

# **THE IMPACT OF CONFLICT IN CHOLERA RESPONSE INTERVENTIONS: THE CASES OF SOUTH SUDAN AND YEMEN.**

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# **THE IMPACT OF CONFLICT IN CHOLERA RESPONSE INTERVENTIONS: THE CASE OF SOUTH SUDAN AND YEMEN.**

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

By

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Mexico

Declaration:

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The thesis "The impact of conflict in cholera response interventions: The cases of South Sudan and Yemen" is my own work.

Signature:

A handwritten signature in black ink, appearing to read 'LAGR', with a horizontal line extending to the left and a large, stylized flourish extending to the right.

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This thesis is dedicated to all the healthcare professionals working under the line of fire and all the populations affected by conflict who with great resilience overcome unimaginable challenges.

## List of abbreviations

CFR	Case Fatality Rate
CTC	Cholera Treatment Centre
GTFCC	Global Task Force on Cholera Control
IDP	Internally Displaced Populations
INGO	International Non-Governmental Organization
LMIC	Low-middle-income-countries
MoH	Ministry of Health
MSF	Medecins Sans Frontieres
OCV	Oral Cholera Vaccine
ORP	Oral Rehydration Points
ORS	Oral Rehydration Salts
REC	Research Ethics Committee
RDT	Rapid Diagnostic Test
SPLA-IO	Sudan's People Liberation Army Internal Opposition
SPLM-IO	Sudan People's Liberation Movement Internal Opposition
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, sanitation and hygiene
WHO	World Health Organization

## Abstract

**Introduction:** Cholera remains a global burden affecting mainly Low-middle-income countries including those affected by conflict. The coincidence of conflict and cholera is associated with worst outcomes due to impaired responses as it jeopardizes access to the affected populations because of insecurity, impairing the capacity of the actors to carry out interventions to contain the outbreaks. Little has been described about the adaptations that cholera interventions undergo when a conventional approach is not feasible in conflict settings. This thesis aims to explore how conflict and its consequences define cholera outbreak management strategies through the example of South Sudan and Yemen in order to formulate pertinent recommendations.

**Methodology:** Research questions were answered through a literature review of the grey and published literature about the past cholera outbreaks in South Sudan (2014-2017) and Yemen (2016-2018), with emphasis on documents detailing its management and implementation. Three semi-structured interviews with key informants were carried out to complement and illustrate the findings.

**Results:** The main challenges influencing cholera response in conflict settings are the already weakened health systems and the multiple access barriers affecting the coverage and scope of interventions. Every single component of the cholera response is negatively impacted by conflict and the current recommendations for outbreak response are not always applicable in these contexts. Modifications made to enhance interventions were mainly oriented towards facilitating case confirmation and surveillance, decentralization of care, increased participation of the community in response implementation and outbreak prevention and contention using oral cholera vaccines.

**Conclusion:** Cholera outbreak management as advised today is only possible to implement in a frame of peace and not in one of war, this results in fragmented interventions and protracted large-scale outbreaks. It is needed to update the cholera response guidelines by adopting a conflict sensitive approach; integrating the best possible practices feasible to implement in conflict affected settings for outbreak contention and prevention.

**Key words:** Cholera, Outbreak, Conflict, Response, South Sudan, Yemen.

**Word Count: 13,176**



## Introduction

As a medical doctor initially I understood medicine and its practice as the act of restoring health through direct patient care; it was in Mexico when I was first confronted with the fact that a health system and the environment can also play against this principle and how sometimes direct patient care might not be enough to alleviate suffering. This revelation was what guided my career in a completely different direction and I decided to join Medecins Sans Frontieres (MSF).

I've had the chance to work in different contexts for the last several years and in a variety of positions, such as medical doctor in the field, and more recently, as a medical coordinator in charge of all the medical activities and strategy design for countries like Ukraine and South Sudan. It was this latter of these two that put me face to face with the coalition of two monsters: Cholera and Conflict.

Working in the field in the midst of medical humanitarian crises I realized that despite the availability of guidelines, protocols and standard operating procedures for interventions, very frequently these were invalidated due to the different constraints posed by the context which greatly impaired ideal implementation. It's at that point when creativity, analysis, innovation and coordination become key factors in order to adapt strategies, with the resources at hand and in such a way that it is feasible, so contextual challenges can be overcome and actors involved remain capable of delivering relevant and effective responses.

The coexistence of cholera outbreaks and conflict is an example of the past statement. Cholera outbreak management principles are well established and have proven to be effective if correctly implemented. But what happens when one or several components of a cholera response are not possible to materialize due to the presence of conflict and its direct and indirect consequences? I was personally confronted with such dilemmas during my mission in South Sudan in 2017 which is one of the reasons I decided to elaborate on this subject for my master's thesis.

The different dynamics triggered by conflict make conventional cholera interventions difficult, if not impossible, to implement. Access to the affected populations, surveillance, quality diagnosis, treatment and control measures for the outbreak become a challenge as conflict impairs the required proximity to the communities and health facilities to alleviate the outbreaks. Because of this, fragile states often bear a heavier burden

of cholera, leading to longer outbreak durations, higher attack rates and higher morbidity/ mortality (1).

This thesis aims to describe how conflict and its consequences shape cholera outbreak management strategies through the example of South Sudan and Yemen in order to generate relevant recommendations for future interventions in contexts with similar challenges.

These two countries were chosen for study as they represent recent outstanding examples of the implementation of cholera outbreak response in conflict affected settings. My latest work experience in South Sudan also motivated me to deepen this subject analysis, hoping to give something back that could be useful for the actors involved in future response implementation.

Cholera remains a public health concern worldwide, and states in conflict are in an increased risk of cholera outbreaks; it's therefore important to describe the possible interventions to overcome the barriers imposed by conflict to be able to contain cholera outbreaks despite these challenges. Medical humanitarian interventions, notably emergencies, will continue to be my professional field of work, which is why this subject is of extreme relevance on a personal note.

Living in an era in which armed conflicts spread rapidly and evolve into protracted crisis, jeopardizing access to basic services and profoundly affecting living conditions positions these populations into an increased risk for cholera; it's time to react and acknowledge the hostile environments in which cholera interventions are to be implemented in order to develop better tailored strategies that can facilitate saving lives and preventing new infections. Given that conflicts and settings are always unique, considerations to deal with the challenges brought by conflict in these situations need to be part of the current cholera response guidance documents.

# Chapter 1: Background

## 1.1 Yemen

### 1.1.1 Geography

The Republic of Yemen was created in 1990 with the unification of the Yemen Arab Republic and the People’s Democratic Republic of Yemen, also known as North and South Yemen respectively. The young country is situated in the Middle East in the south extreme of the Arabian Peninsula sharing borders with Saudi Arabia and Oman (2,3).

The country is extended in 527,970 square kilometres in a territory that includes desert regions, mountain chains and a costal line in the Red Sea. Yemen’s administrative division consists of twenty-one governorates, subdivided into 333 districts, and one municipality (3,4). A map of Yemen is displayed for reference in *Figure 1* (5).

**Figure 1: Yemen administrative divisions map**



SOURCE: UNIVERSITY OF TEXAS LIBRARIES (2012) (5)

### 1.1.2 Demographics

Yemen's population was estimated to be 19,684 603 habitants as per the last census in 2004; but the World Bank estimates 27,580,000 habitants by 2016. 70 percent of the population lives in rural areas spread across the country with a predominance of Arab communities but also including Afro-Arabs, South Asians and Europeans (4,6).

The country's population is predominantly young with 46 percent of the population being less than 15 years old and only less than 3 percent older than 65 years (3). Yemen holds one of the highest growth rates in the world with 3.1%, this can be explained by the low use of contraceptives which contributes to the fertility rate of 6.2 (2).

Although the population is nearly equally divided between males and females there are important gender gaps due to different cultural, religious, political and social factors. These inequities are further evidenced by the disparities between urban and rural areas whereas rural children have 22% greater possibility of dying before turning 5 years old compared to children in urban areas (2,7).

### 1.1.3 Health profile and health system

Despite the important progress made in the 1990's in terms of health indicators these are still below acceptable norms. The infant mortality rate is 76 per 1,000, the under-five mortality rate is 101.9 per 1000 and the life expectancy at birth is 62.9 years. Mother and child health remain of great concern as Yemen is among the countries with the higher maternal mortality rates and up to half of the children under five years old suffer from malnutrition (7).

Even before the recent crisis and consequent cholera outbreak, diarrhea was already the main cause of morbidity and mortality in the general population. Other important causes of morbidity in the country included malnutrition, obstetrical complications, respiratory disease and malaria (7).

The Yemeni health system follows the primary health care approach and services are provided on a typical three layered system with health units, district hospitals and tertiary level facilities; these last ones are mainly available in urban settings which serve as teaching hospitals (2). Only close to 50 percent of the health facilities in the country are functional because of the disruption caused by conflict and severe challenges are faced for staff salary payment as well as for procurement of medical supplies resulting in shortages and low staff morale (8).

#### 1.1.4 Conflict and humanitarian crisis

Yemen entered into a full blown armed conflict in June 2014 between the national government with its supporting coalition led by Saudi Arabia and the Houthi militias with backing from Iran. This was further escalated by the return of radical Islamists factions like the Islamic State which took advantage of the political turmoil to expand their presence in the country (9,10).

Insecurity in the country continues to increase with armed conflict and other forms of violence prevailing with terrible consequences for the population, which even before the conflict, already lived below the poverty line and with high rates of unemployment, lack of access to basic services and human rights violations (8).

The conflict has now expanded to all the 22 governorates in the country, infrastructure has been severely damaged with housing, schools and healthcare structures affected or destroyed which among other consequences of conflict, has caused over three million people displaced (8). An estimated 22 million Yemenis are in need of humanitarian aid, more than half of the healthcare facilities in the country are not functional and more than 50 percent of the population lacks a stable access to safe drinking water (11).

The health system in Yemen has recently collapsed due to the conflict, resulting in 16.4 million people without access to health services, 62,000 injured or killed and 50 percent of deaths due to maternal, nutritional or communicable conditions including cholera reported in 2017 (12).

The conflict has worsened an already existing humanitarian crisis making it one of the worst today. The crisis has called together a variety of actors from the international community to local authorities in order to provide the desperately needed assistance. These have encountered several challenges for their relief operations like restricted access, bureaucratic constraints and high levels of insecurity (10).

#### 1.1.5 Cholera outbreaks

The weakened health system together with the over 2 million people in need of water and sanitation services has led to two cholera outbreaks in Yemen in October 2016 and May 2017 beginning in the capital Sana'a; this last one has been the fastest spreading cholera epidemic ever registered. Unfortunately the government resisted to declare the outbreak

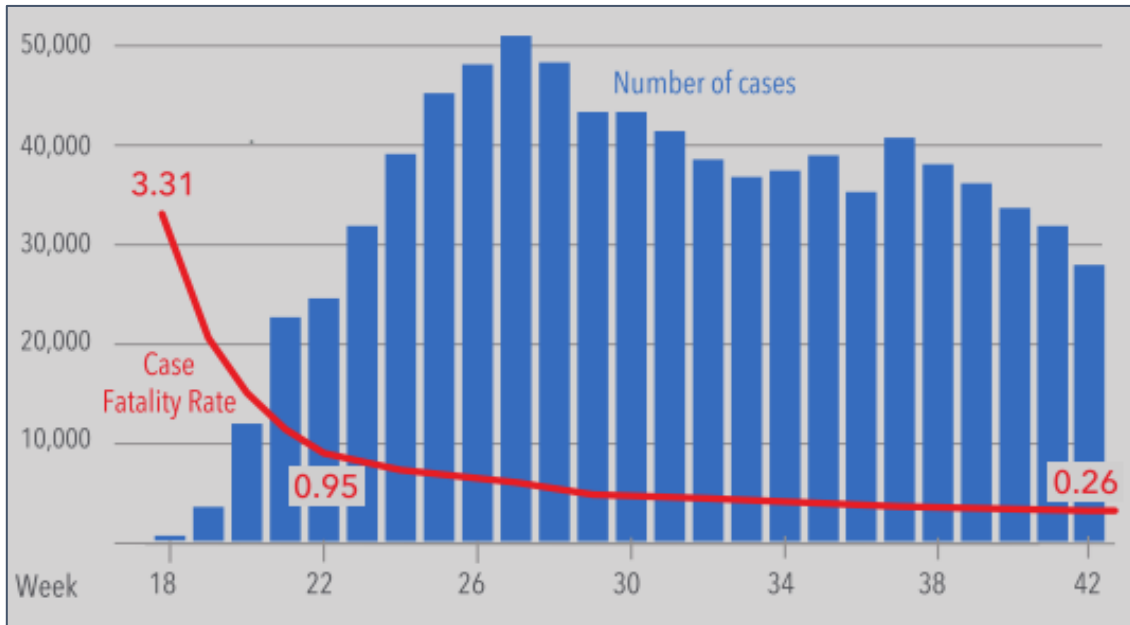
which translated into slower and only partial responses, creating a lack of trust between local and international actors (10).

The quick transmission could be explained in part by the high rates of malnutrition, insufficient health services, food insecurity and scarce sanitation systems which are all direct consequences of the ongoing conflict (13). This outbreak has been of unprecedented dimensions with 21 out of 22 governorates affected, 1,105,371 suspected cholera cases and 2,300 associated deaths since the second wave of the outbreak in April 2017 until June 2018 according to the World Health Organization (14).

Cholera is affecting the most vulnerable populations in the country with internally displaced populations (IDPs) at increased risk of infection due to poor living conditions and children under 18 years of age representing 57 percent of suspected cases and 25 percent of deaths; adults over 60 years old account for 30 percent of all fatalities (15). Nevertheless, despite all challenges, 99 percent of those ill with cholera that had access to treatment have survived the infection reaching a case fatality rate (CFR) of 0.22 percent, but the percent of cholera affected patients without access to treatment is unknown (12).

Political factors seem to importantly influence the epidemic trends as the areas under Houthi rebels control (67% of the population) are more heavily affected by the outbreak, with reported attack rates in 2017 reaching 17 per 1000, compared with government controlled governorates (23% of the population), where attack rates reported were of 10 per 1000; same as in the disputed areas by government and rebel factions (16). The overall attack rate for the country from the onset of the outbreak and until the 1<sup>st</sup> quarter of 2018 was 3.69 percent and the CFR remained mostly below 1 percent except during the early stages of both epidemic waves as shown in *Figure 2* (15,17).

**Figure 2: Number of cholera cases VS case fatality rate Yemen April-October 2017**



SOURCE: UNOCHA (2017) (15)

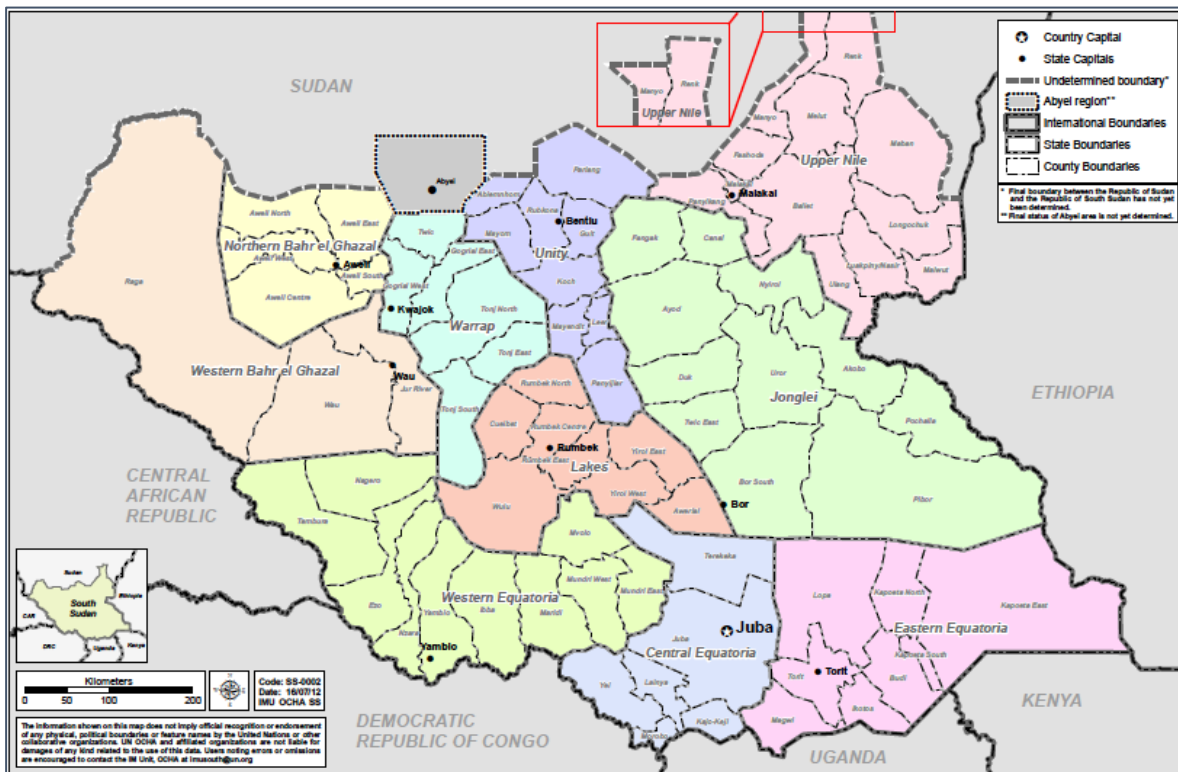
Before this set of outbreaks Yemen had not suffer cholera since 1980, though it can be expected for cholera to become endemic due to the magnitude of the outbreak and the torn by war infrastructure of the country (18).

## 1.2 South Sudan

### 1.2.1 Geography

South Sudan, the youngest country in the world, extends in 640,000 square meters completely surrounded by land, bordering with Sudan, Ethiopia, Kenya, Uganda, Democratic Republic of Congo and the Central African Republic (Figure 3) (19). A special administrative area, Abyei, is still claimed by both Sudan and South Sudan. The country's territory is mainly plain with low mountains in the northern regions and rainforests in the rest of the country. Wet and swamp areas are formed by the passage of the White Nile river across the country (20).

**Figure 3: South Sudan counties map**



**SOURCE 1: UNOCHA (2012) (19)**

### 1.2.2 Demographics

According to the last census of 2008, before the country’s independence, South Sudan’s population is 8.26 million although statistics from 2013 estimate 11.3 million habitants according to WHO; the density is estimated to be 15 people per square kilometre (20,21). More than 80 percent of the population is based in rural areas and 72 percent are under the age of 30. Female and male populations are balanced with 52 and 48 percent of the total population respectively. The country’s fertility rate is 6.7 with only 4% of married women using contraceptive methods; while the life expectancy is 42 years (20,22).

The main ethnic groups in the country are the Dinka, representing 36 percent of the population, and the Nuer which constitutes the 16 percent (20).

Average living conditions are characterized by scarce access to safe drinking water (less than 50%), scarce sanitation services (7%) and extremely high illiteracy rates among the adults reaching 88 percent among women and 63 percent among men (22).



### 1.2.3 Health profile and health system

South Sudan has a maternal mortality rate of 2,054 deaths per 100,000 births making it one of the highest in the world. The infant mortality rate is 102 per 1000 and the under 5 mortality rate is 135 per 1000 which are dramatic indicators. Despite the high fertility rate, only 10 percent of births are assisted by a professional birth attendant (23).

Lower respiratory infections (12%), HIV/AIDS (11.4%), diarrheal diseases (6.8%), malaria (4.6%) and pre-term complications are the top five causes of death; while maternal, neonatal, nutritional and infectious diseases represents South Sudan's main burden of disease (21).

The weak South Sudanese health system is the result of years of protracted conflict which led to its collapse, profoundly affecting the service provision. Service delivery is decentralized and divided into four tiers with Primary Healthcare Units, Primary Healthcare Centres, County Hospitals and State Hospitals (22). In 2011 only 2 percent of the national budget was allocated to health initiatives in comparison with 29% for security. By 2012 only 77 percent of the country's health facilities were functional, 26 percent had sufficient infrastructure and 33% were in need of full rehabilitation (20,23).

### 1.2.4 Conflict and humanitarian crisis

After acquiring its independence from Sudan in July 2011, South Sudan entered into a new armed conflict during the independence celebration in 2013 between the two rebel factions represented by President Kiir and his former deputy Riek Machar (24).

A peace agreement was reached by August 2015 between the Sudan People's Liberation Movement Internal Opposition (SPLM-IO) and the Sudan's People Liberation Army Internal Opposition (SPLA-IO) nonetheless, conflict restarted in July 2016 in Juba, the capital of the country, to rapidly spread across the nation (25). By then, South Sudan suffered a macroeconomic collapse additionally contributing to the country reaching the bottom for most global health, economic and development indicators which overlapped with the country's third cholera outbreak since its independence (26).

The human consequences have been disastrous with 7.5 million people in need of humanitarian aid, 2 million internally displaced and another 2 million refugees in neighbouring countries (25).

The displaced live now in overcrowded camps in suboptimal living conditions. Food insecurity is resulting in global acute malnutrition (presence of both, moderate and severe acute malnutrition in a population) rates exceeding 15 percent in certain areas, and the lack of access to quality water and sanitation services has led to the re-emergence of cholera outbreaks all across the country. All this framed with high levels of insecurity, military dynamics, killings and violations affecting both the local communities as well as the international actors on the ground intending to implement relief operations (24,27).

### 1.2.5 Cholera outbreaks

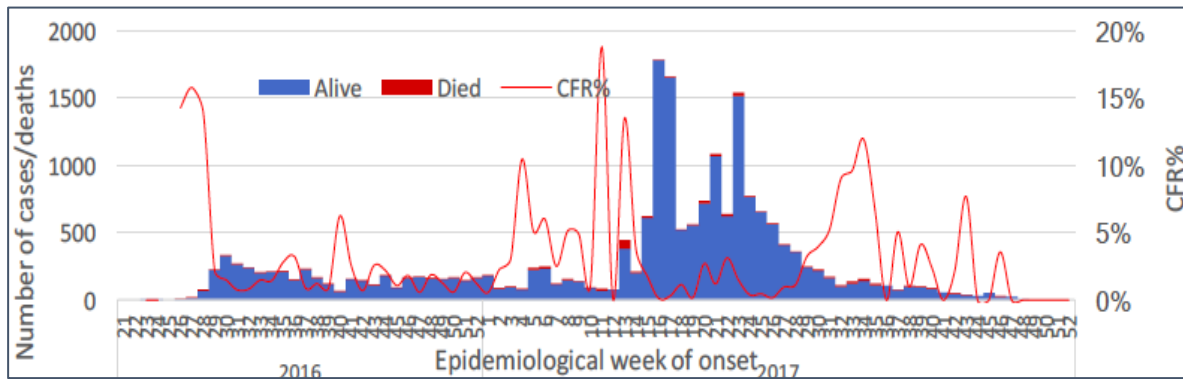
Several cholera outbreaks have hit South Sudan from 2006 to 2009 with CFR's reaching 3.64 percent in 2007. The absence of proper water and sanitation services and protracted conflict in the country has caused a re-emergence of outbreaks in the last years (20,24).

After 5 years without confirmed cholera cases, an outbreak caused by *Vibrio Cholerae O1 Inaba* was declared in Juba in 2014 causing 6,269 suspected cases, 156 deaths and a CFR of 2.4 percent. The epidemic spread throughout the country with most of the cases near the capital being local residents, while in northern regions the IDPs were the most affected (28). The attack rates reached 53.4 per 10,000 for the community in Juba and 49.9 per 10,000 for camp populations (29).

By June 2015 the South Sudanese Ministry of Health declared the second cholera outbreak in Juba during a major humanitarian crisis which originated in the United Nations Protection for Civilians Camp that hosted around 28,000 IDPs. This wave lasted for five months (30,31). During this outbreak a total of 1,735 cases were reported including 47 deaths (32).

The third consecutive and longest running cholera outbreak for the youngest nation in the world started in June 2016 when fighting resumed in the capital after a short-lasting truce between the two warring parties collapsed. This time the epidemic showed different epidemiological trends severely affecting rural areas which were not touched in previous outbreaks. The outbreak continued for 18 months with more than 20,000 cases and 436 deaths registered (*Figure 4*). Fatality rates were higher in counties with scarce healthcare reaching up to 9.74 percent in 2017. This wave came to an end in February 2018 with no cases reported since December 2017 (27,33).

**Figure 4: Cholera epidemic curve for South Sudan 2016-2017**



SOURCE: MINISTRY OF HEALTH OF SOUTH SUDAN (2018) (34)

After these yearly epidemics of cholera registered in several regions, the disease is now endemic in the country (35). All outbreaks have occurred during the rainy season affecting states situated along the river. Among the causal factors for the repeated epidemics are the use of untreated water from the Nile River, contaminated food in markets due to deficient hygiene practices and open defecation (32).

In spite of all factors against, cholera responses have been implemented and enhanced along the years, having an impact on the attack rates which have decreased from 27 to 17 to 22 cases per 10,000 in 2014, 2015 and 2016 respectively; with the same trend in the CFR's which reached 1.75 percent in 2016 (36).

## Chapter 2: Cholera highlights, problem statement, justification, objectives and methodology

### 2.1 Cholera highlights

#### 2.1.1 Cholera definition

Cholera is an acute watery diarrheal disease result of an enteric infection caused by the gram negative bacteria *Vibrio Cholerae*. It produces a profuse secretory diarrhoea that if not treated, can result in severe dehydration, hypovolemic shock and death (37).

*Vibrio Cholerae* can be subdivided into two serogroups: *V. Cholerae O1* and *V. Cholerae O139*. *V. Cholerae O1* presents Classical and El Tor biotypes which can both be subdivided into 3 serotypes: *Ogawa*, *Inaba* and *Hikojima*. Clinical features do not vary depending on the strain, reason why the approach and response is the same regardless this specificity (38).

The bacteria can be found in seas, estuaries, rivers and ponds. Humans are the main reservoir but molluscs, fish and other aquatic flora can potentially host vibrios. Cholera is transmitted to humans through the ingestion of contaminated sources (faecal-oral). The main sources of transmission are: person to person, contaminated food or water, contact with corpses of cholera patients and contamination in cholera treatment centres (CTC) if insufficient hygiene measures in place (37,38).

A high infectious dose of  $10^8$  organisms is needed to cause disease in healthy individuals, but lower doses might be enough for causing illness in those with an impaired gastric acid barrier or when the bacteria is ingested through food with a buffering effect in the gastric acid (39).

Cholera case definitions have been developed depending on whether the disease is endemic or not, among the most widely used are the ones by the WHO, the Global Task Force on Cholera Control (GTFCC) and MSF; in all of them 1 confirmed case is considered an outbreak. These definitions are summarized in *Table 1* (37,38,40) .

**Table 1: Main cholera case definitions**

<b>WHO Standard Case Definition</b>	In an area where the disease is not known to be present.	Severe dehydration or death from acute watery diarrhoea in a patient aged 5 years or more.
	In an area where there is a cholera epidemic.	Cholera should be suspected in all patients with acute watery diarrhoea.
<b>Global Task Force on Cholera Control Definition</b>	In areas where a cholera outbreak has not been declared.	Any patient aged 2 years and older presenting with acute watery diarrhoea and severe dehydration or dying from acute watery diarrhoea.
	In areas where a cholera outbreak is declared.	Any person presenting with or dying from acute watery diarrhoea.
<b>MSF Definition</b>	In an area where there is a cholera epidemic.	Any patient presenting with 3 or more liquid stools and/or vomiting for the last 24 hours.

**SOURCE: ADAPTED FROM WORLD HEALTH ORGANIZATION (2017), GLOBAL TASK FORCE ON CHOLERA CONTROL (2017) AND MEDECINS SANS FRONTIERES (2004).**

Culture of stool samples or rectal swabs for identification of *V. Cholerae* are still considered the gold standard for case confirmation, even if not essential for diagnosing cholera as the clinical presentation is quite obvious. Although several rapid diagnostic tests (RDT's) have been developed, their sensitivity and/or specificity are still below standards; because of this they are recommended for screening purposes followed by confirmation of positive tests with stool culture (37,39).

### 2.1.2 Clinical Manifestations

Cholera incubation period goes from 18 hours to 5 days, clinical features can be mild or severe and the disease shows sudden onset of symptoms with watery stools and vomiting. The disease is painless in general but cramping can occur and usually there is no fever (39). 80 percent of those infected with *V. Cholerae* will not present any symptoms; and from the ones becoming symptomatic 20 percent will show signs of severity losing more than 10-20 litres per day, with up to 70 percent dying if not treated (37).

According to the level of dehydration, patients can present with intense thirst, dry mucus membranes, sunken eyes, rapid pulse, hypotension, lethargy and oliguria/anuria. If severely dehydrated a patient can enter in hypovolemic shock (37–39).

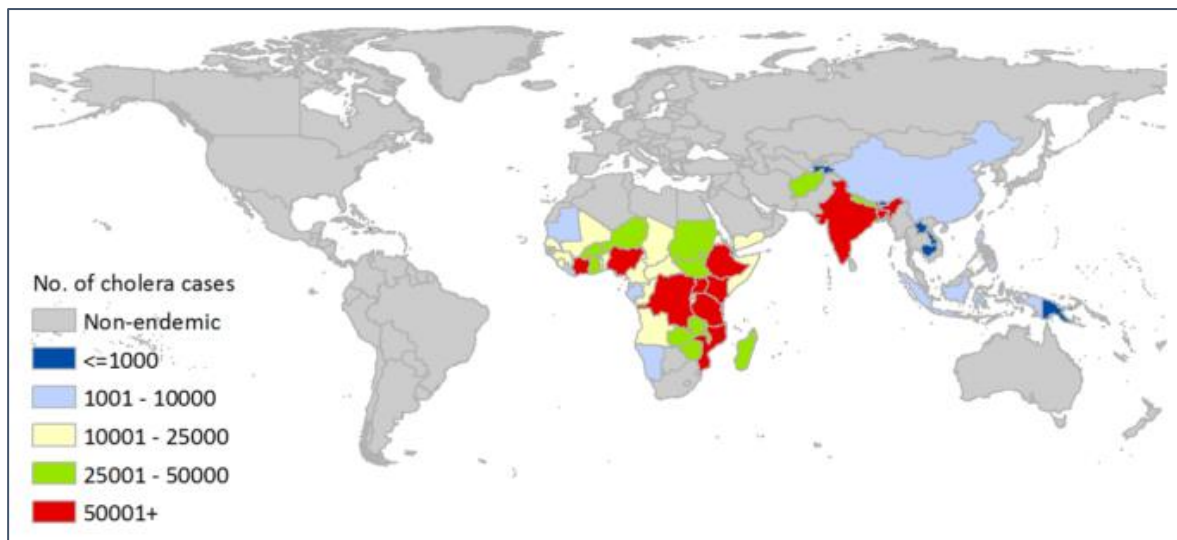
Cholera complications are notably electrolyte imbalance (Hypokalaemia, hyponatremia and hypocalcaemia) and acidosis. There is also a well-documented risk of foetal death in pregnant women with cholera (37).

### 2.1.3 Cholera global burden

Texts from 500-400 BC in India already describe an illness similar to cholera and the epidemic reached Europe for the first time in 1829 when John Snow studied its trends in England. Today, cholera continues to affect around 47 countries in the world and outbreaks still cause high mortality with CFR's rarely reaching levels below 1 percent (37,41).

The real global burden of the disease remains unknown mainly because most of the cases are unreported as consequence of poor laboratory and surveillance systems in the affected countries which are in majority low-middle-income countries (LMIC) in Africa and Asia where cholera is endemic (*Figure 5*) (42,43).

**Figure 5: Annual number of cholera cases in endemic countries**



SOURCE: M. ALI, A. NELSON, A. LOPEZ ET AL. (2015) (42)

The most recent study estimates that between 2008 and 2012 there were 1.3 billion people at risk of cholera in 69 countries where the disease is endemic, while another 99 million in non-endemic countries were at risk of acquiring the disease. The annual case load was around 2.9 million cases and 95,000 deaths with an average incidence rate of 2.30 cases per 1000 people at risk. The highest burden was found in Sub-Saharan Africa and South-East Asia with 60 and 29 percent of the global burden of cholera respectively (42).

## 2.1.4 Conventional cholera response components

Several guidelines about cholera outbreak response have been developed in the last years defining the set of actions required for a successful outbreak management and contention. Two of the most widely recognized and referenced in the international literature are the cholera guidelines by MSF and those by the WHO. Despite minor differences in their formats and approach, these two guidelines coincide in the core components of cholera outbreak response interventions which are summarized in *Table 2* (38,44).

**Table 2: Core components of cholera outbreak response interventions**

<b>CORE COMPONENTS</b>	<b>MAIN ACTIVITIES</b>
<b>Outbreak detection and investigation</b>	-Defining a case definition -Laboratory diagnosis confirmation -Identifying priority areas for intervention
<b>Intervention strategy and response</b>	-Assessment of the response capacity -Coordination for outbreak follow up and decision making -Information dissemination
<b>Interventions to reduce mortality</b>	-Setting up cholera treatment centres and decentralization of care -Organization of cholera treatment facilities -Human resources and training -Supplies
<b>Case management</b>	-Patient's assessment -Rehydration therapy -Antibiotic treatment -Correct identification of complications
<b>Reducing of the spread</b>	-Access to safe water -Access to safe food -Improved sanitation -Hygiene measures in healthcare facilities -Oral cholera vaccination
<b>Community involvement</b>	-Active case finding -Health education and appropriate messages -Hygienic handling of corpses and feasts restriction. -Cultural acceptability of the response
<b>Monitoring and evaluation</b>	-Surveillance -Descriptive epidemiology -Information for response adaptation
<b>End of outbreak and cholera preparedness</b>	-Confirmation of end of outbreak -Correct closing of cholera treatment facilities -Planning for optimization of future interventions in case of outbreak

*SOURCE: ADAPTED FROM MEDECINS SANS FRONTIERES (2004) AND WORLD HEALTH ORGANIZATION (2004).*

Cholera case management is centred on the quick restauration of the water volume and electrolytes lost after vomiting and diarrhoea. This can be easily done with the use of Oral Rehydration Salts (ORS) in most of

the cases; intravenous fluid administration preferably with Ringer's Lactate is reserved for patients with severe dehydration only (38). The use of antibiotics such as doxycycline or azithromycin is complementary and recommended exclusively for severe cases after appropriate rehydration therapy to reduce time of recovery (37,38).

Oral Cholera Vaccines (OCV) are now recommended by WHO for complementing response interventions in terms of prevention and outbreak containment. Manufacturers of the two vaccine variants available advise two doses with intervals from 1-6 weeks between doses depending on the type of vaccine used. However, after the evidence found in South Sudan later on described in this thesis, single-dose strategies can be also considered for areas with ongoing epidemics (45).

### 2.1.5 Conflict as an increased risk for cholera

In general outbreaks are unpredictable, but they are often related to natural and man-made disasters (37). Although during conflicts most of the attention is given to the direct injuries and casualties, outbreaks of communicable diseases including cholera are also a direct effect of war (46).

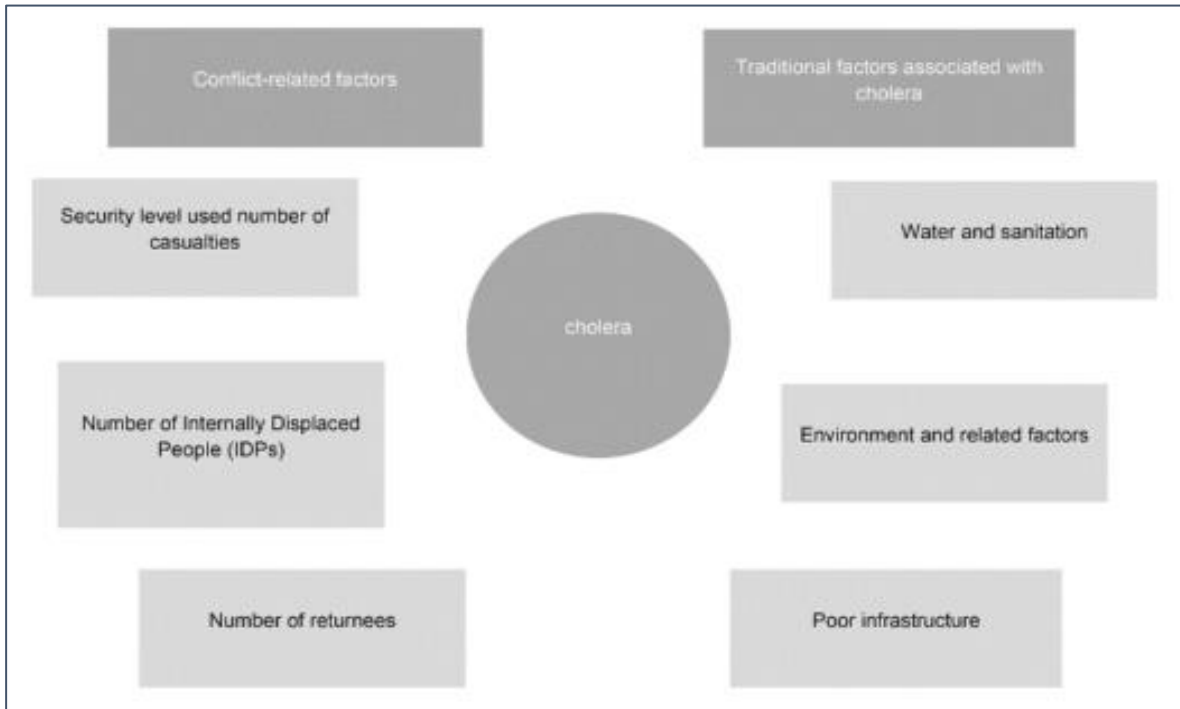
As described by Gayer et al, the main risk factors promoting the surge of infectious diseases such as cholera in conflict settings are: population displacement, environmental conditions, collapse of disease and infection control programs along with the health system, weak surveillance systems, restricted access to affected populations and the intense movement of refugees including health workers (47).

In the frame of political turmoil and conflict dynamics, access to healthcare services is hampered and appearance of waves of refugees and overcrowded displaced populations facing intense food insecurity leaves them immunocompromised and therefore in increased risk for cholera. Deficient health facilities and water and sanitation services are also contributing factors behind cholera outbreaks in these contexts (48).

It is then possible to classify the risk factors associated with a cholera outbreak into those related to conflict and traditional factors as proposed by Dureab et al. in *Figure 6 (1)*.



**Figure 6: Framework of factors associated with a cholera outbreak**



*SOURCE: F. DUREAB, K. SHIBIB, R. AL-YOUSUFI ET AL. (2015) (1)*

## 2.2 Problem statement

The risk of cholera outbreaks is increased by suboptimal living conditions, overcrowding and impaired access to safe drinking water (44); all these characteristics are commonly met by populations in distress like those victim of conflicts.

The presence of conflict in a region acts as a risk factor for cholera since war often damages infrastructure and the population is cut off from access to proper sanitation services and medical care (49).

In 2016, 38 countries reported a total of 132,121 cholera cases and an overall case fatality rate of 1.8%. This includes countries like Democratic Republic of Congo, Somalia, South Sudan and Yemen which also suffer from prolonged conflict and intense instability (50).

Conflict jeopardizes the access to the affected and vulnerable populations since security becomes at stake, impairing the capacity of the involved actors to carry out key activities to contain cholera outbreaks (51). The coincidence of conflict and cholera is also associated with worst outcomes due to impaired responses as seen in Somalia where 15,619 cases and 540 deaths were reported in 2016, in contrast with Mozambique which

outside from a context of conflict reported 883 cases and 2 deaths in the same period (50).

Although several cholera outbreak management guidelines are available, as well as new tools to contain epidemics like the oral cholera vaccination (41), little has been said about the possible ways to adapt cholera interventions when a classical approach is not feasible due to the context in fragile states and active conflict settings.

### 2.2.1 Research questions

- How does conflict impair the successful implementation of conventional cholera interventions?
- How can cholera interventions be adapted to overcome the obstacles in outbreak management rendered by conflict?
- Which practices and strategies are pertinent and feasible to implement during cholera outbreaks in conflict affected settings?

## 2.3 Justification

Although the relation between cholera and conflict seems obvious, little has been described about the interactions between these two phenomenon's and the response required. With wars evolving into long protracted crises, and consequently causing protracted outbreaks, it is relevant to define the implications of conflict in the cholera response to consider them in the design of cholera outbreak management interventions.

The cases of Yemen and South Sudan allow the study of cholera interventions in conflict affected settings in order to explore how these are shaped by the direct and indirect consequences of conflict, which affects the capacity of local ministries of health and the international community in charge of the response.

## 2.4 Objectives

### 2.4.1 General objective

Explore how conflict and its consequences shape cholera outbreak management strategies through the example of South Sudan and Yemen generating relevant recommendations for future interventions in contexts with similar challenges.

## 2.4.2 Specific objectives

Through the cases of South Sudan and Yemen:

- 1) Identify how the different components of cholera outbreak management interventions can be affected by conflict.
- 2) Describe the strategies that can successfully overcome the obstacles rendered by conflict when managing a cholera outbreak.
- 3) Contribute to the body of knowledge for the design of cholera outbreak management strategies in conflict affected settings

## 2.5 Methodology

Research questions are answered through a literature review of the recent grey and published literature about the past cholera outbreaks in South Sudan (2014-2017) and Yemen (2016-2018), including its management and implementation. This methodology allows to identify what has been already accomplished in this field of research but also to capitalize on past experiences building on to the body of knowledge by identifying gaps (52).

The literature search was carried out in Google Scholar, PubMed and other humanitarian reports platforms using a combination of key words like "cholera", "South Sudan", "Yemen", "response", "conflict", "war", "outbreak", "management", "communicable diseases", "report" and "challenges". Snowballing technique was followed from the initial set of articles selected to enrich the sources. Grey literature such as situation and epidemiological reports were searched via ReliefWeb and Humanitarian Response platforms following the same set of key words previously presented. Relevant articles were manually selected based on the title and summaries. Only articles published after the year 2000 were considered for inclusion with the exception of technical guidelines published before this date and one article from 1997 judged to be relevant. The literature search was performed only in English and articles were discarded if published in a different language as timeframe didn't allow translation. The search strategy is summarized in *Table 3*.

**Table 3: Literature search strategy**

<b>KEY WORDS</b>									
	Cholera	A N D	Outbreak	A N D	Response	A N D	Conflict	A N D	Yemen
OR	Diarrhoea		Epidemic		Intervention		War		South Sudan
OR	Diarrheal disease		Crisis		Strategy		Fragile		Sudan
OR	Infectious disease		Surge		Plan		Battle		Africa
OR	Waterborne disease		Onset		Management		Insecure		Middle East
OR	Communicable disease		Emergency		Report		Challenges		Global
<b>SEARCH PLATFORMS</b>									
Google Scholar, PubMed, VU Online library, ReliefWeb, Humanitarian Response, World Health Organization									
<b>SEARCH LIMITS</b>									
<p>Inclusion criteria: English language, published after year 2000, reliable sources, health/public health related, full access to publication, guidelines, briefing notes, position papers, articles with emphasis on response implementation aspects and detailed descriptions of the strategies and context.</p> <p>Exclusion criteria: Language different to English, published before year 2000, focused on water and sanitation aspects, limited access to publication (abstracts), data bases, reports limited to epidemiological indicators, theses, informal reports, blogs and financial reports.</p>									

**SOURCE: ADAPTED BY THE AUTHOR (2018).**

Three semi-structured interviews with members involved in cholera outbreak responses in the countries of study considered as key informants were conducted to gather specific examples about the impact of conflict in cholera management interventions and complement the findings. Interviews were performed first with a UN agency representative in South Sudan, second with a Country Health Adviser for a humanitarian INGO in South Sudan and the third one with a Medical Activities Coordinator in Yemen for an emergency INGO; oral informed consent was given by the three interviewees after clear explanation of the purpose of the interview. Interviews were done using Skype, recorded with the help of a smartphone and transcribed verbatim for analysis. Participants were asked about the conflict dynamics at the moment of interventions, how did the presence of conflict influence operational decisions in the outbreak response, how their interventions were adapted and if this was successful or not. Since interviews were carried out with public health professionals in their capacity of cholera response managers, questions remained within the scope of their usual work and responsibilities and given that interviews are not the main method used to answer the research questions, in accordance with KIT’s research ethics committee (REC) guidance this approach didn’t require REC clearance or waiver. These are referred to along this thesis as Source 1, 2 and 3 (S1, S2, S3). The interview guide used is presented in *Annex 1*.

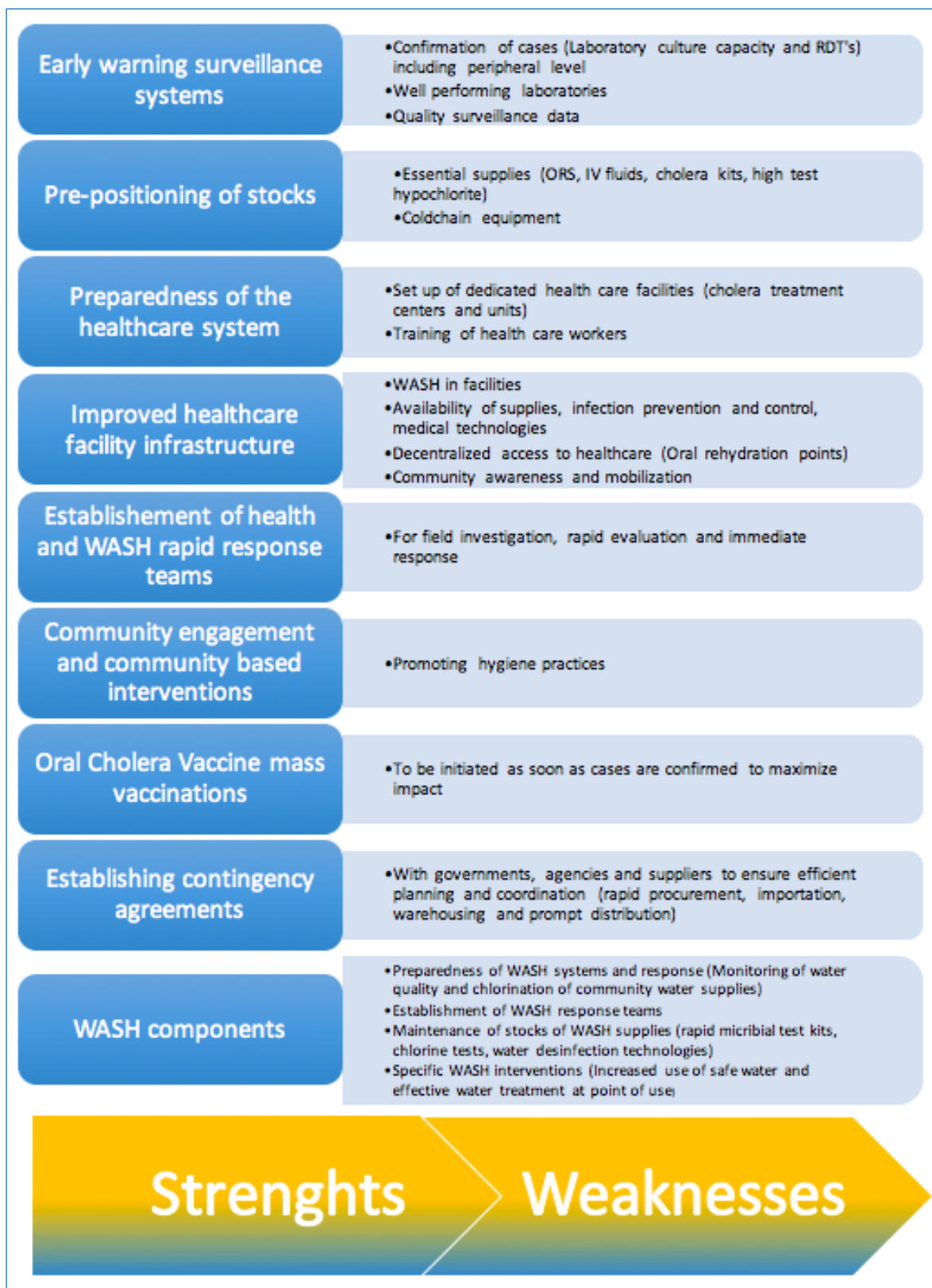
A framework has been adapted prior to the study using the Global Roadmap to end cholera by the Global Taskforce on Cholera Control for results analysis and presentation (*Figure 7*) (41). This framework was chosen because it approaches cholera interventions in a conceptual and comprehensive manner, rather than listing all the tasks and activities required for a response as many checklists published.

The framework derives from the first axis of the roadmap which is dedicated to early detection and response to contain outbreaks proposing eleven core components. It allows to assess the potential impact of conflict at the different levels of an ideal cholera intervention; describing its challenges and adaptations due to the conflict dynamics. The framework is complemented with a strengths and weaknesses analysis to finally base recommendations on these findings.

The gathered literature was analysed by identifying strengths and weakness corresponding to each one of the levels in the framework's structure, including available evidence from any of the two countries under study.

Since this thesis concentrates on the health components of cholera interventions, the four components of the response related to water, sanitation and hygiene (WASH) stated in the framework are englobed in one niche covering here the main WASH related findings and considerations.

**Figure 7: Adjusted framework for the study of cholera interventions in conflict settings**



SOURCE: ADAPTED FROM THE GLOBAL TASKFORCE ON CHOLERA CONTROL (2017) (41)

## 2.6 Limitations

The present thesis analyses cholera interventions from a perspective that has not yet been widely studied so most of the literature referred to has different objectives and appraisals from the one proposed here. Since Yemen and South Sudan are still going through active periods of conflict, the literature available is limited and access to several reports by the involved actors is restricted what reduces the scope of the search. Both conflicts and outbreaks studied in this thesis have had different determinants and take place in different contexts what makes the results and recommendations of this study only partially applicable and transferable to other settings.

## Chapter 3: Findings

A total of 51 reports and 39 published articles regarding cholera outbreak response in the studied countries were identified (excluding guidelines and maps), 56 of them are analyzed in this section. These were selected because they offered a sufficiently detailed insight and evidence into one or several components of cholera intervention according to the proposed framework. Besides, the transcripts of the 3 interviews with key informants were reviewed and relevant quotes are included to complement the findings.

### 3.1 Early warning surveillance systems

The literature review performed shows that during periods of active conflict, the health services were deeply impacted limiting the population's access to these, including disease surveillance initiatives (53,54).

Cholera RDT's were found to be widely used for screening of suspect cases and were rolled out in governmental, private and NGO run health facilities. An important bottleneck was that a portion of samples of suspected cholera cases required confirmation with culture, which was not within the capacity of many local laboratories, reason why shipment of samples to central laboratories in urban areas was required what was problematic due to the limited transport alternatives and security situation (53,55). This was even more problematic when it was requested that all suspected cases underwent confirmation through both diagnostic methods (56).

The use of conventional cholera RDT's with addition of a 4-6 hours enrichment step with alkaline peptone water was recommended as part of a case based surveillance approach in Juba given that it increases the test's specificity, bringing it to a similar performance level as culture (30); this variant has been proven effective in other settings eliminating false-positive results (57,58) . Nevertheless, this was only implemented by few actors in the country due to capacity and supply restraints (56). This technique was found to be recommended in late stages of the outbreak in Yemen but only partially implemented according to one of the informants (S3).

The advantage of the outbreak starting in country capitals or big cities was that it allowed the anticipated deployment of surveillance teams across the country aiming to increase monitoring and enhance prompt detection of suspected cases (53). Nevertheless, initial response interventions were focused mainly in urban areas, and most of the reports do not mention if these efforts covered rural or hard to reach areas where



the most vulnerable populations could be found. Key informants stated vulnerable populations were indeed not reached. *"There were many health actors but because of the insecurity none of them were reaching remote areas"* (S3).

In the case of South Sudan, active surveillance was implemented through sentinel sites to enhance early case detection. Although this measure was only possible to implement in the capital and exclusively in neighbourhoods where security allowed safe access to the teams for proper follow up (59).

In Yemen, targeted field monitoring was implemented to assess the adherence to the case definition in certain districts, which was found to be low what could have contributed to over-reporting of suspected cases (55,60). In contrast, other actors pose the possibility of underreporting due to shortcomings in surveillance and diagnosis confirmation (61).

Both in Yemen and South Sudan, the respective cholera taskforce committees were in charge of data gathering, aggregation and analysis to circulate weekly situational reports informing the partners and community about the evolution of the outbreaks in order to take decisions. In both cases data was consolidated in a single national line-list what facilitated analysis and information sharing (53,62). One of the challenges in this regard was the lack of an electronic based platform for data management at health facility level, what resulted in mistakes and hampered completeness and timeliness of data entries (63).

In Yemen, an online platform bringing together all the relevant data about the epidemiological trends and latest response to the outbreak was successfully implemented in the form of a dashboard to facilitate information sharing and consultation by the partners to guide interventions (12). This was confirmed to be a functional and useful tool by the key informants, who found it also a good opportunity for collaboration and information sharing with other actors involved in the response.

### 3.2 Pre-positioning of stocks

Essential supplies pre-positioning was facilitated by the use of kits including items for cholera investigation (Cary Blair medium, RDT's, packaging material) and clinical management (Oral rehydration salts, intravenous fluids, etc.). The downside at this level of intervention is that most of the times, this was only possible in stable areas; leaving out healthcare structures situated in places with ongoing violence and/or with limited geographical access (53,62).

This response component was challenged by the fact that humanitarian access, including provision of medical supplies and human resources, was often restricted as flights and movements were limited due to high levels of insecurity. Conflict also badly influenced the economic situation in the affected countries, destabilizing markets and making basic supplies required for the response locally less available or absent (53). For instance, shortage of laboratory reagents and RDT's were a constant threat along the response in Yemen (64,65).

Stock pre-positioning was justified not just by the risk of a new outbreak but also by the increased chances of outbreak escalation in certain areas (66). This strategy was not limited to public healthcare structures but also included for example, private pharmacies and clinics in urban areas which were encouraged to have copious stocks of oral rehydration salts (ORS) to provide to all suspected cases (56). Although it's not reported whether these were provided free of cost to patients in need or not, this could make an important difference in terms of access.

Although cold chain equipment availability was not found to be a concern among the revised literature, key informants from both countries reported this was not functional or available in several locations what challenged oral vaccination campaigns and sample conservation prior to shipment to central laboratories for diagnosis confirmation (S1, S3).

### 3.3 Preparedness of the healthcare system

Key informants were all of the opinion that the bedrock capacity of the local health systems was one of the main challenges. As these were compromised by conflict, it was difficult to build up on something to develop a response. *"There was really no health system to provide the initial care that was required, like case management"* one of them said (S1).

Cholera treatment centres were opened in existing health facilities ranking from hospitals to clinics. These facilities were also set up in IDP's settlements with anticipation to the event of large scale epidemics (67). Apart from this conventional approach, other formats of care delivery were implemented like mobile clinics for targeted populations such as IDP camps with reported cases, or in areas that didn't benefit from WASH interventions (56,61).

In Yemen by the end of 2017, when a decreasing trend was observed, it was recommended to integrate cholera treatment structures into the existing health facilities. This with the objective of resource optimization, but also as a preparedness approach in case of new peaks coming.

Although, this would not really apply for cholera treatment facilities in remote areas or those affected by active conflict where no other health structures were functioning (68).

In the perspective of the key informants, integration of CTC's into health facilities was not a good decision as it jeopardized standard cholera prevention measures putting others at risk of infection. Moreover, this strategy resulted in the closure of other essential medical services. *"There was only one Inpatient Therapeutic Feeding Centre, they closed it to put a CTC we kept insisting, we need this service!"* (S3).

Apart from the presence of active frontlines and checkpoints, because of the loss of financial security, vulnerable populations could not reach CTC's and other healthcare structures as they could not afford transport (69). Response actors could sometimes neither reach the population as recalled by a key informant *"We were just there in our CTC waiting for the people to come but we didn't know what was happening in the villages..."* (S3). To surmount these issues, MSF established advanced health posts reachable to communities lacking access to healthcare (10). Furthermore, the coalition of conflict and cholera aggravated the existing gender inequities resulting in impaired access to care, as seen in Yemen where women were reported to be forbidden to go to CTC's or be admitted into one what increased their vulnerability (69).

Some health facilities, especially in hard to reach areas, were improvised with extremely limited infrastructure such as huts and were run by a core team of medical and paramedical staff working as volunteers. Highly depending on donations of supplies and training by humanitarian actors (70).

In both cases medical personnel was scarce, making training and capacity building initiatives for medical and paramedical staff very much needed and these were often suspended because of intense insecurity limiting access. On top of the needs generated by the cholera outbreaks, the high number of casualties caused by conflict overwhelmed the few available health facilities making conflict affected regions lag behind in service delivery (15,53).

In the case of Yemen, several health facilities were left without medical personnel; with 49 out of 276 districts in the country lacking medical doctors by May 2017, and those who stayed in their workplace were not paid for months because of the crisis (15,62). Training of human resources for health in case management and correct infection control practices was mainly offered in the form of on-the-job training; but

supervisory visits were sporadic as many health actors lacked the capacity and/or means to perform them (55,71).

A key informant also noted that when preparedness efforts took place in advance, these were affected by onset of conflict and consequent displacement of populations. *"When it comes to the time that you need the services of the people you've trained, you find... one, or two or none left"* (S1).

Even if several humanitarian actors were already present in the field before the onset of the outbreaks, some of them showed not to have any level of preparedness in terms of cholera response, or were unable to develop such readiness because of having other ongoing priority activities like nutritional programs in Yemen, where cholera and malnutrition coincided in 67 out of 240 districts affected with cholera by 2017 (69,72). Others, even if capable to respond, were targeted by either of the warring factions, like MSF facilities in Yemen which were attacked 4 times including by bombardment (46).

The crippled health system consequence of conflict does not only impair preparedness and response, but also directly contributes to the spread and intense transmission of the disease. This was proved by He et al who, through modelling techniques using data from Yemen, identified that the cholera transmission rates increase as the medical resources decline; bringing evidence to an already well-known hypothesis (73).

In an attempt to prevent this, respondents reported to have integrated cholera preparedness as an extra component of primary health care services in terms of support with training, supplies and equipment (S2), although no evidence was found to confirm this approach's successfulness.

### 3.4 Improved healthcare facility infrastructure

Among the reviewed reports it was found that ever since the first waves of cholera outbreaks, conflict crippled healthcare delivery as health facilities were closed looted or destroyed; with limited expenditure following these events to improve access to basic services (27,53,70).

Continuous and comprehensive cholera response activities were restrained because of security concerns and constant hostilities. This prevented actors from intervening to break transmission which contributed to the protracted evolution of the epidemic in South Sudan (56,70). Negotiations with key stakeholders were attempted to secure

access for humanitarian actors for cholera response but these were not always successful (66).

The quality of care in CTC's in terms of infection prevention and control often didn't meet standards (60). To address this, protocols were updated and adapted following past experiences aiming to improve quality of care by standardizing procedures; although no data is available about nosocomial cholera transmission to evaluate whether this was successful or not (67).

Availability of medical supplies, including essential items for case management like ORS, gloves and intravenous fluids, was very limited because of the slow rate under which these items were entering the country, with reports from Yemen stating this was at one third of the rate before the conflict due to the blockage of borders; making stock levels in the country enough for not more than 8 weeks of activities during most of the period of intervention (54,68). This was also confirmed by the key informants who experienced diverse administrative blockages to bring supplies to the field. Moreover, medical supplies availability was also limited because of the parallel high demand in other countries undergoing conflict and outbreaks requiring support from the international community like Bangladesh and Venezuela (74).

To overcome these challenges, United Nations (UN) agencies and non-governmental organizations became the main provider of medical supplies required for the response in Yemen, facilitating importation of medications and equipment. However they didn't always manage to meet the demand in a timely manner according to the increasing needs (75).

Oral rehydration points (ORP's), treatment corners at community level offering oral rehydration therapy and advice for referrals to CTC's if needed (44), was the most used strategy for decentralization of care in both countries (65,67). This was adapted to broaden coverage by involving the community as seen in Bentiu camp in South Sudan, where community members were trained to carry out door by door case finding, correctly provide oral rehydration and advice referral to CTC when needed (56). Still, coverage of this response component was below the demand as seen in Yemen where only 60% of the ORP's required were implemented (69).

Humanitarian actors were confronted with intense insecurity and violence leading to movement restrictions, further impeding access to the populations especially during phases of intensification of conflict (76). In South Sudan, humanitarian staff working in cholera response activities were killed and/or kidnapped forcing at least three organizations to

suspend their activities and others to relocate, what translated into an increased spread of the outbreak due to the halt in contingency interventions (32,33). In these cases, the withdrawal of humanitarian actors in the field contributed to the limited capacity of response as stated by a key informant, *"In the midst of the crisis... response capacity was minimal when the outbreak started because most agencies had evacuated and left only skeleton staff"* (S1).

In order to overcome the severe access restraints and succeed to address the imperious needs, some humanitarian actors have looked into new models of intervention such as remote-management approaches relying on the work of local actors for implementation. Nonetheless, no evidence was found published about the effectiveness of this approach if applied to cholera outbreak response (10).

### 3.5 Establishment of health rapid response teams

The strategy of deploying rapid response teams was implemented in both cases studied (53,71). This was a task under WHO's and Ministry of Health (MoH) responsibility for implementation. These teams worked in close collaboration with the community and were expected to facilitate early detection, alert and response to outbreak; but because of the security situation, their time in the field was very limited, impeding response optimization (33,63).

Little is reported about the impact of these teams in enhancing the outbreak response and most of all, about its coverage, continuity and sustainability. What is clear is that even with this approach, communities in need were left untouched because of the reigning violence and insecurity what resulted in high fatality rates in these areas (65). For instance, WHO's support to local health authorities in Yemen for strengthening the outbreak response reached only 305 out of the 333 affected districts, for what no justification is documented but this can be easily attributed to the consequences of conflict (12).

A respondent also explained that since the rapid response teams were composed by MoH staff, they were not in the position to work in non-government controlled territories as these represented no-go areas for them. In such cases, response gaps were tried to be filled with the help of emergency response partners (S1).

### 3.6 Community engagement and community based interventions

Messages promoting cholera prevention and options of care available were disseminated in different fashions including radio forecasts, mobile text messages, social media, school events and door to door health promotion in high risk areas (66,67,76).

In the case of South Sudan, information, education, communication and WASH related messages tried to be harmonized under agreement of all partners involved. This became a very slow process, justified by the high volume of work what ended up delaying the publication of such materials (72).

Community based interventions were found to be implemented not just for health promotion purposes but also for prevention and direct response. For example, at the moment when cholera transmission spiked in Bentiu camp in South Sudan a case-centred approach was adopted. This strategy consisted of early identification of suspected cases at community level with the help of RDT's, followed by identification of home contacts older than one year of age to whom a single dose of azithromycin or doxycycline was administered within the first day after case identification. This was then complemented with active case finding, social mobilization, WASH support and OCV administration to all household members in a 200 meter radius from the initially identified case (77). Recent research estimated through modelling methodologies that these interventions could be indeed effective to reduce the length of outbreaks and promote resource efficiency, having a similar impact as mass interventions while requiring less resources (78).

A similar strategy, but without antibiotic administration, was also used in South Sudan's capital following suspected cases identified in the community or targeting the radius around households of patients admitted in CTC's (31,66).

The communities were also reported to be involved in the design and organization of response activities notably by implementing partners engaging with community leaders in the process (69).

Nonetheless, interviewees reported outreach and community activities being completely impaired by conflict, for what they raised concerns of this having contributed to the spread of the outbreaks. *"Because of the insecurity at the beginning we couldn't do outreach (activities) at all... imagine a cholera response without any outreach, any health promotion... our response was not complete"* (S3).

### 3.7 Oral cholera vaccine mass vaccinations

The WHO supports the use of oral cholera mass vaccination for high risk and vulnerable populations to cholera epidemics and campaigns have been successfully implemented in fragile contexts (45). In South Sudan in 2013 the possibility of a single dose, instead of the recommended double dose, was identified as an opportunity to enhance logistics and adherence increasing coverage; although not stating the advantages this would represent for settings undergoing conflict (35).

Since 2013, multiple OCV campaigns took place in South Sudan, eventually engaging non-medical profile organizations in implementation allowing to expand the actors involved. This could have potentially contributed to reach more areas including conflict affected ones; but even then, key populations were left behind because of limited access (28).

Azman et al documented an 87.3% effectiveness of a single dose of OCV to prevent cholera infection for up to two months during an epidemic in South Sudan, this represents a new tool for cases in which a fast decrease in cholera risk is required (79,80). This approach is revolutionary as it would allow to overcome barriers such as limited vaccine stockpiles, but also limited resources for implementation or restricted access to areas in which second rounds would be highly unlikely to carry out; all of these are common features in conflict affected settings. On the other hand, the high level of effectiveness reported by Azman might have been influenced by previous exposures to the vaccine in the population (79).

The OCV single dose scheme gave room to further innovation as seen in the highly-targeted vaccination campaigns in Juba. The strategy targeted neighbourhoods with active transmission and specific high risk populations; the intervention was proven to be effective for optimizing resources by providing protection to the maximum amount of people at risk (31). However, as much as this approach might be of value in conflict settings, it seems to be feasible and relevant only at very early or late stages of an outbreak when cases are already occasional.

Other forms of implementation of OCV were described by a key informant in South Sudan, where OCV was implemented alongside a headcount with another partner in a particularly insecure area that remained inaccessible for a long period of time. *"We were able to go on the ground for the course of two days and vaccinated tens of thousands of people with a single dose OCV during an actual outbreak"* (S2).

Even if widely accepted most of the times, OCV perception was also found to be shaped by the context of conflict as it can lead to mistrust among



the target populations. Like in South Sudan, where it was believed the vaccine was another way for the government to harm them. Although this feature seem to be extremely context specific and is probably linked with other factors influencing the populations acceptance to the vaccine, like the community awareness and mobilization strategies prior to vaccination campaigns (81).

Although a single dose mass cholera vaccination was planned in Yemen by July 2017, for what one million doses were released from the global stockpile; this was cancelled by the authorities who argued the vaccines were “not necessary” and instead, a larger campaign would be planned for the following year. One of the main reasons to call off this plan, apart from the scale of the epidemic, were the conflict dynamics and high insecurity at that moment which would impair the logistical capacity to carry out the campaign. Another concern was the potential diversion of resources from ongoing cholera response activities to be devoted to the vaccination (54,82,83). The lack of healthcare workers with experience in oral cholera vaccination, and the required training on this subject, was also one of the factors weighting against its implementation in the country (84,85).

The interviews carried out showed the agreement of the respondents with the decision of cancelling the campaign in Yemen, mainly because the available stockpile would not have met the enormous needs in terms of vaccination target required at that point of the epidemic.

### 3.8 Establishment of contingency agreements

In both cases, Yemen and South Sudan, cholera taskforce committees were formed after the confirmation of the outbreaks, including national and international partners to coordinate preparedness and response interventions (53,86). Sometimes response activities were even launched from strategies previously defined as past and protracted outbreaks allowed to draw lessons learned (67). Nevertheless, outbreak response coordination risked becoming too complex like seen in South Sudan, where several coordination entities where created (Taskforces, clusters, sub clusters, etc.) what affected the quality of the coordination, notably by duplication of efforts and losing efficiency in information sharing (72).

The involvement of experts to support the outbreak response was sometimes obstructed because of the volatile security situation, combined with bureaucratic barriers such as visa procedures and travel permits what caused severe delays for the arrival of humanitarian actors in general (60,69). Workshops and meetings aiming to bring together all the actors involved in the response to draw contingency plans were also

challenged as they were often cancelled by cause of the security situation derived from conflict (68). The restrictions on importation of IT and telecommunication accessories became common and also baulked planning, information sharing and efficient coordination (76).

Conflict was found to affect response coordination initiatives like in Yemen, where the outbreak monitoring and response was tried to be decentralized through the creation of Emergency operations centres (EOC's) at governorate level, but this strategy reached a suboptimal coverage with only 8 functional EOC's by March 2018 because of diverse challenges (87).

In South Sudan, a cholera prevention and response plan was prepared in 2017 capitalizing on the lessons learned from the previous outbreaks in order to frame and coordinate the next steps in the response. Regrettably, this resulted only in a list of tasks and indicators to follow up in the form of an ideal cholera intervention, failing to analyse and contextualize the response components and not giving space to reflection about the impact of conflict in the country, in the response and in the outbreak itself (36).

The same remarks are applicable to the Integrated Response Plan developed in Yemen the same year. This draws a very comprehensive strategy and roadmap towards an optimal cholera response in line with the latest guidelines, but does not give consideration to how implementation of these activities will be managed in areas heavily affected by conflict and cholera simultaneously, like seen in Taiz and Hudaydah governorates (64,88).

### 3.9 Water, sanitation and hygiene components

WASH needs were found to be a priority not only in cholera affected areas but also in cholera-free regions as both countries lacked optimal infrastructure in this regard dating from pre-conflict times. In South Sudan more than 60% of the population practices open defecation and the country counts with very limited sanitation facilities with a major proportion of them malfunctioning (89). In Yemen 80% of the population lacked access to safe water in 2015 and barely half of the population had access to quality sanitation services (4). Because of this dramatic baseline, cholera outbreaks came to stretch the already scarce and poor quality services, what conflict only made worse.

In general, WASH activities in the frame of cholera response were found to be focused on supplies prepositioning, operation and maintenance, chlorination, water supply, hygiene kits distribution and health promotion; following the conventional recommendations of most guidelines. All these,

notably under the lead of UNICEF as chair of the WASH clusters in both countries of study (77,90). Same as with the health components of the interventions, it's not clear whether these efforts reached areas with heavy conflict or not; for instance, 43 out of 333 districts in Yemen showed very high access constraints due to conflict and all of these were also affected by cholera (64).

In Yemen, cholera response competed with other WASH priorities like those of the displaced populations or the affected by malnutrition (55). In this scenario, an integrated approach was promoted by UNICEF in order to unite health, WASH and communication efforts to provide a comprehensive response (13). However, roles and responsibilities were confused among the different sectors which made coordination very challenging. Besides, communication gaps between health and WASH actors were common which caused a deficient visibility of the epidemiological trends of the outbreak for the WASH actors, who sometimes found themselves without a health partner in the field what impaired an optimal response (91).

In South Sudan the conflict weakened the WASH actor's capacity of response as insecurity decreased access at the same time that it increased the needs. The conflict dynamics and consequent volatile context made locations in need frequently inaccessible what delayed procurement of WASH supplies and impaired activities implementation as some actors were forced to evacuate due to the instability (89). No evidence was found about whether stock pre-positioning was of any help in these situations or not.

In addition, the antagonism between developmental and humanitarian approaches to WASH interventions becomes evident with the onset of conflict. International agencies, often working in different locations and seldom in coordination, avert operational risk by implementing vertical interventions in the realm of their relief or developmental mandates. This affects the response by creating competition of resources for achieving only partially effective interventions even if sharing similar objectives (92).

### 3.10 Summary of findings

*Table 4* summarizes the main findings of this section. Following the framework, these are presented contrasting the remarkable strengths and weakness encountered at each level of the intervention.

**Table 4: Summary of strengths and weaknesses in cholera response interventions in conflict settings**

	Activities and strengths	Weaknesses
<b>Early warning surveillance systems</b>	<ul style="list-style-type: none"> <li>• Cholera RDT's used for screening of suspected cases.</li> <li>• Early deployment of surveillance teams in accessible areas.</li> <li>• Enriched RDT's for increased specificity</li> <li>• Active surveillance through sentinel sites in urban settings.</li> <li>• Outbreak monitoring using line-lists compiled at central level with the help of online platforms</li> </ul>	<ul style="list-style-type: none"> <li>• Stool culture as only mean for case confirmation with availability limited to central laboratories</li> <li>• Limited coverage of initial response and enhanced surveillance activities due to insecurity</li> <li>• Lack of electronic systems for data collection at health facility level</li> </ul>
<b>Pre-positioning of stocks</b>	<ul style="list-style-type: none"> <li>• Use of pre-packed kits for deployment</li> <li>• Involvement of private facilities in stock pre-positioning.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of coverage in conflict-affected and hard to reach areas</li> <li>• Disruption of supply chains due to movement restrictions.</li> <li>• Impairment of local procurement of essential items leading to shortages.</li> <li>• Partial availability of cold chain commodities</li> </ul>
<b>Preparedness of the healthcare system</b>	<ul style="list-style-type: none"> <li>• Reactive and pre-emptive establishment of CTC's</li> <li>• Mobile teams for case management in targeted areas</li> <li>• Integration of CTC's into existing health facilities</li> <li>• Establishment of advanced health posts</li> <li>• On-the-job training as capacity building approach</li> <li>• Integration of cholera preparedness into primary health care</li> </ul>	<ul style="list-style-type: none"> <li>• Impossibility for resource optimization when no other health facilities present in cholera affected areas</li> <li>• Affected communities could not reach health facilities due to transport and security issues</li> <li>• Health facilities of poor infrastructure and capacity</li> <li>• Scarcity of medical/paramedical staff</li> <li>• Surpassed health facilities what affected service delivery</li> <li>• Suspension of supervisory and training visits jeopardizing quality of care</li> <li>• Absence of cholera preparedness plans by actors present in the field prior to the outbreaks</li> <li>• Other health interventions competing with cholera response</li> <li>• Closure of other essential medical services to be replaced with cholera treatment facilities</li> <li>• Loss of trained staff after displacement</li> <li>• Targeting of healthcare facilities by the warring parties</li> </ul>

<p><b>Improved healthcare facility infrastructure</b></p>	<ul style="list-style-type: none"> <li>• Adaptation of protocols based on prior experiences</li> <li>• International agencies and organizations filling gaps of essential items through donations</li> <li>• Establishment of ORP's for decentralization of care</li> <li>• Enhancement of ORP's by adding a door by door approach for case management and referrals</li> <li>• Remote-management of operations with local staff empowerment</li> </ul>	<ul style="list-style-type: none"> <li>• Healthcare facilities damaged by the ongoing violence and targeted attacks</li> <li>• High insecurity impeding access to response actors</li> <li>• Suboptimal infection control practices</li> <li>• Limited stocks of medical supplies due to importation restrictions</li> <li>• Interruption of activities due to periods of intense violence and threats against humanitarian workers</li> </ul>
<p><b>Establishment of health rapid response teams</b></p>	<ul style="list-style-type: none"> <li>• Successfully implemented by international agencies in partnership with the MoH</li> </ul>	<ul style="list-style-type: none"> <li>• Limited presence on the ground because of security concerns</li> <li>• Partial coverage of cholera affected areas</li> </ul>
<p><b>Community engagement and community based interventions</b></p>	<ul style="list-style-type: none"> <li>• Usage of media channels in addition to face to face interventions for spreading messages</li> <li>• Community based approaches integrated in comprehensive response interventions like the "case-centred approach"</li> <li>• Inclusion of community representatives in project design and implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Difficulty for harmonization of messages</li> <li>• Complete incapability for outreach activities implementation due to conflict</li> </ul>
<p><b>OCV mass vaccinations</b></p>	<ul style="list-style-type: none"> <li>• Single dose administration for outbreak contention</li> <li>• Scope of implementing partners widen by including non-medical agencies</li> <li>• Highly-targeted campaigns allowing optimization of resources</li> <li>• Micro-targeted campaigns as part of the "case-centred approach"</li> <li>• Implementation in parallel with other activities targeting the same populations</li> </ul>	<ul style="list-style-type: none"> <li>• Limited stockpile globally</li> <li>• Highly-targeted campaigns only relevant when cases are sporadic</li> <li>• Difficult implementation in large scale outbreaks coupled with active conflict</li> <li>• Perception issues among affected populations</li> </ul>
<p><b>Establishment of contingency agreements</b></p>	<ul style="list-style-type: none"> <li>• Cholera taskforces implemented.</li> <li>• Attempts for decentralization of response coordination</li> <li>• Cholera contingency plans developed and updated in collaboration with partners</li> </ul>	<ul style="list-style-type: none"> <li>• Complex coordination between partners resulting in duplication</li> <li>• Multiple barriers to bring international experts to support the response</li> <li>• Disruption of planned meetings due to volatile context</li> <li>• IT and communication impediments due to lack of equipment</li> </ul>
		<ul style="list-style-type: none"> <li>• Crippled WASH infrastructure prior to the conflict</li> </ul>

<p><b>Water, sanitation and hygiene components</b></p>	<ul style="list-style-type: none"> <li>• Coordination of activities following a cluster model</li> <li>• Implementation of recommended strategies in accessible areas</li> <li>• Attempts to create comprehensive approaches in collaboration with other sectors</li> </ul>	<ul style="list-style-type: none"> <li>• Cholera response competition with other areas of WASH priority</li> <li>• Lack of coordination between health and WASH initiatives</li> <li>• Restricted access and withdrawals from conflict affected areas</li> <li>• Contrariety between developmental and relief programs with competition for resources</li> </ul>
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*SOURCE: ADAPTED BY THE AUTHOR (2018)*

## Chapter 4: Discussion

The results show that conflict undoubtedly has a severe impact on cholera response design and implementation, and therefore requires important adaptations from the conventional or ideal strategies. The main challenges influencing cholera response interventions in conflict settings have as origin the already weakened health systems in these countries on which responses are to be based as they show severe downsides prior to conflict times; the multiple access barriers affecting the reach and coverage of interventions, notably because of insecurity; and the fact that the available cholera guidelines do not take into account all these features in their recommended activities for outbreak contention.

Surveillance and case confirmation, the first component of the response according to the framework, were deeply impacted by the onset of conflict in both cases studied. Despite the frequent shortages, the use of RDT's was promoted for screening purposes but the stool culture became an obstacle for case confirmation as this was not available but in central laboratories. This, together with discrepancies on the use of appropriate case definitions, resulted in delayed outbreak confirmation and reporting in areas affected by conflict; what surely contributed to either under or over-reporting of cases. Key informants however, leaned more to the possibility of over-reporting of cases especially in Yemen, what could have led to lower CFR estimates.

In spite of having an option to overcome this challenge, for example through enriched cholera RDT, this was not sufficiently encouraged by the health authorities, leaving actors on the ground with no choice but to keep struggling with what the constant shipment of samples implied. The use of the enriched cholera RDT could make a big difference in managing cholera outbreaks as it would feasibly allow to increase the capacity for case confirmation at health facility level with a sustainable and effective alternative to culture, even in remote areas and those affected by conflict, as it does not require high laboratory infrastructure (30); this would facilitate quick and evidence based decision making for responding actors. Despite the evidence gathered in at least 3 countries confirming its accuracy (30,57,58), this technique is not yet mentioned nor recommended in any of the recognized cholera outbreak guidelines what prevents implementation. The GTFCC has opted to encourage research and development for the production of new RDT's rather than endorsing the enrichment method which they judge "not acceptable" because of its duration(93). This position suggests that for the GTFCC the multiple barriers faced for samples referrals including security, capacity and transport concerns are acceptable even if they result in delayed case confirmations, loss of samples and deferred declaration of outbreaks.

Although in both cases surveillance data could successfully be centralized for analysis and presentation with the use of line-lists, data gathering and dissemination could still be enhanced by accelerating the data collection at health facility level with the use of online platforms following the example of the dashboard developed in Yemen (12). This would translate into more accurate, recent and available epidemiological information avoiding delays to feed the response partners and guide them in their interventions. It would be relevant to be able to feed these platforms through mobile data entry methods, avoiding to rely only on web-based systems that might not be available in remote settings.

Stock pre-positioning was attempted along both cholera responses but only reaching a partial coverage as conflict restricted access importantly. Moreover, the local procurement of medical items was very limited in the affected countries making its provision dependent on humanitarian actors who also struggled to bring the supplies into the countries. Knowing that during periods of active conflict some areas can be cut off from access, stock pre-positioning would be more effective if done in anticipation, especially in countries like Yemen and South Sudan where cholera is now endemic. This strategy could gain value and pertinence if incorporated in the overall preparedness of the health system especially at primary level, and not as a vertical strategy to implement once outbreaks have been declared. This would reduce the chances for this component of the response to be jeopardized by conflict, allowing an initial response even in less served and reachable areas.

Cholera treatment facilities were established as per the usual recommendations despite the volatile contexts, but adaptations to care delivery were also made in order to increase access and reach of vulnerable populations. Mobile teams were reported to be deployed in the affected communities to carry out case finding and provide rehydration therapy to suspected cases using ORS's (56,61). A key informant also reported that the level of care provided by these mobile teams in South Sudan was adapted to the capacities of the staff in charge of implementation; for instance, if the teams were composed by paramedical staff, they could also provide intra-venous fluids if needed (S2). It must be said that as valuable as these sorts of strategies can be for increasing access to care, these do not replace traditional ways of cholera treatment provision, especially when admission is necessary for rehydration and close monitoring. And as stated by a respondent, this approach was limited to areas where a CTC was not possible to implement and which presented small scale outbreaks (S2). It is fair to assume that in certain cases outreach or mobile services might be impossible to establish due to security concerns leaving populations cut-off from any source of healthcare. In such situations community empowerment initiatives might



be a possibility to explore to ensure a minimum access to care by developing “self-care” approaches; these could be centred on homebased oral rehydration therapy and basic infection control measures for the households.

Some cholera treatment facilities were reported to be set in precarious conditions and with minimal staff in isolated areas (70). This poses concerns about the quality of care provided in such situations, but no information on this regard was found as it was not within the scope of the study.

Training of human resources for health was also disrupted due to the conflict as supervision and training sessions could not always be held because of security and access concerns (55,71). Similar as with stock pre-positioning, training of medical staff should ideally be done pre-emptively in cholera endemic and fragile states as the high risk for outbreaks justifies anticipation in this regard, knowing that access will be unstable after the onset of a crisis. Telemedicine initiatives might be an opportunity to explore in cases in which face to face supervision of medical teams is not possible because of access barriers and capacity building is required. This would however not address the lack of a trained health workforce when they have fled after conflict, the prompt generation of new resources would be then the only alternative for what standardized training materials would be valuable.

Acknowledging the intense weaknesses of the local health systems, which in these two cases collapsed with the crisis, the role of humanitarian actors becomes paramount as the health authorities and the population rely on them for service provision. Because of this, health actors on the ground, regardless of their core objective of intervention, should have a minimum level of preparedness in terms of stock and awareness among their staff in order to be in the position to deal with a cholera outbreak, to avoid fatalities and facilitate basic initial response. This sometimes was not the case among actors present in these countries (69,72).

Since South Sudan and Yemen populations have very difficult health profiles which got aggravated by the crisis, it’s not a surprise to see cholera coinciding with other pathologies such as malnutrition and other tropical diseases (69). In this sense the integration of CTC’s into existing health facilities as advised in Yemen could make sense (68). Apart from resource optimization, this would have allowed a more comprehensive package of health services, facilitating linkage to care for patients with other illnesses besides cholera. Unfortunately, this objective was not reached since competition of resources persevered and priority was given

to cholera facilities over other required health services which were closed according to key informants (S3).

The results show a profound negative impact on the local health facilities infrastructure, both because of shortcomings prior to the crises and due to direct consequences of conflict as health facilities including CTC's were damaged (27,46,53,70). This puts the local health systems in almost total incapacity to respond autonomously to the outbreaks, becoming dependent on humanitarian actors and international agencies for outbreak management. Despite the challenges faced in importation, the international community succeeded to procure essential medical items for the response, securing sufficient stock levels to the scale of the needs. Even then, delays were sometimes experienced impeding response when access was possible (54,68,75).

ORP's were reported to be established in both cases studied, this can be seen as a proof of its pertinence and feasibility to implement even for outbreaks in contexts of conflict (65,67). Nevertheless, no literature was found to confirm its coverage in areas with active conflict. It is then fair to question if ORP's and its enhanced versions were possible to implement only in areas with a minimum level of access and security, what could have excluded several locations at least for certain periods of time.

The highly volatile context rendered by conflict payed a toll on the accessibility to cholera affected areas, sometimes obliging actors to leave following security incidents (32,33). While one key informant reported high insecurity completely impeding response implementation, others experience never put them in the situation in which they wanted to respond but couldn't because of the highly insecure context; this last point of view seems rather optimistic and contrasts with the findings (S2, S3). These different perceptions put in evidence the heterogeneity of the impact of conflict in cholera outbreak response, which can be assumed is also highly related to the security management capacity and objectives of the responding actors.

Another example of the consequences of restricted access due to conflict is the partial coverage of rapid response teams. This could be explained not just by the insecurity, but also by the influence of political dynamics at the time of the response. These challenges could have also contributed to the contrasting attack rate levels between government and non-government controlled areas in Yemen reported by McCoy (16). Moreover, the correlation found by Dureab et al, between the number of cholera cases and number of injured in Yemen could be interpreted as a consequence of conflict hampering cholera response interventions allowing the spread of the epidemic in these scenarios (1).

Community based interventions were found to be a core component of the outbreak response, although not always possible to implement according to interviewees. Apart from the well-known strategies in community involvement, the studied conflict settings gave room for successful innovations; notably by engaging the community in direct outbreak response activities aiming to prevent the spread by integrating different approaches into comprehensive community interventions as seen in South Sudan (77). Given that a close proximity to the community is required for implementing such activities, it can be implied that an acceptable level of risk must have been found at that time in order to be capable of deploying teams in the field. However, this is not always a feature in conflict settings, so this approach could be easily jeopardized what makes this strategy partially or non-applicable in more violent contexts. Empowering the community by transferring key activities for them to be implemented by community members themselves could be an alternative to overcome these challenges to a certain extent.

Maybe the biggest progress made in cholera outbreak management in the recent years has been the OCV. Yet, this response component has gone through several adaptations to make it suitable for use in unstable contexts as the results show. OCV campaigns have evolved from double to single dose what has definitely increased feasibility of implementation at the same time it facilitates higher coverages (79,80). Interviewees agreed on the added value of OCV campaigns as a stopgap, both during ongoing outbreaks and in settings with high risk of developing one (S1, S2). Yet, OCV implementation might not be feasible in conflict affected settings as seen in Yemen (54); where even highly-targeted campaigns (31) wouldn't not have been relevant as the full-blown outbreak ended to affect almost all the country and security didn't allow deployment (14). However, lack of experience in OCV campaigns does not represent a valid argument against vaccine deployments as it does not require high skilled staff and effective trainings can be offered in short periods. Moreover, OCV might bring other challenges as conventional cholera case definitions risk losing positive predictive value in populations with previous exposure to the vaccine increasing the percent of false positives; making suspected cases identification more difficult in future outbreaks. As effective as OCV can be in the fight against cholera, it does not override other response components which remain crucial. OCV should be acknowledged as another tool to contain outbreaks along with other comprehensive interventions and not only as a standalone strategy; especially in cholera endemic countries and large scale outbreaks where vaccination of entire populations could hardly be granted.

Cholera outbreaks in conflict settings cannot afford a response becoming dependant on a single approach for control. Given that conflict can eventually impair all the layers in the response, it is wise to maximize efforts at each level so that when one is affected, strengthening of functional components can maintain the response's efficiency while compromised interventions are restored.

Even when coordination bodies were created to organize the response to the outbreaks, these were also touched by conflict. Partner coordination, information sharing and bureaucracy were found among the main challenges (60,69). When countrywide cholera response plans were developed, these seem to have completely overlooked the consequences of conflict and the current shape and capacity of the local health systems they were supposed to be implemented in (36,88). Moreover, even if the outbreak response very much depended on international actors such as INGO's for operationalization, their way of working, capabilities and constraints were not taken into account. This can be seen as a normalization of conflict, its consequences and the crippled health systems at the moment of designing outbreak responses; accepting the status quo of violence and insecurity affecting the quality of the responses and threatening the actors involved.

Although not explored in-depth since it was not the main scope of the thesis, the results point out that WASH responses were not exempted from being affected by conflict. Same as with health interventions, the poor WASH infrastructure dating from pre-conflict times was one of the main challenges to develop an appropriate response (4,89). The overlap of needs led to competition of resources which was intensified by the different mandates of the responding actors coupled with poor coordination (55,92). As with all the cholera response components assessed, insecurity hampered WASH interventions resulting in limited access and insufficient supplies availability.

Results also evidence that the official reports and published literature regarding the cholera outbreaks tend to focus more on the accomplishments and success of the interventions, while putting less emphasis on the different challenges and gaps experienced along the response and its consequences; implementing and coordinating partners do not seem to challenge the quality of their own responses. A critical perspective in the capitalization of cholera response in conflict settings would allow to draw lessons learned and build on past experiences to enhance interventions.

The impact of impaired cholera interventions because of conflict is also reflected in the outbreak's duration and mortality rates. For instance, the

outbreak in 2017 in Mozambique, a stable but yet fragile state, caused a total of 3,616 cases with a CFR of 0.1% in the country, and the first of the two epidemics reported that year had a duration of only 4 months (94). In contrast, South Sudan experienced an 18 months long outbreak with more than 20,000 cases and CFR's of up to 9% (33). Such dramatic indicators could have been decreased if responses such as the case-centred approach with OCV and water treatment could have been implemented at early stages of the outbreaks since these are estimated to reduce outbreak durations by 70% and caseloads by 82% compared to outbreaks without control measures (78).

#### 4.1 Framework discussion

The selected framework for the analysis and presentation of results did fit its purpose and was useful to identify the main obstacles in cholera response interventions in conflict settings, facilitating the description of how each level is impacted; the original framework proposed was adapted by putting together all WASH interventions in one single level to facilitate analysis. Some overlaps were noted as with community awareness and mobilization activities which are included in the improved healthcare facility infrastructure component and could also be described at the level of community engagement in the framework.

It's worth noting that the framework and cholera response strategies itself do not take into account the additional needs emerging from epidemics, like the psychosocial impact on the wellbeing of the affected populations. These are therefore not identified and hence not addressed or streamed into cholera interventions.

#### 4.2 Limitations of findings

Some of the actors contacted while gathering field reports from cholera interventions refused to share them as they consider them sensitive internal information, this limited the scope of the review. Since many reports were gathered from official sources ranging from international agencies to local ministries, the content of these risks being biased by favouring a particular perspective over another when describing the situations in which responses were present. Moreover, conflict dynamics and epidemiological trends are ever evolving, unique and unrepeatable, making the determinants of each response always particular. Because of this, results and recommendations are not transferable per se to other settings, but the reflections and analysis presented in this thesis might be of value to cholera outbreaks in other conflict-affected settings and even to other outbreaks different to cholera.

## Chapter 5: Conclusion and recommendations

### 5.1 Conclusion

Conflict impairs the successful implementation of cholera responses by importantly limiting access to the affected populations due to the appearance of highly insecure environments, including attacks against healthcare workers and facilities. Moreover, conflict constrains the availability of essential supplies for the response affecting interventions even when access is possible. The broken health systems and infrastructure where responses are to be established are also a reason behind the hampered cholera responses delivered in conflict affected settings. Every single component of the cholera response, from surveillance to the establishment of contingency agreements, is negatively impacted by the direct and indirect consequences of conflict.

The current guidelines and technology available for cholera outbreak response are not always applicable in the midst of conflict since they require a minimum of proximity, resources and infrastructure that often are lacking in conflict settings, for which adaptations are to be made. Modifications made to enhance interventions in these settings were found to be oriented towards facilitating case confirmation and surveillance, integration of preparedness initiatives into the health systems, decentralization of care to make it available in hard to reach areas, increased participation of community members in response implementation, and outbreak prevention and contention through the optimized use of OCV.

The experience of South Sudan and Yemen shows practices that could feasibly be implemented in contexts of war with simultaneous onset of cholera outbreaks to enhance responses. Among the most pertinent ones are the use of enriched cholera RDT's for case confirmation at health facility level, the development of online platforms for surveillance and information sharing, the pre-emptive establishment of cholera preparedness plans and facilities, the creation of mobile and advance situated forms of care delivery, increased community-based integrated responses and the use of OCV including its adapted forms of implementation like single dose and highly-targeted approaches in collaboration with other sectors. All these strategies follow a rational of resource optimization as is necessary to do as much as possible with the available means and access, taking advantage of the periods of stability to recover closeness to the affected populations.

The diverse challenges faced at all levels of cholera response described in this thesis result in partial and fragmented interventions, obliging actors to improvise and adapt in order to be able to deliver the needed responses, of which quality and effectiveness is sometimes a big question mark.

As long as the contexts of conflict in which cholera responses are frequently to be implemented are not acknowledged, we'll continue to rely on unsuitable strategies failing to timely prevent, identify and contain epidemics. Its then imperative to adapt the current guidance documents by including potential approaches and considerations to enable response actors to feasibly plan, establish and coordinate a minimum core of interventions to contain cholera outbreaks despite the challenges brought by conflict. This to be done in close collaboration with local health actors so they develop the capacity to cope with cholera outbreaks with a minimum resilience and autonomy.

Cholera does not discriminate, but its response does, because conflict makes it insufficient either in its access, coverage or completeness, leaving the most vulnerable out of its scope. This fact evidences that cholera outbreak responses as recommended today, are only possible to be effectively implemented in a frame of peace and not in one of war. Because of this its crucial to in line with international humanitarian law principles, demand respect to medical staff and health facilities in conflict settings so that they are not targeted by the warring parties what profoundly affects response implementation and access to healthcare.

## 5.2 Recommendations

- 1) For expert organizations and cholera management policy makers, to update the current cholera response guidelines by adopting a conflict sensitive approach; integrating the best possible practices and considerations for implementation for interventions in conflict affected settings including highly targeted approaches.
- 2) For the Global Taskforce on Cholera Control, to incorporate in their guidance documents for surveillance the enriched cholera rapid diagnostic test as an option for case identification in low resource settings; enhancing cholera diagnosis at field level for early outbreak identification and encouraging actors to implement this tool.
- 3) For the WHO, to promote and support pre-emptive cholera preparedness initiatives at primary healthcare level in high risk settings; improving the actor's capacity to timely identify and respond to initial cholera cases.

- 4) For the WHO and Global Taskforce on Cholera Control, to develop evidence based predictive tools to timely identify the cases in which oral cholera vaccines campaigns should be deployed pre-emptively due to the high risk of an outbreak, allowing prevention before access is obstructed due to conflict as well as the onset of large scale outbreaks.
- 5) For partners involved in cholera outbreak interventions in conflict affected settings, to improve collaboration and give space to further research to increase understanding of the impact of conflict in cholera outbreaks using mixed-methods to quantify and describe its burden and consequences.
- 6) To the warring parties in conflict affected and fragile states and the United Nations, to ensure respect to humanitarian law and principles so that aid can be delivered safely and effectively during cholera outbreaks in these settings.



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## Annex 1: Interview guide

### INTRODUCTION:

Interviewer background, thesis overview (Title, main objectives, methodology), purpose of interview (exemplification purposes, illustration of findings) and consent for the interview to be recorded and be used for complementing the thesis findings.

### QUESTIONS:

*1) Can you tell me a bit about yourself?*

-Background of the interviewee: professional background, position in the field.

*2) Since when are you working/when have you worked in South Sudan/Yemen?*

*3) Could you describe which were the conflict dynamics and humanitarian space during that period?*

*4) What kind of cholera response did you help to implement? (level of intervention: surveillance, case management, vaccination, etc.)*

*5) How do you think conflict has influenced cholera response in South Sudan/Yemen?*

*6) From the different components of cholera response (surveillance, rapid response teams, preparedness, case management, prevention, community mobilization, etc.) do you think there is one that was particularly affected by conflict?*

*7) Can you describe the main challenges in the intervention posed by conflict?*

*8) Can you give any examples of how cholera response interventions were adapted in South Sudan/Yemen to overcome the challenges caused by conflict?*

*9) Were the available guidelines for cholera response useful/applicable in those settings?*

*9) Would you like to add anything else?*