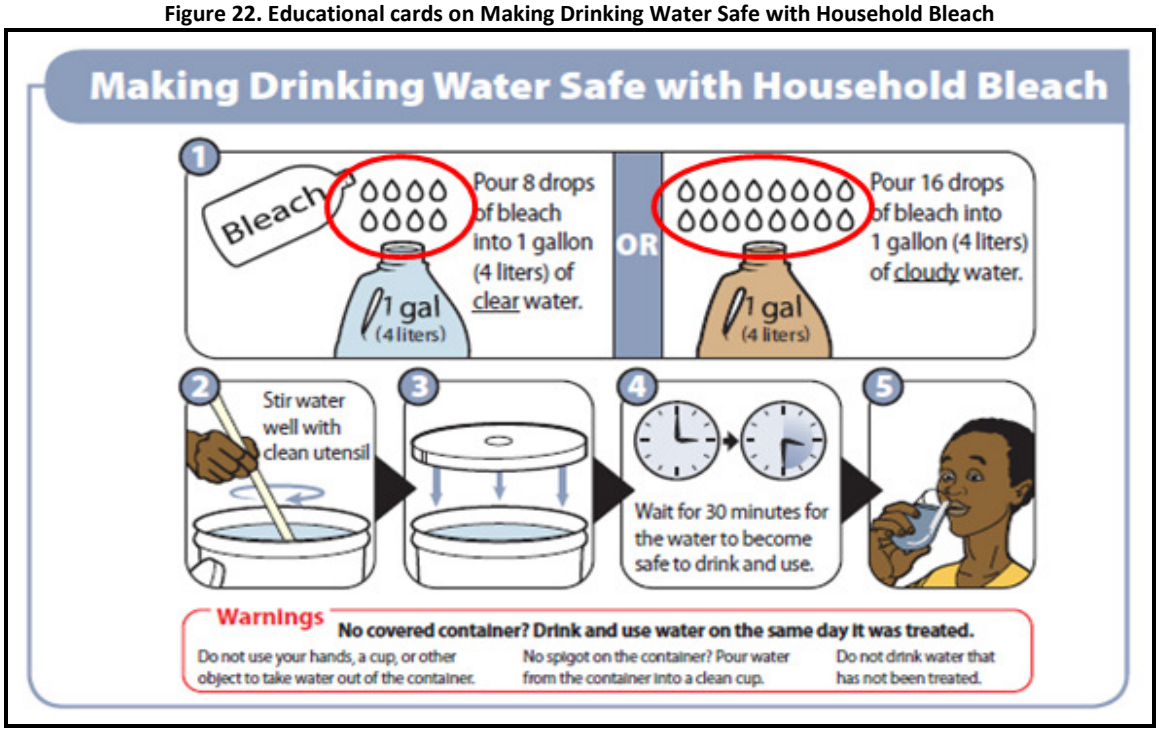
Figure 21. Poster used by MSPP on "How to prepare ORS"



Source: Cholera prevention message-poster MSPP, 2011[63]

The educational card on "Making Drinking Water Safe with Household Bleach" generated questions about the number of drops needed for 1 gallon of clear or cloudy water. According to some participants, the number of drops suggested (8 drops of bleach into 1 gallon of clear water; and 16 drops of bleach into 1 gallon of cloudy water) to make drinking water safe with household bleach is highly concentrated and may damage the gastric wall (Figure 22). Concerned about the interaction of the amount of chlorine used to treat the drinking water on the gastric walls, the master trainers were recommending the community to halve the concentration dose of the household liquid chlorine used to treat their water. This matter may require a consensus from CDC and MSPP before taking corrective actions.

Figure 22. Educational cards on Making Drinking Water Safe with Household Bleach



Source: www.cdc.gov[13]

5.1.4 Language

During the focus group meeting, there was no language inaccuracies reported from the master trainers.

5.2 Comments gathered from community health workers during the field evaluation

The following findings were captured from one-on-one interviews with CHWs during the field evaluation.

5.2.1 Design

During the field evaluation, the CHWs did not report any technical error with images used on the training materials.

5.2.2 Format or presentation

During the field evaluation, the CHWs mentioned the size of the images on the training materials was not appropriate to show to large groups during community educational activities. Large, sturdy, picture-based educational posters on cholera control and prevention measures are suggested for CHWs for use during their community education sessions. Additionally, a laminated copy of the community education cards would be preferred for use during community education sessions to help improve the community's understanding on effective measures to control and prevent cholera.

5.2.3 Content

Many CHWs requested supplemental training materials specifically books on cholera for their own knowledge.

5.2.4 Language

During the field evaluation, there were no language inaccuracies reported from the CHWs.

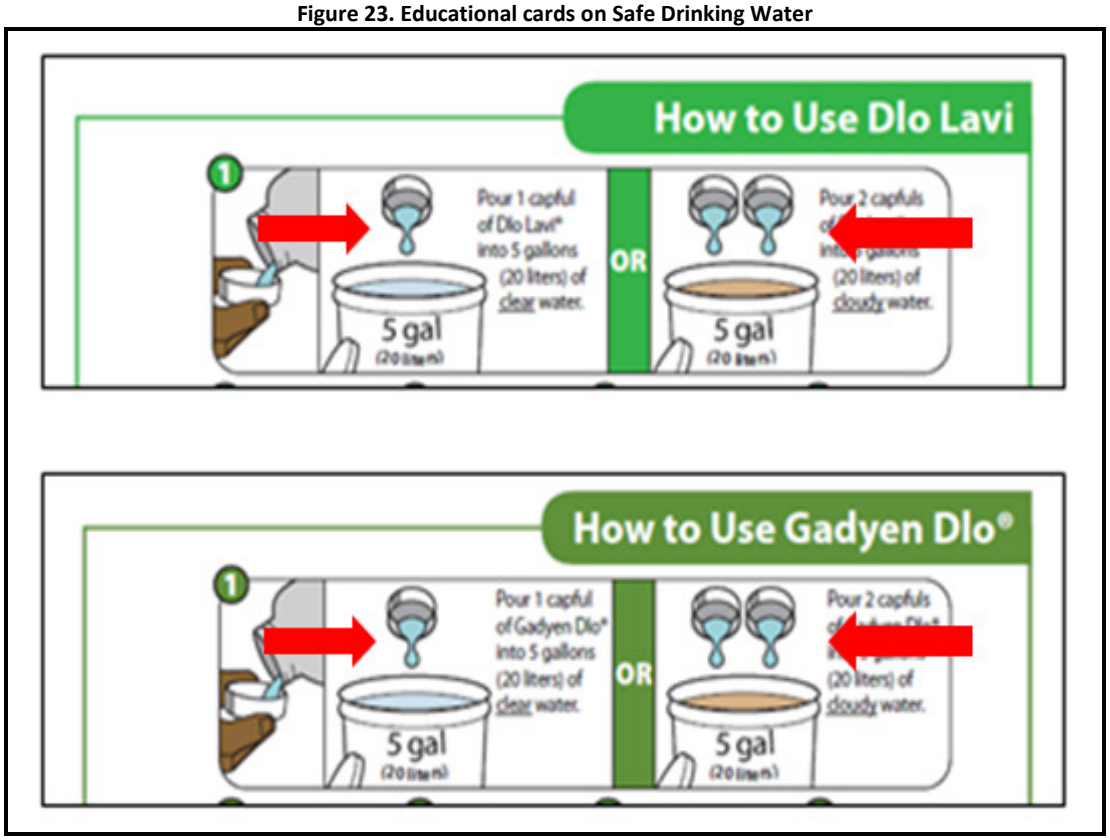
5.3 Suggestions made by partner institutions

In January 2012, the WDPB branch received supplemental comments from Save the Children, a partner organization involved in the cholera response in Haiti.

5.3.1 Design

The educational card on "Safe Drinking Water" that illustrates how to use the point-of-use water treatment products *Dlo Lavi*® and *Gadyen Dlo*®, may need some corrections. During the focus group, it was brought to the team's attention that the image illustrating adding drops of the liquid water treatment products (*Dlo Lavi*® and *Gadyen Dlo*®) was not clearly represented on the card (Figure 23). They suggested that the tip of the drop should be detached from the cap or including the number of drops would be more comprehensible.

Figure 23. Educational cards on Safe Drinking Water



Source: www.cdc.gov[13]

5.3.2 Format or presentation

The comments were about rearranging the order of the modules, suggesting that "Module 1", "Module 3", "Module 6", "Module 7", "Module 7A", and "Module 8" of the training could be placed at the end of the training document in appendix (Table 3). According to Save the Children, "Module 3" on "Decision Making Guide for Taking Care of People with Watery Diarrhea" appeared to be more appropriate for health agents (*Brigadiers*) and could be placed at the end of the manual as additional resources or an optional chapter for the CHWs' activities.

5.3.3 Content

The comments were regarding "Module 2" suggesting that the module should be more interactive and instead of Powerpoint® presentation slides, a set of game cards would be a very useful tool during the training; "Module 12" -- a recommendation to include a component on cadaver management in the community. The institution also suggested including in the training document an additional chapter on hygiene promotion (Table 3).

5.3.4 Language

According to Save the Children, a few terms used in the training manual and material needs to be reviewed. The term "Community Health Workers" should be replaced by the word "mobilizator" which would reflect more the role they occupy in the community.

In "Module 10", the section on "How do I prepare food safely?" outlined "Eat cooked food HOT" as a preventive measure to prevent cholera. Here the word "HOT" is referring to the food's temperature. Based on the feedback received from Save the Children, the Haitian Creole word "*cho*" used to translate the English word "hot" has been reported during focus groups to cause a misinterpretation of the message. The word is often confused with the word "hot" referring to spicy food.

Furthermore, "Module 3" should be titled "Cholera control and prevention" in lieu of "Decision Making Guide for Taking Care of People with Watery Diarrhea"

Table 3. Summary of suggestions made by Save the Children on CHW training manual

Module	Title	Action
Cover Page	-	The term "Community Health Workers' should be replaced by "*mobilisateur"* meaning mobilizator reflecting more the role of the CHWs.
Module 1	Community Mobilization	This module should be moved to the end of the manual
Module 2	What You Need to Know about Cholera	This module should be more interactive and instead of Powerpoint® presentation slides, a set of game cards would be very useful tool during the training
Module 3	Decision Making Guide for Taking Care of People with Watery Diarrhea	• This module can be placed at the end of the manual as an additional resource or an optional chapter because the messages appeared to be more appropriate for health agents ("*brigadiers*") • This module should be titled "Cholera control and prevention"
Module 6	Safe Drinking Water Aquatabs®	This module should be inserted in an appendix section
Module 7	Safe drinking water *Dlo Lavi*®	This module should be inserted in an appendix section
Module 7A	Safe drinking water *Gadyen dlo*®	This module should be inserted in an appendix section
Module 8	Safe Drinking Water PuR®	This module should be inserted in an appendix section
Module 12	When a Person with Cholera Dies at Home	This section should also cover cadaver management in the community.

5.4 Thesis project review

This section includes findings and recommendations obtained from the review process of the training manual conducted by the graduate student.

5.4.1 Design

The educational cards are designed to illustrate key messages on cholera control and prevention and to maximize the effectiveness of the tool for a low-literacy audience. In order to convey health messages on cholera control and prevention in a more effective manner, the set of educational cards should contain more images or drawings to increase the visual attributes of the tool. We are also suggesting an alternate design for the cards: the front of the cards could contain more image illustrations and the back of the cards would be reserved for the explanatory text related to the topic.

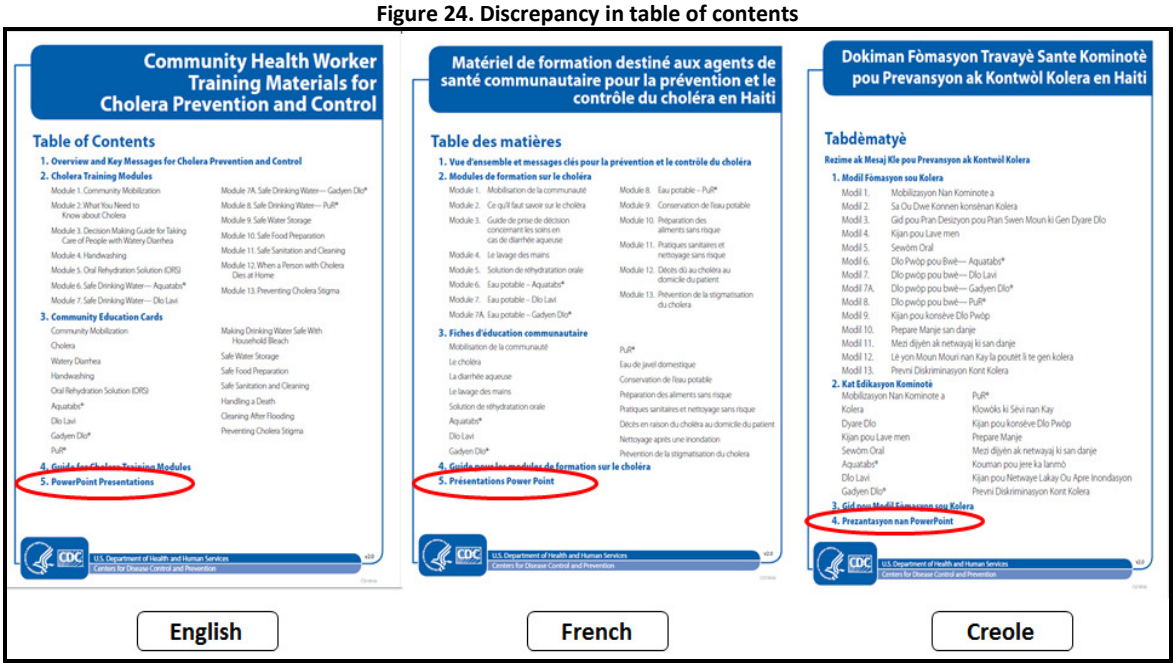
5.4.2 Format or presentation

The pages of the training materials, training manual and educational cards, are not numbered. Numbering the pages of the training tool is more user-friendly when looking up a specific cholera topic or to find pages during a group activity. The trainer may easily refer to a module by giving out the page number. Also, a cover page displaying only the title of the module could be included before each module as a separator tab to differentiate each section.

The training materials (training manuals, educational cards, and tutorial documents) are embedded in one electronic file on the website[13]. Having the option to print each component of the training materials separately would be more convenient for the users. Knowing that computer proficiency is not always a strength in a low-literacy population, we suggest uploading separately each training component on CDC and/or MSPP websites.

When comparing the "Table of Contents" of the three versions, we noticed the English and the French versions were similar and outlined five main chapters; whereas the Haitian Creole version numbered four main sections (Figure 24). The chapter on "Overview and Key Messages for Cholera Prevention and Control" is not numbered in the Haitian Creole version and it may be corrected if an updated version is envisioned.

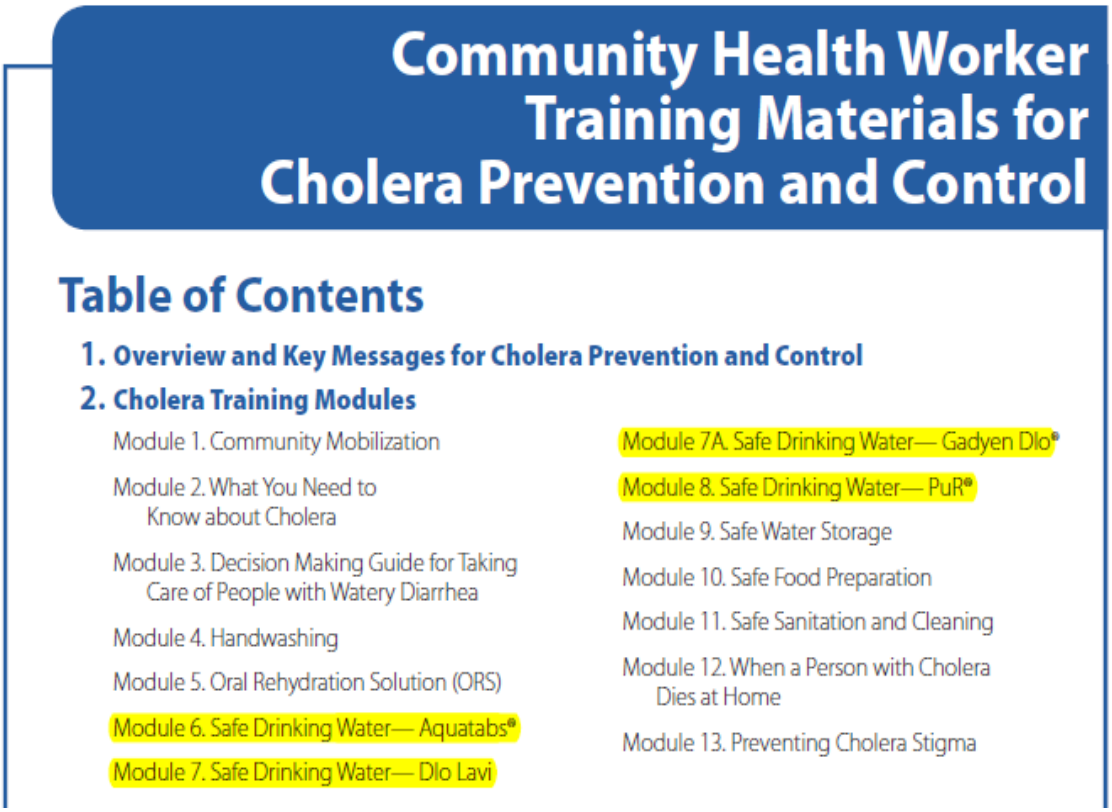
Figure 24. Discrepancy in table of contents



Source: www.cdc.gov[13]

The "Safe Drinking Water" component is covered in four training modules: "Module 6: Safe Drinking Water - Aquatabs®", "Module 7: Safe Drinking Water - Dlo Lavi®", "Module 7A: Safe Drinking Water - Gadyen Dlo®", and "Module 8: Safe Drinking Water - PuR®". For clarity purposes these sections could be numbered differently by having a general module on "Safe Drinking Water" under "Module 6", then the new "Module 6" could describe each point-of-use water treatment products in four sub-modules: "Module 6A – How to use Aquatabs®"; "Module 6B – How to use Dlo Lavi®"; "Module 6C – How to use Gadyen Dlo®"; and "Module 6D – How to use PuR®" (Figure 25).

Figure 25. Table of contents showing titles of modules on "Safe Drinking Water"



Community Health Worker Training Materials for Cholera Prevention and Control

Table of Contents

1. Overview and Key Messages for Cholera Prevention and Control

2. Cholera Training Modules

Module 1. Community Mobilization

Module 2. What You Need to Know about Cholera

Module 3. Decision Making Guide for Taking Care of People with Watery Diarrhea

Module 4. Handwashing

Module 5. Oral Rehydration Solution (ORS)

Module 6. Safe Drinking Water— Aquatabs®

Module 7. Safe Drinking Water— Dlo Lavi

Module 7A. Safe Drinking Water— Gadyen Dlo®

Module 8. Safe Drinking Water— PuR®

Module 9. Safe Water Storage

Module 10. Safe Food Preparation

Module 11. Safe Sanitation and Cleaning

Module 12. When a Person with Cholera Dies at Home

Module 13. Preventing Cholera Stigma

Source: www.cdc.gov[13]

There is a discrepancy on the first page of "Module 9 - Safe Water Storage" in the Haitian Creole version. The module's header title on the first page is different than the titles on the subsequent pages: the title on the first page is "*Kijan pou konseve dlo POTAB*" meaning "Potable Water Storage"; yet the header title of other pages is translated into "*Kijan pou konseve dlo PWOP* meaning "Clean Water Storage". Whereas, in the English version, the header title "Safe Water Storage" is used throughout the pages of "Module 9".

In the same manner the beginning of the training manual has a table of contents. For searching purposes, a table of contents listing the different modules covered in the series of educational cards could be inserted before the set of education cards.

5.4.3 Content

The training material was intended to train master trainers and CHWs. Master trainers would train CHWs who in turn will educate the community on cholera control and prevention. Because their roles in the community are different, we recommend that CDC develop a training manual on cholera control and prevention adapted to the needs of master trainers. The revised training materials on cholera would be exclusively for CHWs' use.

The module on "How to prepare ORS" did not specify that the ORS solution should be made with safe water (boiled or treated). Although in the case of severe diarrhea, which is considered as a medical emergency, it is recommended to prepare ORS with treated water or if not available, the water regularly available for drinking, guidelines on drinking safe water should be maintained in order to keep consistency across the document.

The educational card on "How to Wash your Hands' shows how to wash hands, and it also illustrates when to wash hands. The "When to Wash Your Hands" component is not clearly demonstrated on the card. On the actual card, the up and down arrows are used to indicate "WHEN" the action of washing hands should take place. In lieu of using up and down arrows as shown in the figure below, the key message could be portrayed on two separate cards by drawing on one card "How to Wash Your Hands" and on a different card "When to Wash Your Hands" (Figure 26). In addition, the actual card does not have a time component as to "How long should you was wash your hands?" This could be included in the revised version.

Figure 26. Showing educational card on How to Wash your Hands

Source: www.cdc.gov[13]

Before October 2010, cholera infection had not been found in Haiti in over a century. One year later, WHO approved the use of Shancol® OCV in Haiti. However, Haitian public health officials instigated many ethical concerns and initially disapproved the launch of the research protocol. In April 2012, after obtaining clarifications and upon agreement MSPP approved the distribution of the OCV for a pilot study. Because of the changes observed in health priorities around the cholera vaccine pilot, we suggest incorporating a module on OCVs in revised version of the training materials to empower CHWs with more knowledge that will better prepare them for educational community activities.

5.4.4 Language

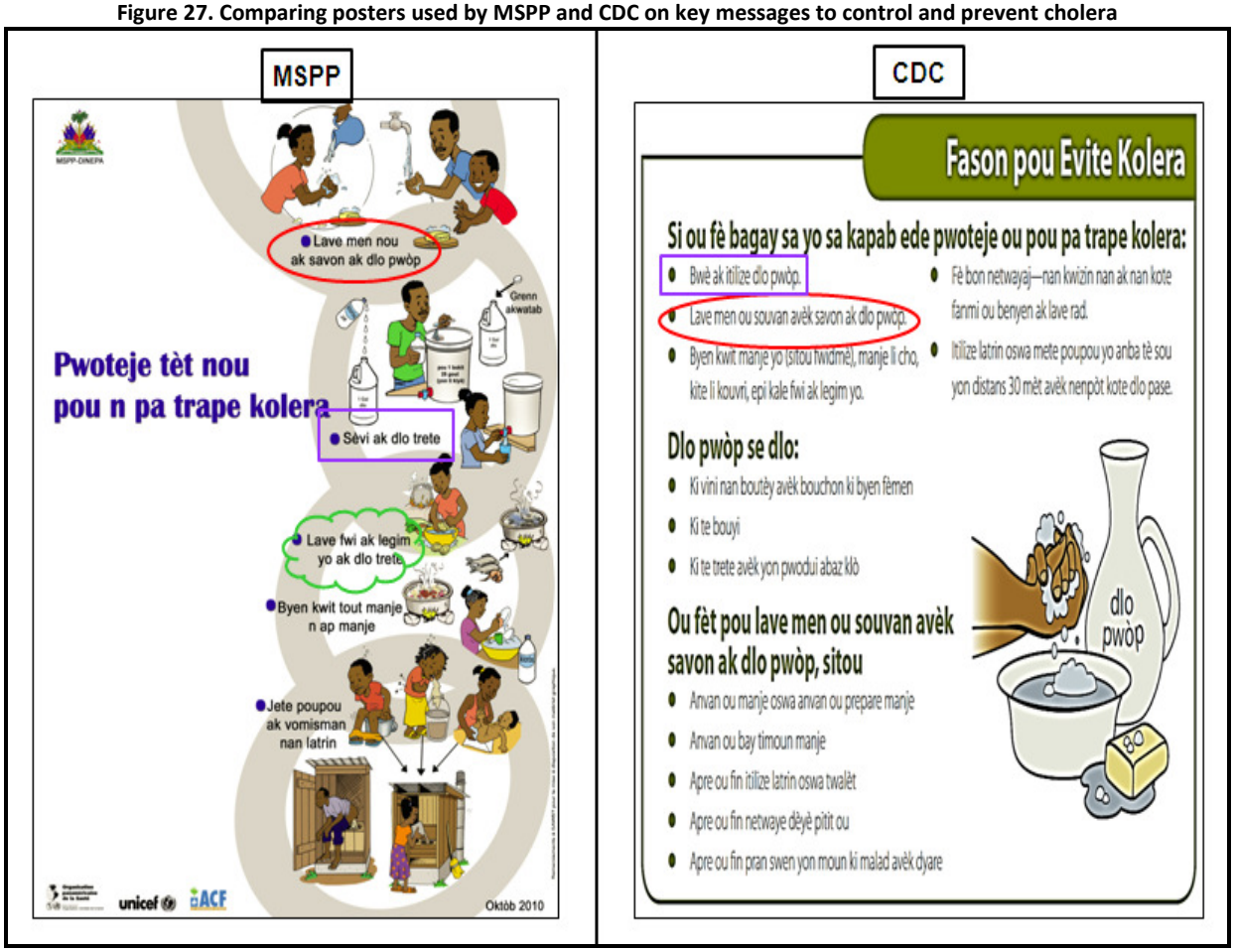
Throughout the Haitian Creole version, spelling and grammar errors are found in the text of training manual and the educational cards. Additionally, many words are not accurately translated from English into Haitian Creole. The main language inaccuracy discovered was around the term "Safe Water".

In several sections of the training materials, "Safe Water" is translated into Haitian Creole using the words "*dlo pwop*". In Haitian Creole the word "*pwop*" means "clean". "Clean water" cannot be interchangeably used for "safe water" because even if the water looks clear, it can contain cholera pathogens and other microbial germs. This discrepancy has raised questions about the appropriateness of the key message delivered. The use of treated water for drinking and adequate sanitation is the key intervention to control or prevent the spread cholera infection in a population. Furthermore, different Haitian Creole words such as "*dlo trete*" meaning "treated water"; "*dlo potab*" meaning drinking or potable water; "*dlo san danje*" meaning "water without danger or safe water", have been used in several locations in the document to refer to "safe water". The use of different terms or words can be confusing and misleading especially when dealing with a low-literacy audience. Therefore, it is important to be consistent with the translation of technical words from one language to another. For those reasons, we are suggesting a consensus on the appropriate word that will be used with consistence throughout the training tool. A complete list of the language inaccuracies around the term "safe water" is incorporated in the appendix at the end of the document (Appendix 2).

In addition to the inconsistencies around the words used for safe or treated water, we came across some variances around key messages delivered on "How to prevent cholera" in the Haitian Creole version. In some modules of the training materials, treated water was mentioned as the type of water to use to wash hands. When comparing a MSPP poster on key messages to control and prevent cholera to the key messages delivered in the CDC/MSPP training materials, the content of the message differed between them.

MSPP's message was to use "clean water" for handwashing; whereas "safe or treated water" is recommended on the CDC/MSPP training materials (Figure 27). Once again, it is important to be consistent with the message.

Figure 27. Comparing posters used by MSPP and CDC on key messages to control and prevent cholera



Source: Cholera prevention message-poster MSPP, 2011[64] **Source: EID Volume 17[60]**

5.4.5 Post hoc review around the term safe water

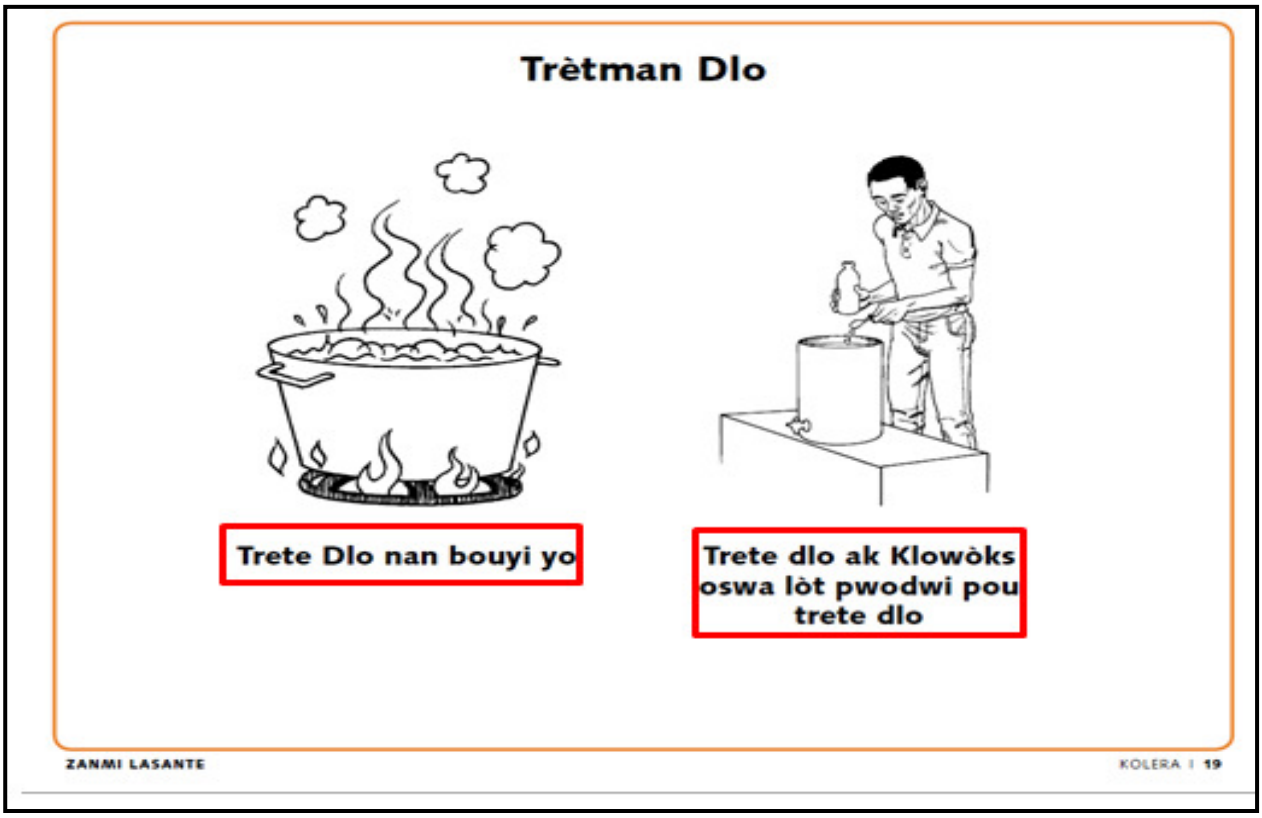
After identifying language inaccuracies around the term "safe water" a *post hoc* search was conducted using gray literature to compare terms used in the CDC/MSPP training materials to translate "safe water" with translated terms used on other training or support materials. Only documents available in Haitian Creole and using images or graphic illustrations were selected for the *post hoc* review.

We retained two institutions involved in cholera response in Haiti–the Direction Nationale de l'Eau Potable et de l'Assainissement (DINEPA), which is the National Haitian Drinking Water Association, and PIH–after finding published materials on key messages around cholera control and prevention measures. Poster materials published by these two institutions used the Haitian Creole words "*dlo trete*", meaning "treated water", to translate the term "safe water" (Figure 28-29). Whereas in the training materials developed by CDC/MSPP, different Haitian Creole words were used to translate the term "safe water".

Figure 28. Posters used by DINEPA on key messages to control and prevent cholera

Source: http://www.dinepa.gouv.ht

Figure 29. Poster used by Partners in Health on key messages to control and prevent cholera



Source: www.pih.org

Chapter 6 – Conclusion

Cholera is an ancient disease that has occurred over the past 200 years but it was described in documents dating back 2,000 years ago. During Ancient times cholera was found in many parts of the world. Today, the disease has been eliminated in developed countries with better sanitation but may emerge as an outbreak in countries with limited access to treated water, lack of sanitation and poor hygienic environment. Seven cholera pandemics have been documented worldwide.

Cholera is a bacterial disease that causes profuse watery diarrhea and severe dehydration that can lead to death within days. The disease is spread through the ingestion of contaminated food or drinking water. Water can be contaminated by the feces of a person infected with *Vibrio cholerae* or untreated water or sewage; and food may be contaminated with water containing the bacterial pathogen or by inadequate food handling by a person ill with cholera.

Before the introduction of cholera in Haiti in October 2010, the disease had not occured in the country in over a century. Given the pre-existing precarious conditions in Haiti and the recent situation following the devastating January 2010 earthquake, including poor access to safe drinking water, lack of environmental hygiene and sanitation, disrupted infrastructure, and large number of internally displaced population, the cholera outbreak in Haiti has been a major concern for public health officials worldwide. On October 19, 2010, within days after the disease onset, LNSP isolated *Vibrio cholerae* from stool specimens of patients presenting with acute watery diarrhea with severe dehydration. The outbreak was then confirmed by CDC on October 21, 2010. The outbreak emerged in the Artibonite Department, a rural city located approximately fifty miles north of Port-au-Prince, and spread to all ten administrative departments within the first two months. CDC partnered with MSPP, PAHO and other organizations to respond quickly to the complex humanitarian emergency. CDC in collaboration with MSPP developed training materials on cholera control and prevention, trained over 500 health care workers and more than 1,000 CHWs across the country.

The cholera epidemic in Haiti has become the largest country outbreak observed in the world, sickening more than 500,000 and claiming the lives another 7,000 by March 2012. CDC/MSPP developed training materials to train CHWs on cholera control and prevention. The CHW training materials are available in three languages and are widely used among health care personnel, CHWs and community leaders in Haiti. A series of evaluation activities were conducted by CDC to assess the impact of the training and the resources on the CHWs education activities. Subsequently, a review process of the training resources was launched to control for errors and omission of some data. During the review process we recorded suggestions from evaluation activities conducted after the implementation of training and identified in the training manual inconsistencies around language uses. Our main finding was regarding inconsistent translation of the term "safe water or treated water" in the Haitian Creole version.

There are some limitations and strengths related to the development of the training materials and the CDC evaluation activities and in the design of this project. The lack of systematic use of CDC/MSPP "CHW Training Manual for Cholera Prevention and Control" by institutions in Haiti could account for discrepancies between CHW education sessions. In addition, translating the training materials from English to French and then to Haitian Creole, present many challenges and barriers. Haitian Creole is not widely spoken outside of Haiti and there are some language variations between different regions of the country. However, the training materials are comprehensive, user-friendly, appropriate for the targeted audience; adapted to the Haitian community, available in the two official languages used in Haiti, French and Creole; and accessible for printing on the internet. Because cholera infection was not present in Haiti for the past century, the lack of baseline data will not allow a pre- and post-evaluation of understanding of messages delivered on cholera. Additionally, insufficient time and resources at the time of the outbreak explains omissions detected in the current versions of the training materials. The evaluation activities did not assess whether the training method used was appropriate for the audience. However, focus group meetings are an effective way to amass a large group in a short time and gather feedback on an intervention.

Also, participants at the June 2011 focus group unanimously reported that the training provided by the CDC in March 2011 was very useful and empowered health care providers with efficient cholera management skills that greatly contributed to controlling disease transmission. Most suggestions were requesting some changes regarding the training materials, especially the community education cards.

From this evaluation, our main recommendations to CDC and MSPP are to: 1) revise CHW training manual based on the findings and recommendations presented for this project; 2) pilot test various Haitian Creole words used to describe safe water to gather more information about the population's understanding of safe water terms; 3) conduct an in-depth comparison of CHW training manual developed by CDC/MSPP with other documents and messages published by partner institutions, particularly around the way treated water is described; and 4) compose at CDC a revision committee board to assist the communication team in the development of subsequent versions of the CHW training material.

Although cholera has had a dramatic effect on mankind, the disease has also contributed to medical progresses and behavior changes such as the discovery of ORS, vaccine development, promotion of safe water, sanitary improvements and environmental cleanliness. Furthermore, the implementation of effective cholera control and prevention measures in a community may indirectly reduce poverty, decrease the prevalence of other infectious diseases and increase life expectancy of a given population. Because the disease continues to claim lives of at-risk populations in developing countries, better cooperation is needed between public health officials with the goal to eliminate cholera in endemic regions.

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Appendix

Appendix 1 – List of partners institutions presented during evaluation activities

I. List of institutions represented during the focus group in June 2011

Organization / Affiliation	
International Child Care	ICC
Centre pour le Development et la Santé	CDS
Fondation pour la Santé Reproductrice et l'Education Familiale	FOSREF
Partners in Health	PIH
Unite de Gestion et de Programme / Ministry of Public Health and Population of Haiti / President's Emergency Plan for AIDS Relief	UGP/MSPP/PEPFAR
Haitian Group for the Study of Kaposi's Sarcoma and Opportunistic Infections	GHESKIO
Ministry of Public Health and Population of Haiti	MSPP
TOTAL	

II. List of institutions visited during CHW Evaluation in July 2011

Organization / Affiliation	
Hospital St Boniface	HSB
Ministry of Public Health and Population of Haiti	MSPP
Hospital St Boniface / Ministry of Public Health and Population of Haiti	HSB/MSPP
Hopital Immaculée Conception	HIC
Clinton Foundation/ Ministry of Public Health and Population of Haiti	Clinton Foundation /MSPP
TOTAL	

Appendix 2 – List of language inconsistencies found around the term "Safe Water"

	ENGLISH VERSION		CREOLE VERSION			COMMENTS
MODULES	**Words used**	**Page Number**	**Translated words used**	**Page Number**	**Incorrect translation**	
HOW YOU CAN HELP YOUR COMMUNITY FIGHT CHOLERA						
	Treated water	50	Dlo trete	49		-
	Boiled water	50	Dlo ki byen bouyi	49		-
	Running water	50	Dlo kap koule	49		-
CHOLERA						
	Safe water	51	Dlo pwòp	51	**X**	Should be "dlo san danje"
	Safe water	52	Dlo pwòp	51	**X**	Should be "dlo san danje"
WATERY DIARRHEA: WHAT TO DO						
	Drink and use safe water	53	Lave men yo souvan avèk savon ak dlo pwòp	53	**X**	• Drinking safe water is not included in the sentence • The key messages presented in the English version are different than those describes in the Creole version
	Clean water	54	Dlo pwòp	53		-
HANDWASHING						
	Safe water	55	Dlo pwòp	55	**X**	Should be "dlo san danje"
	Treated water	56	Dlo pwòp	55	**X**	Should be "dlo trete"
ORAL REHYDRATION SOLUTION (ORS)						
	Safe water	57	Dlo ki san danje	57		-
	Safe drinking water	57	Dlo pwòp	57	**X**	Should be "dlo san danje"
	Water is safe	57	Dlo pwòp	57	**X**	Should be "dlo san danje"
AQUATABS®						
	Making water safe	59	Fè dlo vin pwòp	59	**X**	• Should be "fè dlo san danje" • In the English version a table showing the dosage of aquatabs is used. Whereas packets of Aquatabs are shown in the corresponding age in the creole version
	Water can be made safe	59	Dlo ki kapab vin pwòp	59	**X**	• Should be "dlo san danje"

	N/A	N/A	Wap bezwen trete dlo a chak 24 etdan	59		• Sentence was not found in English version
	Clear water safe	60	Dlo klè	59	**X**	• Did not translate the word safe
	Cloudy water safe	60	Dlo twoub	59	**X**	• Did not translate the word safe
	Water to become safe to drink and use	60	Pou fè kantite dlo sa a vin pwòp	59		• Should be "dlo san danje pou bwè e sevi" • The images used to illustrate "How to use Aquatabs" in the English version are different than those used in the creole version
DLO LAVI						
	Making water safe	61	Rann dlo a san danje	61		-
	Safe water	61	Dlo san danje	61		-
	Water to become safe	62	Dlo a vin pwòp	61	**X**	Should be "dlo san danje"
	Pour 1 capful of Dlo Lavi into 5 gallons (20 Liters) of clear water	62	Pou trete chak 5 galon dlo ki klè	61	**X**	The word "treated" was not used in the English version
	Pour 1 capful of Dlo Lavi into 5 gallons (20 Liters) of cloudy water	62	Pou trete chak 5 galon ip a klè	61	**X**	The word "treated" was not used in the English version
	Water to become safe	62	Dlo a vin pwòp	61	**X**	Should be "dlo san danje"
	… to take water	62	… nan veso dlo ki finn trete	61		The word "treated" was not used in the English version
	Pour water from a container into a clean cup	62	Vide dlo treté a nan yon gode ki pwop	61	**X**	The word "treated" was not used in the English version
	Has not been treated	62	Ki pa treté	61		-
GADYEN DLO						
	Making water safe	63	Pou rann dlo a san danje	63		-
	Drink and use safe water	63	Pou bwè e pou sèvi ak dlo ki san danje	63		-
	Safe water	63	Dlo san danje	63		-
	Make water safe	63	Pou ip dlo a san danje	63		

	Pour 1 capful of Dlo Lavi into 5 gallons (20 Liters) of clear water	64	Pou trete chak 5 galon dlo ki klè	63	**X**	The word “treated” was not used in the English version
	Pour 1 capful of Dlo Lavi into 5 gallons (20 Liters) of cloudy water	64	Pou trete chak 5 galon ip a klè	63	**X**	The word “treated” was not used in the English version
	Water to become safe	64	Dlo a vin pwòp	63	**X**	Should be “dlo san danje”
	… to take water	64	… nan veso dlo ki finn trete	63		The word “treated” was not used in the English version
	Pour water from a container into a clean cup	64	Vide dlo treté a nan yon gode ki pwop	63	**X**	The word “treated” was not used in the English version
	Has not been treated	64	Ki pa treté	63		-
PUR						
	Safe water	65	Dlo pwòp	65	**X**	Should be “dlo san danje”
	Make water safe	65	Rann dlo a san danje	65		
	Makes water looks clear	65	Fè dlo a vin klè	65		Use of word “klè” meaning “clear” is appropriate but maybe misleading
	Wait for 20 minutes for the water to become safe to use and drink	66	Rete tan 20 minit avan dlo a vin pwòp	65		Use of word “pwòp” meaning clean is appropriate but word maybe misleading
	… to take water	66	… nan veso dlo ki finn trete	65		The word “treated” was not used in the English version
	Pour water from a container into a clean cup	66	Vide dlo treté a nan yon gode ki pwop	65	**X**	The word “treated” was not used in the English version
	Has not been treated	66	Ki pa treté	65		-
HOUSEHOLD BLEACH						
	Making drinking water safe	67	Klowòks ki Sèvi nan Kay	67		In the Creole version the title of this module does not mention drinking water safe
	Making water safe	67	Dlo vin san danje	67		-
	Safe water	67	Dlo san danje	67		-
	Make water safe	67	Fè dlo vin san danje	67		-

	makes water safe for drinking	67	fè dlo vin san danje pou bwè	67		-
	to make water safe	67	Fè dlo vin san danje	67		-
	the water to become safe to drink and use	68	Dlo a vin pwòp	67	**X**	Should be “dlo san danje”
	… to take water	68	… nan veso dlo ki finn trete	67		The word “treated” was not used in the English version
	Pour water from a container into a clean cup	68	Vide dlo treté a nan yon gode ki pwop	67	**X**	The word “treated” was not used in the English version
	Has not been treated	68	Ki pa treté	67		-
SAFE WATER STORAGE						
	Safe water storage	69	Kijan pou konsève dlo pwòp	69	**X**	Should be “dlo san danje”
	Making water safe	69	Ran dlo a san danje	69		-
	Safe water	69	Dlo pwòp	69	**X**	Should be “dlo san danje”
	Keep water safe	69	Kenbe dlo a san sanje	69		-
	Safe water	69	Dlo pwòp	69	**X**	Should be “dlo san danje”
	Safe water	69	Dlo pwòp	69	**X**	Should be “dlo san danje”
	Safe water storage	70	Kijan pou konsève dlo pwòp	69		• If referring to how to store water for household use the word “pwòp” is correct
	Safe water	70	Dlo pwòp	69		• If referring to how to store water for household use the word “pwòp” is correct • In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???
	Safe water	70	Dlo pwòp	69		• If referring to how to store water for household use the word “pwòp” is correct • In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???

	Safe water	70	Dlo pwòp	69		• If referring to how to store water for household use the word “pwòp” is correct • In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???
FOOD PREPARATION						
	Safe water	71	Dlo pwòp	71		• If referring to how to store water for household use the word “pwòp” is correct • In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???
	Safe water	71	Dlo pwòp	71	**X**	Should be “dlo trete”. Here the use of safe water is for cooking
	Wash your hands with treated water before you eat or cook	72	Lave men ou souvan ak savon e ak dlo pwòp lè w kwit manje	71	**X**	• In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing??? • The time component “before” is not included in the Creole translation • The Creole sentence does not indicate before you eat or cook. It is only describing to wash hands “when cooking”
	Use treated water for cooking	72	Sevi ak dlo ki san danje pou kwit manje	71		-
	Clean kitchen surfaces, pans, and utensils with soap and treated water	72	ak dlo ki san danje	71		-
SAFE SANITATION AND CLEANING INSTRUCTIONS						
	Safe water	74	Dlo pwòp	73		In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???
	Safe water	74	Dlo pwòp	73	**X**	Defining “dlo pwòp” as safe water

	Safe water	74	Dlo pwòp	73		In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???
HANDLING A DEATH: WHEN A PERSON DIES AT HOME						
	Safe water	75	Dlo pwòp	75		In the English, safe water = treated water. Here it is suggesting the use of safe water for handwashing???
	Safe water	75	Dlo pwòp	75	**X**	Defining “dlo pwòp” as safe water
HANDLING A DEATH: FUNERALS						
	wash their hands often with soap and treated water	76	Lave men w tout tan ak savon e ak dlo pwòp	75	**X**	The word “treated” is translated to Creole by “dlo pwòp” meaning clean water
	Clean all food preparation areas and kitchenware with soap and treated water	76	yo ak savon e ak dlo pwòp	75	**X**	• The word “treated” is translated to Creole by “dlo pwòp” meaning clean water • This sentence is not listed in the same order in the creole version
	Use only treated water for drinking, cooking and washing	76	Bwè dlo pwòp epi itilize li pou tout sa ou bezwen fè nan kay la	75	**X**	• The word “treated” is translated to Creole by “dlo pwòp” meaning clean water
	Store treated water in a clean, covered container	76	Konsève dlo pwòp	75	**X**	• The word “treated” is translated to Creole by “dlo pwòp” meaning clean water
	Wash your hands with soap and treated water after using the latrine. Clean under your nails when you wash	76	N/A	75	**X**	This sentence is not included in the Creole translation