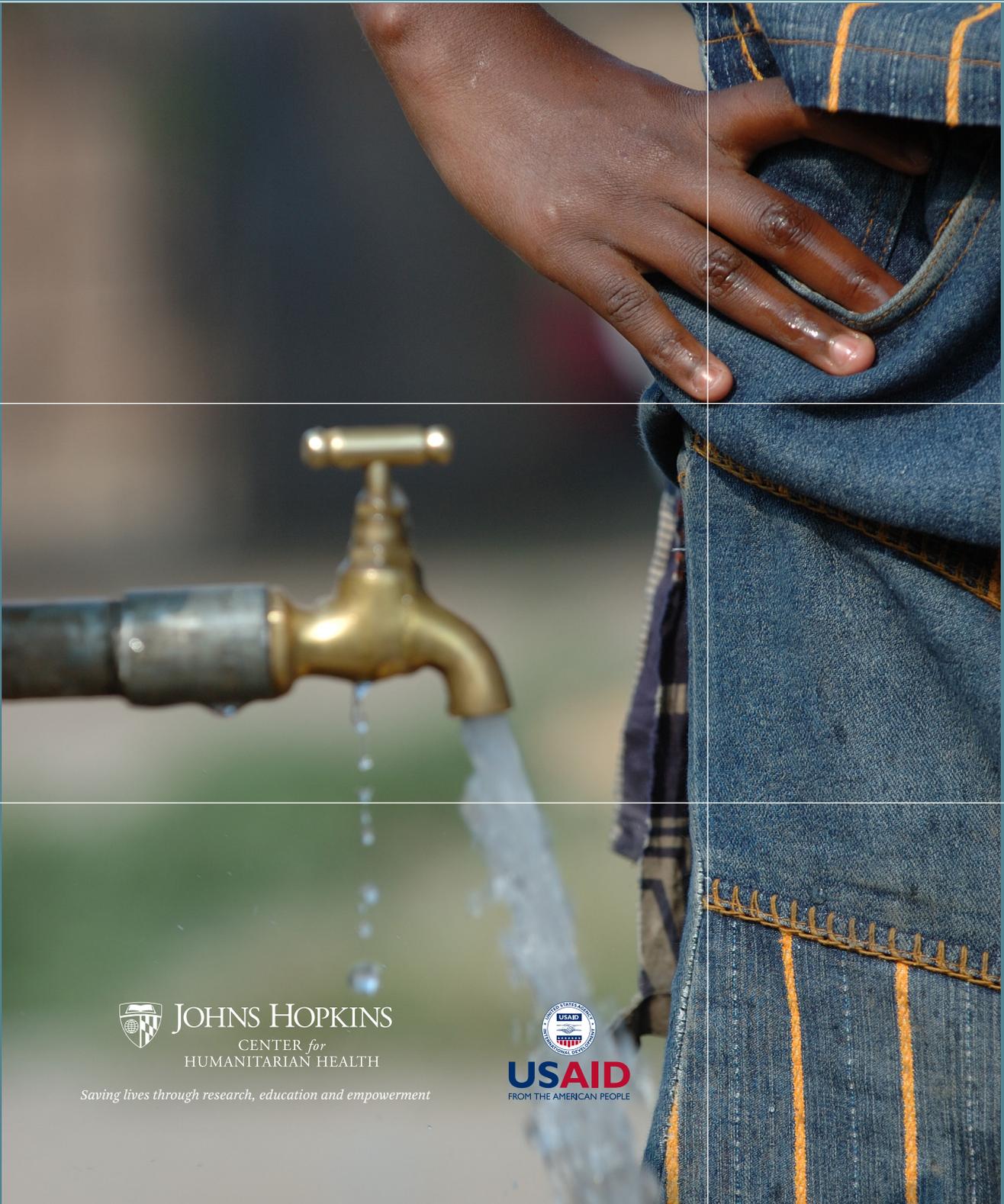


RETROSPECTIVE CASE STUDIES ON CASE AREA TARGETED INTERVENTIONS FOR CHOLERA EPIDEMICS

The Democratic Republic of the Congo (2017-2020) | Haiti (2010-2019)
Yemen (2016-2020) | Zimbabwe (2018-2019)



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EXECUTIVE SUMMARY

Cholera remains a serious global public health threat, particularly in fragile and humanitarian settings. Cholera transmission risk is higher for cholera case household members and nearby households. Mass interventions to contain cholera outbreaks are resource inefficient. Preventive interventions targeting cholera case households and neighbors have been found effective. These interventions, often referred to as **case area targeted interventions (CATIs)**, are spatially and temporally focused and are delivered to the case household and immediate neighbors as soon as possible after case identification. The CATI approach is often implemented through rapid intervention mechanisms that are activated in response to an increase in cholera cases in a given area. CATIs predominantly include water, sanitation, and hygiene (WASH) activities. They can also encompass epidemiological surveillance and health services, including the provision of oral rehydration salts, oral cholera vaccination, and antibiotic chemoprophylaxis.

In this report, we retrospectively investigated the process of CATI implementation in the **Democratic Republic of the Congo (DRC)** (2017–2020), **Haiti** (2010–2019), **Yemen** (2016–2020), and **Zimbabwe** (2018–2019). We developed qualitative interview questions focusing on the following: background of the outbreak; decision making; response actors; flow of information; interventions; coordination and integration of WASH, health, and surveillance activities; change in interventions over time; challenges; and lessons learned. From July to October 2020, we interviewed 30 key personnel from United Nations agencies, non-governmental organizations, ministries, government branches, and academic institutions involved with the CATI implementation in the countries mentioned above.

We found that while the general approach of targeting the case and surrounding neighbors was similar in the four countries, the particulars of CATI team composition, flow of information, and interventions varied across countries depending on local contexts. An alert system to monitor the outbreak was operational in all settings. However, the rapid access of the CATI teams to case data was inconsistent. The selection of cholera case's neighbors as recipients of CATIs varied between 10 and 30 households, and their selection depended on the context and decisions of the CATI team lead. CATIs regularly included WASH and surveillance activities. Health interventions were delivered either by the same CATI team that provided WASH interventions or by a different health team, or the cases were referred to the nearby cholera treatment center (in urban settings).

LESSONS LEARNED

- (1) Introduction of CATI immediately after an outbreak detection** was consistently believed to substantially reduce the spread of cholera in the community
- (2) Quick access to case information** can facilitate rapid implementation of the response
- (3) Involvement of local persons** (e.g., community health workers, volunteers, leaders) can strengthen case identification, raise awareness, and reduce stigma
- (4) Integrated CATI teams** including WASH, health, and surveillance expertise can be resource- and time-efficient, reduce activity duplication, and deliver organized responses.

ACRONYMS

ACF	Action Contre la Faim
BRIDH	Beatrice Road Infectious Diseases Hospital
CATI	Case area targeted intervention
CDC	Centers for Disease Control and Prevention
CoH	City of Harare
CTC	Cholera treatment center
DELR	Division of Epidemiology, Laboratory, and Research
DINEPA	National Directorate for Water and Sanitation Authority
DRC	Democratic Republic of the Congo
EMIRA	Équipes Mobiles d'Intervention Rapide
EOC	Emergency operations center
ESAG	Emergency Strategic Advisory Group
FCR	Free chlorine residual
GPS	Global positioning system
HH	Household
HTH	High test hypochlorite
IEC	Information, education, and communication
LNSP	Laboratoire National de Santé Publique
MCZ	Médecins chef de zone (zone health officer)

MDM	Médecins du Monde
MoH	Ministry of Health
MOHCC	Ministry of Health and Child Care
MSF	Médecins Sans Frontières
MSPP	Ministère de la Santé Publique et de la Population
NCSS	National Cholera Surveillance System
NGO	Non-governmental organization
OCV	Oral cholera vaccine
ORS	Oral rehydration salt
ORT	Oral rehydration therapy
PAHO	Pan American Health Organization
PNECHOL-MD	National Program for the Elimination of Cholera and Control of Other Diarrhoeal Diseases
RDT	Rapid diagnostic test
REDIGESO	Regie de Distribution des Eaux
RRT	Rapid response team
SI	Solidarités International
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, sanitation, and hygiene
WHO	World Health Organization

I. RETROSPECTIVE CASE STUDY ON CASE AREA TARGETED INTERVENTIONS IN THE DEMOCRATIC REPUBLIC OF THE CONGO (2017–2020)

SUMMARY DEMOCRATIC REPUBLIC OF CONGO

Cholera has been present in the Democratic Republic of Congo (DRC) since the 1970s. The number of cases has steadily increased since the 1990s, peaking in 2017 with more than 50,000 cases recorded. DRC is among the top three sub-African countries in terms of annual number of cholera cases reported in the last seven years. The most affected areas are in the Great Lakes region in the eastern provinces of the country (North and South Kivu, Tanganyika, Kasai Orientale).

Numerous outbreaks have occurred in recent years, and several approaches have been employed by national and international health and water, sanitation, and hygiene (WASH) actors to contain the spread of the disease. We conducted nine key informant interviews with personnel from governmental branches, non-governmental organizations, United Nations agencies, and academic institutions to learn about the various cholera responses in Masisi, North Kivu (2017); Kinshasa (2017–2018); Kasansa, Kasai Oriental (2018); and Goma, North Kivu (since 2019).

Two approaches have been developed over time (Quadrillage and case area targeted interventions [CATIs]), which coexist in the country. They both aim to reduce cholera spread; however, Quadrillage is activated only during outbreaks, while the CATI approach includes continuous surveillance activities between spikes of cholera cases to identify households (HHs) with a cholera case, and to immediately intervene to stop the spread of infections. Both approaches include interventions at HH and community levels.

Successes of the various responses include the reduction of cases in each outbreak examined, uptake of the cholera kit by the communities, the combination of door-to-door and mass communication activities with the engagement of community and religious leaders to increase knowledge about cholera and reduce stigma, and the presence of an exit strategy in one outbreak. Several challenges were reported around CATI implementation including lack of a clear CATI protocol in 2017, consistent data flow between health facilities and CATIs, and cholera kit composition and distribution. Other challenges were related to stigma during the identification of cholera cases while visiting neighboring HHs, and resources, such as lack of supplies to visit the agreed number of HHs in the cordon sanitaire.

BACKGROUND

While targeted WASH interventions to rapidly confine cholera cases have been studied retrospectively, the evidence of health interventions and their integration with those of WASH are scarce. Documenting health interventions in cholera response together with their integration with WASH in rapid response teams (RRTs), as well as the epidemiological/surveillance components, can inform future cholera outbreak responses. For this research at present, RRTs will be defined as CATIs that occur at the household level.

CATIs are the focus of a research study conducted by the Center for Humanitarian Health at the Johns Hopkins Bloomberg School of Public Health titled *Cholera rapid response teams in humanitarian and fragile settings*. This study entails four main

components: (1) a systematic review of peer-reviewed literature; (2) a landscape analysis of grey literature; (3) a retrospective study of implemented CATI; (4) a prospective assessment of CATIs during a cholera response. The peer-review literature report on CATIs, as well as the grey literature review and landscape analysis report, were published in August 2020.

For the retrospective component, our aim is to document the retrospective evidence of CATI approaches in different cholera outbreaks. Since some of the details of WASH interventions have been recorded recently,¹ we aim to complement that work by focusing primarily upon the health interventions and their integration with those of WASH from previous RRT/CATI documentation, as well as the epidemiological/surveillance components. Four countries have been selected for the retrospective components, namely: Haiti, the Democratic Republic of the Congo, Yemen, and Zimbabwe.

This report focuses on DRC and presents different response approaches that have been used in the past two decades to respond to cholera outbreaks in the DRC. It is based on information derived solely from the key informant interviews and reports shared by the interviewees for the retrospective component.² It does not include findings from reviews of the grey and peer-reviewed literature that were conducted within the frame of this study. These retrospective summaries are intended to complement the other components of the overall research study.

Cholera outbreaks and cholera responses in DRC

Cholera has been present in DRC since the 1970s. The number of cases has steadily increased

since the 1990s, peaking in 2017 with more than 50,000 cases recorded. DRC is among the top three sub-Saharan African countries in terms of annual number of cases reported in the last seven years. The most affected areas are in the Great Lakes region in the eastern provinces of the country (North and South Kivu, Tanganyika, Kasai Orientale), which reported 88% of the national cases in 2019. An important number of cases also occur along the Congo River, and sporadically also in Kinshasa.

Cholera CATIs, as one of the approaches to eliminate cholera transmission, first started in the DRC in 2004–2005. Dr. Didier Bompangue extensively studied cholera transmission in DRC and suggested using surveillance data to identify hot spots where to prioritize WASH interventions. Under the leadership of National Program for the Elimination of Cholera and Control of Other Diarrhoeal Diseases (PNECHOL-MD), and among the many emergency agencies responding to cholera outbreaks in DRC, international non-governmental organizations (NGOs) such as Action Contre la Faim (ACF), Solidarités International (SI), and Oxfam started implementing the hot spot targeted interventions between 2007 and 2009.

The ‘Quadrillage approach’ was designed and piloted in Kimpese, Kinshasa, and Mbujimayi in 2017 and 2018. It is a community-based approach that aims to reduce cholera incidence by identifying the (1) source of infection; (2) area where transmission can occur; and (3) risk factors. Areas that reported a recent increase in cholera cases are identified using surveillance data and/or data from cholera treatment centers (CTCs). The surrounding area around the last cholera cases reported at the CTC is divided into squares (radius of 500 m from the case HH). Then within each square, clusters of

1 UNICEF. *Global review of water, sanitation and hygiene (WASH) components in rapid response mechanisms and rapid response teams in cholera outbreak settings—Haiti, Nigeria, South Sudan and Yemen*. UNICEF, New York, 2019.

2 D’Mello-Guyett L, Greenland K, Bonneville S, et al. Distribution of hygiene kits during a cholera outbreak in Kasai-Oriental, Democratic Republic of Congo: a process evaluation. *Confl Health* 2020; **14**: 51; Bompangue D, Moore S, Taty N, et al. Description of the targeted water supply and hygiene response strategy implemented during the cholera outbreak of 2017–2018 in Kinshasa, DRC. *BMC Infect Dis* 2020; **20**: 226.

FACTOR	QUADRILLAGE	CATI
Aim	Decrease and stop transmission during spike of cases	Reduce cholera incidence
Activation	In case of cholera outbreak	Continuously active to respond to each case
Targetting criteria	Community/cholera case cluster	HH cholera case
Components	<ul style="list-style-type: none"> • Epidemiological analysis • Areas and HH identification • Activities at HH and community level 	<ul style="list-style-type: none"> • Active surveillance • Case and neighbors (typically within a radius) targeted interventions • Hygiene promotion at community level • Water and sanitation activities at community level

Table 1: Differences between Quadrillage and CATI

HHs are created and a set of activities are implemented at both the community and HH levels. The Quadrillage approach has been designed and implemented by the PNECHOL-MD with the financial support of the World Health Organization (WHO) and the Veolia Foundation.

Eventually, a cholera response strategy based on the recent UNICEF guidelines for CATI and Community Outbreak Response Teams (CORT)³ was developed in 2020 with support from UNICEF. The strategy entails four components:

1. Strengthening surveillance capacity

2. Case area targeted rapid response teams

- 1 suspected case = 1 alert = 1 CATI within 48 hours
- Second targeted response in HHs with laboratory confirmed cases (culture, but far away areas—enriched rapid diagnostic test [RDT])
- Goal: minimum 90% CATI around suspected cases within 48 hours and confirmed by laboratory 100%

3. Hygiene promotion (community level)

4. Water and sanitation (community level)

The system is meant to be implemented on a continuous basis, and not only during outbreaks. The goal is, therefore, to reduce transmission around each case, even during low transmission periods to decrease, as much as possible, the transmission of the disease. Low transmission periods can be used to prepare teams for higher transmission periods.

Each team is responsible for a geographic area (one or more health zones⁴ depending on their size). The surveillance activities at both health facility and community levels are implemented on a daily basis, so that a CATI can be activated as soon as a case is identified. Teams from one zone can be deployed to another zone in case of needs; however, daily surveillance activities must continue.

The two approaches (CATI and Quadrillage) coexist in the country. Key features are summarized in Table 1 to facilitate comparison.

³ UNICEF. *Response to cholera outbreaks: case area targeted interventions and community outbreak response teams*. UNICEF, New York, 2020.

⁴ A health zone is the operational unit for planning and implementing health policies in the DRC.

Outbreaks examined during the interviews

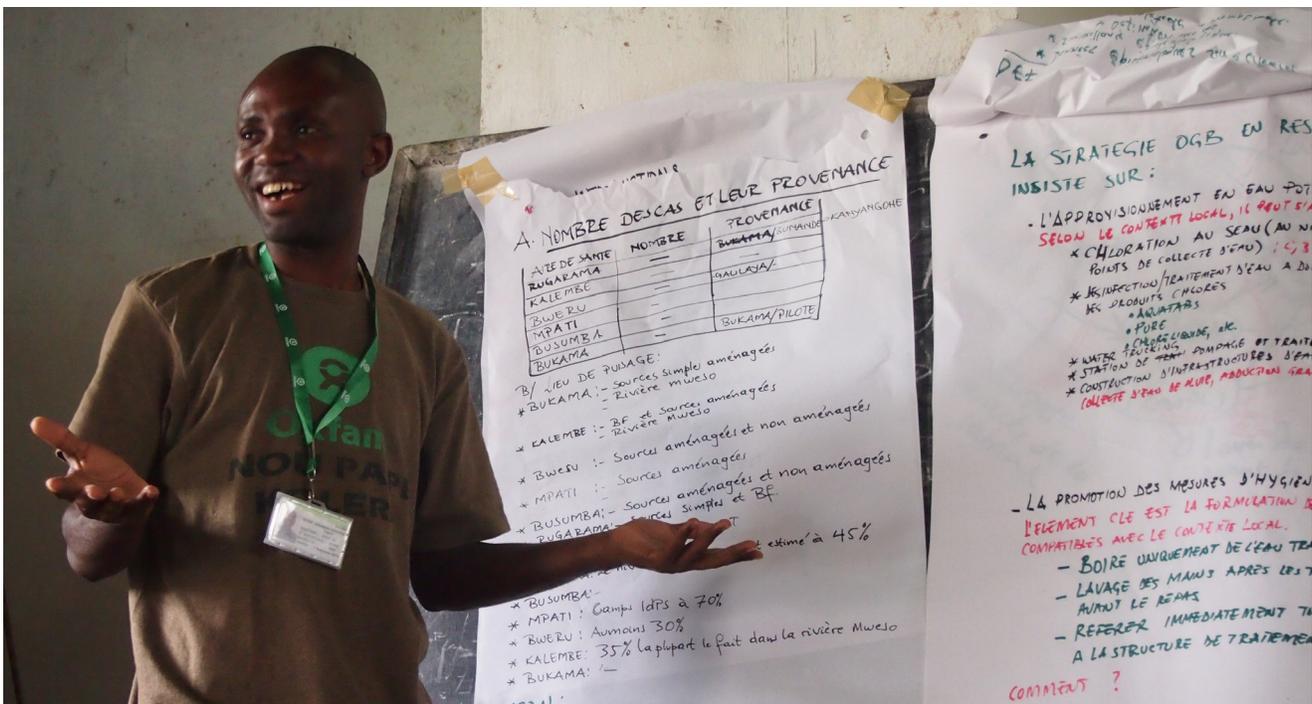
Several outbreaks that occurred in DRC were examined during the interviews. Key details per outbreak are presented in Table 2.

As the response approach differed among the outbreaks discussed in the interviews, key characteristics of the CATI activation and implementation are presented per each outbreak. Challenges, successes, and lessons learned are summarized across response approaches, highlighting differences and similarities across outbreaks.

DATE OF RESPONSE	LOCATION	ACTORS	CONTEXT
Oct–Nov 2017	Masisi, North Kivu	Solidarités International	Epidemic started in 2016; limited local capacity; START network funded RRT/CATI deployments for 45 days.
Nov 2017–Mar 2018	Kinshasa	Ministry of Health (MOH) (PNECHOL-MD)	Between April 2016 and March 2018, Kinshasa experienced 3 cholera outbreaks with numbers of weekly cases peaking in December 2017; this was the second implementation of the Quadrillage strategy (the first being in Kimpese, Congo Central, December 2017).
Aug–Dec 2018	Kasansa district, Kasai Oriental	MSF-Belgium	First confirmed case on August 9, 2018 (w28); Médecins San Frontières (MSF) responded to the second alert by the Government in w34 and arrived in w43, 16 weeks into the outbreak, for 5 weeks; focused on case management in CTC.
Since Dec 2019	Goma, North Kivu	UNICEF	Outbreak started in Goma’s prison on December 23, 2019; first time to implement CATI as per UNICEF’s regional approach.

Table 2: List of cholera outbreaks in the DRC discussed during retrospective interviews

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CATI ACTIVATION AND IMPLEMENTATION BY OUTBREAK

MASISI, NORTH KIVU (October–November 2017)

ACTORS	
WASH	<ul style="list-style-type: none"> • Governmental branches: PNECHOL-MD, Provincial Health Bureau • Funding/technical support: START Network, UNICEF • Implementing organization: SI, Congolese Red Cross
Health	<ul style="list-style-type: none"> • Governmental branches: PNECHOL-MD, Provincial Health Bureau • Funding/technical support: not available (N/A) • Implementing organization: MSF (at health facilities)
CATI IMPLEMENTATION	
Alert and flow of information	<ul style="list-style-type: none"> • The alert was sent by the health cluster based on data from the existing syndromic surveillance system (presence of diarrhea was used to identify cases alongside other easily identifiable symptoms), which captured number and origin of cases • Data about cases from health zone authorities, clusters, local partners were triangulated to identify most affected areas; these were chosen based on number of cases, and density of population • CATI teams did not obtain data from the médecin chef de zone (MCZ) on a daily basis and were not sent to cholera case HHs only; rather, data were obtained at the beginning of the intervention and used to target the villages to implement activities: <ul style="list-style-type: none"> ◦ SI went to the CTCs to get precise data of the HHs; final identification of villages and HH done with MCZ
Team composition	<ul style="list-style-type: none"> • Each team was composed of 3–4 people (this could vary) focusing on WASH activities <ul style="list-style-type: none"> ◦ There were no health staff on the teams ◦ Each team had a supervisor that had the information on the HH and oversaw the protocol ◦ Individuals in the team worked for different stakeholders including 1 from SI and staff from the health facility who were in charge of disinfecting sprayers ◦ Team members were trained on the protocol, how to deliver hygiene promotion sensitization, how to collect the data, and chlorination and spraying • Several teams conducting each specific task (i.e., no multiple profiles/tasks within the same team): (1) water infrastructure improvement; (2) chlorination; (3) sanitation; and (4) hygiene promotion • The teams were tracked and marked by global positioning system (GPS) location
HH identification	<ul style="list-style-type: none"> • Case: based on line list of cholera cases recorded by health facilities • Neighbors: radius of 20 m, approximately 5–20 HHs
Activities at HH	<ul style="list-style-type: none"> • SI focused on WASH: <ul style="list-style-type: none"> ◦ Disinfection of the HH ◦ Disinfection of water containers ◦ Distribution of Aquatabs, soap, jerrycan, storage container ◦ Hygiene promotion for behavior change including tackling stigma (if sick people were found, they were encouraged to go to health facility despite stigma and resistance) • There were no health activities at HHs (e.g., oral rehydration salt [ORS], treatment) ☞

Activities in communities	<ul style="list-style-type: none"> • Mass sensitization—including media, radio, door-to-door on waste management and garbage disposal • Door-to-door sensitization and identification of high-risk HHs (such as with high density, poor sanitation) • Latrine construction and improvement targeted to urban areas • No hygiene or cholera kits were distributed • Disinfection of wells and boreholes • Waterpoint and bucket chlorination • Setup of chlorination points • Water infrastructure improvement • Hygiene promotion at water points
Activities at health facilities	<ul style="list-style-type: none"> • MSF: case management, outreach, transport of patients, data sharing to prioritize sites and zones for chlorination and hygiene kit distribution
COORDINATION	
	<ul style="list-style-type: none"> • The MoH was in charge of the response and its coordination, which took place at provincial level • Environmental health authorities were little involved • Participation to coordination meetings (UN cluster meetings) depended on capacity • MOU and legal agreement were signed between SI and MoH. MoH monitored SI's activities; SI had to obtain approval for actions and report back to MoH • Exit strategy to hand over activities from SI to Congolese Red Cross who continued chlorination and sensitization activities with UNICEF funding

KINSHASA (November 2017–March 2018)

ACTORS	
WASH	<ul style="list-style-type: none"> • Governmental branches: PNECHOL-MD, health departments at provincial and zone level • Funding/technical support: Veolia Foundation and WHO • Implementing organization: PNECHOL-MD, National Red Cross, and local Red Cross
Health	<ul style="list-style-type: none"> • Governmental branches: MoH, PNECHOL-MD, health departments at provincial and zone level • Funding/technical support: Veolia Foundation and WHO • Implementing organization: MoH, PNECHOL-MD
QUADRILLAGE IMPLEMENTATION	
Preparatory activities (7 days)	<ul style="list-style-type: none"> • Micro planning is conducted by the PNECHOL-MD experts together with MCZ and includes: <ul style="list-style-type: none"> ◦ Planning of activities at central level (administrative) ◦ Logistical preparation ◦ Training of trainers ◦ Information sharing with local actors for planning and preparatory activities

<p>Quadrillage implementation (14 days)</p>	<ul style="list-style-type: none"> ● The PNECHOL-MD in collaboration with the MCZ: <ul style="list-style-type: none"> ○ Presentation of the approach to local authorities ○ Training of local teams ○ Investigation of risk factors for the persistence of cholera ○ Field survey to develop the grid covering the targeted area ○ Adjustment of micro planning ○ Engagement with local authorities, including public launch ceremony by local leaders
<p>Alert and flow of information</p>	<ul style="list-style-type: none"> ● Surveillance data were used to identify most affected health zones (reporting >10% of total suspected cholera cases during last 3 weeks) ● Line list at CTCs in most affected health zones were then reviewed to obtain address of patients admitted over previous 2-week period ● A team would then visit HH to take GPS and delineate intervention area around the case HH ● If a new case came from an ongoing CATI, a new CATI was not initiated for another 14 days; rather the CATI team administered prophylaxis for the new case's key contacts, conducted a 'deep' investigation to understand the source of the case (often traveled from other areas), and reinforced the CATI activities
<p>Team composition</p>	<ul style="list-style-type: none"> ● The field team usually comprised 4 people: <ul style="list-style-type: none"> ○ One well-known person in the community who has respect would act as team leader ○ WASH actors—well trained in water decontamination ○ One person working on risk communication ○ Occasionally, a doctor or nurse, particularly in recent active case situations (recent = CATI responded within 7 days of index case hospitalization), to identify cases and administer chemoprophylaxis
<p>HH identification</p>	<ul style="list-style-type: none"> ● Daily examination of line list at CTC to extract address of cases hospitalized in the previous 2 weeks ● Team visit to take GPS of case HH: <ul style="list-style-type: none"> ○ All people living with that patient in same HH are defined as key contact persons ● Surrounding HHs: <ul style="list-style-type: none"> ○ Circle with a 500 meters radius around case HH is delineated ○ 500 meters as max length but depends on setting; in dense areas, this could mean a lot of houses ○ Each circle is then subdivided into a grid ○ Each grid unit represented an average of 20–30 HHs
<p>Activities at HH</p>	<ul style="list-style-type: none"> ● HH drinking water chlorinated every day over a 14-day period using either water purification tablets or 1% chlorine solution ● Hygiene kit distributed included: <ul style="list-style-type: none"> ○ Soap (2/person for the 2 weeks) ○ A 20-L water storage container ○ Aquatabs—for 14 days (given every day by the community health workers and reminded to use only safe water) ● Information Education and Communication <ul style="list-style-type: none"> ○ Key to ensure that head of HH follows the recommended activities ● Disinfection of HH only for active case HHs <ul style="list-style-type: none"> ○ Only if within 7 days from case hospitalization ● When issues with latrines—add building community latrines ● Chemoprophylaxis (doxycycline) given to immediate contacts of active cholera cases (i.e., people living in the case HH) (only if within 7 days from case hospitalization). No antibiotic provided to neighboring HHs

Activities in communities	<ul style="list-style-type: none"> • Public launching ceremony • Installation of water bladders • Installation of fixed water chlorination points (bucket chlorination) • Installation of handwashing points • Hygiene education messages via radio, TV, posters, town criers • Active case search • No latrine was built
Activities at health facilities	<ul style="list-style-type: none"> • In-depth investigation of contamination of the cases • Interview of the patient's attendants to better understand the context • Provision of cholera treatment kits
COORDINATION	
	<ul style="list-style-type: none"> • MoH through PNECHOL-MD was in charge of coordination for entire response and coordinated the activities conducted by Department of Health, health zone, local Red Cross, and representative of the community • Exit strategy was elaborated to hand over activities from PNECHOL-MDI to health zone and Congolese Red Cross who continued activities with funds from WHO

KASANSA DISTRICT, KASAÏ ORIENTALE (August–December 2018)

ACTORS	
WASH	<ul style="list-style-type: none"> • Governmental branches: Regie de Distribution des Eaux (REGIDESO) • Funding/technical support: MSF • Implementing organization: MSF and REGIDESO
Health	<ul style="list-style-type: none"> • Governmental branches: MoH • Funding/technical support: MoH, AIDES, MSF • Implementing organization: MoH and MSF
CATI IMPLEMENTATION	
Alert and flow of information	<ul style="list-style-type: none"> • Cholera cases were reported through the national surveillance system; health authorities requested assistance early August, but only the second request for assistance triggered a response by MSF • MSF investigates cases admitted at health facility, takes samples, and sends them to National Institute for Biomedical Research (INRB) in Kinshasa • In addition, MSF investigates other notification of cholera cases in communities by going to HHs with suspected cases and confirming case fits the case definition; referral to health facility was organized if needed
Team composition	N/A
HH identification	N/A
Activities at HH	No activities were implemented at the HH level ⊕

Activities in communities	<ul style="list-style-type: none"> ● Health promotion and encouragement of care-seeking to oral rehydration points (ORPs) or CTCs ● Outreach community health workers and ambulance were deployed
Alert and flow of information	<ul style="list-style-type: none"> ● Surveillance data were used to identify most affected health zones (reporting >10% of total suspected cholera cases during last 3 weeks) ● Line list at CTCs in most affected health zones were then reviewed to obtain address of patients admitted over previous 2-week period ● A team would then visit HH to take GPS and delineate intervention area around the case HH ● If a new case came from an ongoing CATI, a new CATI was not initiated for another 14 days; rather the CATI team administered prophylaxis for the new case's key contacts, conducted a 'deep' investigation to understand the source of the case (often traveled from other areas), and reinforced the CATI activities
Activities at health facilities	<ul style="list-style-type: none"> ● MSF activities were mainly centered around health facilities and included: <ul style="list-style-type: none"> ○ Clinical care, supporting 2 CTC and 5 ORPs (with few beds), by providing human resources (medical doctors and nurses), essential medicines, and reinforced surveillance ○ WASH in health facilities ○ Set up ambulance service to encourage cases to come to health facility ○ Distribution of hygiene kits to all admitted cases at CTC; note that as all cases were admitted (with a different plan according to their level of dehydration); this activity could be seen as using a case-targeted approach but delivered at health facility ○ Number of kits was not sufficient to implement CATI approach (case + neighbors) (requested 250, but only 165 arrived) ● Hygiene kit composition: estimated supply for a family of 5 for 1 month: jerrycan, bucket, 60 sachets of flocculant disinfectants or 120 chlorine tablets, 1 kg of soap

COORDINATION

	<ul style="list-style-type: none"> ● Long list of actors, but unclear whether they were implicated in the cholera response, or whether they were conducting other activities in the area: <ul style="list-style-type: none"> ○ Catholic Relief Services ○ UNICEF—provided a nutrition program ○ Local government ○ Save the Children ○ SI ○ ActionAid ○ Other organizations that sent supplies to the area to support the response or had been involved in previous cholera responses ○ District provincial sanitaire—WASH officer ● MSF follows national program for the elimination of cholera and viral diseases
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GOMA, NORTH KIVU (since December 2019)

ACTORS	
WASH	<ul style="list-style-type: none"> • Governmental branches: Ministry of Health, PNECHOL-MD • Funding/technical support: UNICEF • Implementing organization: Red Cross
Health	<ul style="list-style-type: none"> • Governmental branches: Ministry of Health, PNECHOL-MD • Funding/technical support: UNICEF, WHO • Implementing organization: MSF-Holland; Heal Africa
CATI IMPLEMENTATION	
Alert and flow of information	<ul style="list-style-type: none"> • Data from health facilities was shared daily with central bureau of zone, and subsequently with provincial division and on the national level; data was also confirmed with lab and results sent to DPS • In addition to daily data reporting, weekly aggregation and analysis were conducted at provincial level by DPS surveillance team • There were 7 or 8 CTCs near Goma reporting cases together with lab and response team; CTC provided case information/line list, but it was up to teams to decide how to prioritize • UNICEF received alerts of suspected cases; prioritized areas with high positivity rates (50% to 60%) over suspected cases and areas where there was no history of recently confirmed cases or no confirmed history of cholera • In North Kivu, each zone had set threshold depending on whether they have endemic cholera or epidemics; in Goma, for example, threshold to activate a CATI at time of the interview (October 2020) was 10 cases • Alert system was reported similar to that which was later implemented in Haiti
Team composition	<ul style="list-style-type: none"> • 8 mixed teams composed of staff from provincial health authorities and partners <ul style="list-style-type: none"> ◦ Included 2 nurses from provincial health directorate in each team ◦ Included 2 Congolese Red Cross staff trained in WASH and CATI basics • WASH personnel included community volunteers financed by different NGOs; some supported by WHO, MSF, UNICEF-financed Congolese RCRC, Heal Africa • Each zone has an investigation team
HH identification	<ul style="list-style-type: none"> • 15–20 HHs in ring around the index case • If another suspected case was found while implementing CATI, a bigger ring was created on the spot to tackle the additional cases found • Prioritization for UNICEF was based on history of cases in that area, closest case geographically, and if they found another suspected case they would create another, bigger ring
Activities at HH	<ul style="list-style-type: none"> • Teams carried out an investigation of HH and 15–20 surrounding HHs and they could finish 4–5 cases per day depending on the neighborhood • HH disinfection targeting toilets and kitchens • Distribution of Aquatabs for 1 month, soap, ORS, and storage container, at times buckets based on an average needed not on the actual number of HH members • Water quality monitoring • Antibiotics not used as they stated that they did not work in this context • The same activities are carried out for areas that have seasonal outbreaks and areas that are endemic



Activities in communities	<ul style="list-style-type: none"> MSF CTC organized a WASH hygiene promotion campaign and distribution of kits that lasted 14 days No activities as part of CATI at community level
Activities at health facilities	N/A
COORDINATION	
	<ul style="list-style-type: none"> Actors coordinating include WHO, UNICEF, MSF-Holland, the Red Cross, Heal Africa Cholera-specific meetings at the beginning Eventually had weekly meetings to share epidemiological information including cholera and most diseases. Coordination in support of the provincial Directorate with a weekly meeting, analysis of the data, and updating on the activities of actors in the area (UNICEF attempted to reinforce data sharing as part of coordination) UNICEF would attend both WASH sector meetings and cholera coordination meetings between stakeholders to make sure information was being shared

CATI ACTIVATION AND IMPLEMENTATION AS PER UNICEF REGIONAL STRATEGY

CATI IMPLEMENTATION	
Alert and flow of information	<ul style="list-style-type: none"> Team goes to CTC and examines register for cholera and/or standard register and/or cholera line list Identify new cases of the day or day before, and nurse (in charge of the health facility) provides additional information, if any Team visits the HH of the cholera case(s)
Team composition	<ul style="list-style-type: none"> 4 persons <ul style="list-style-type: none"> Team leader—trained WASH Sensibilizateur (health/WASH promoter) Driver—decontaminator Health person—often nurse; sometime lab person; facilitate access to CTC; must consider hypothesis of transmission; treat with ORS; refer those who are sick to CTC
HH identification	<ul style="list-style-type: none"> Cordon sanitaire includes an average of 12 houses <ul style="list-style-type: none"> In Haiti could do 15 houses, but depends upon density Ultimately, it is head of the team who decides how many HHs to include in cordon sanitaire according to context (e.g., density, risk factors) If there is case that falls into current CATI, they investigate to see whether it is positive

<p>Team composition</p>	<ul style="list-style-type: none"> ● WASH: <ul style="list-style-type: none"> ○ Decontamination—HH, latrines ○ Kit distribution—soap, ORS, water treatment (such as Aquatab) for 1 month and a 6-person HH ○ Sensibilisateur (health/WASH promoter) ○ If/once case was laboratory confirmed, second visit: ○ Not all products were distributed again, only if they were used ○ Second investigation to better understand epidemiological link/source ● Health: <ul style="list-style-type: none"> ○ ORS (from cholera kit) ○ Chemoprophylaxis is not given, as not sensitive and due to resistance
<p>Activities in communities</p>	<ul style="list-style-type: none"> ● Chlorination of water points ● Surveillance: <ul style="list-style-type: none"> ○ Case investigation ○ Active case search
<p>Activities at health facilities</p>	<ul style="list-style-type: none"> ● Surveillance: <ul style="list-style-type: none"> ○ Case investigation ○ Active case search

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CATI ACTIVITIES IMPLEMENTED IN THE EXAMINED OUTBREAKS (AGGREGATED)

WASH INTERVENTIONS

Household activities

- Household disinfection
- Latrine disinfection
- Hygiene education session
- Aquatab distribution
- Water storage container distribution
- Water collection container/jerrycan
- Water quality monitoring
- Cholera kit distribution
- Hygiene kit distribution
- Soap distribution
- Laundry powder distribution
- Chlorinated solution distribution

Community

- WASH assessment
- Health promotion
- Aquatab distribution
- Bucket chlorination
- Chlorination at water point
- Latrine construction in public areas
- Water point rehabilitation
- Waste management
- Garbage holes dug
- Cholera kit distribution
- Hygiene kit distribution
- Safe burials
- Community volunteer training

HEALTH INTERVENTIONS

Household activities

- Oral cholera vaccine
- Chemoprophylaxis
- Referrals to CTC
- ORS distribution
- Case identification

Community

- Oral cholera vaccine
- Chemoprophylaxis
- ORT through mobile clinics

OVERALL SUCCESSES AND CHALLENGES

Successes⁵

- Cholera incidence. Despite trends already being on the decline when interventions began, both responses in Masisi and Kinshasa were considered successful by the interviewees in curbing the spread of cases.

- In Masisi, the speed of receiving emergency funds for response and the flexibility of the funding were reported as key factors that made successful CATI interventions possible.
- In Kinshasa, cholera incidence decreased rapidly in the zones where interventions were implemented; however, attribution is difficult to assess.

⁵ Note that success for this report refers to the CATI mechanism of implementation and NOT the control of cholera.

- In Kasai-Oriental, cholera kit uptake and use were reported as high.
- Combined door-to-door communication, mass education, and engagement with zone leaders to increase knowledge about cholera and reduce stigma.

Challenges

Despite the reported overall successes, the implementation of CATIs in DRC faced various challenges

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that can be grouped around three main issues: CATI implementation; stigma; and resources.

CATI implementation

- Masisi outbreak. As no CATI protocol existed in 2017, partners had to define a protocol at the beginning of the intervention. Despite the joint WASH-health design, WASH activities and medical referrals did not work together to identify, treat, and support cholera case HHs. Also, the protocol lacked clear instructions in the event that a HH had already been visited in relation to a previous case; this included a lack of clarity in terms of time that must elapse before a HH is visited again and alludes to challenges with managing clusters of cases.
- The admission of cholera cases to health facilities varied:
 - In Masisi, two respondents noted that there was not an established protocol to consistently admit cholera cases. This in turn affected the data and information available to CATI teams, and undermined the ability of teams at the field level to implement the activities. This specifically affected the speed at which CATIs could be implemented to reduce incidence of cholera cases in an area.
 - In Kasai-Oriental, cholera kits were meant to be distributed to all admitted cholera cases. In practice, cases admitted to CTC received kits, but those who sought care at ORPs did not, as an ORP was not considered a health facility for those teams delivering kits. As some ORPs did have beds and admitted patients, the non-distribution of kits to admitted patients created some confusion among communities and represented a lost opportunity to increase coverage.
- The timing of each CATI intervention was influenced by a series of factors, including availability of NGOs to respond, funding, and supplies.
- Composition of kits was based on an 'average HH size' of five to six persons, without the possibility of adapting kit size for much larger HHs.

- In one outbreak only, there was a clear exit strategy (Masisi). In other locations, the reduction of incidence was sufficient for a decision for the CATI interventions to end; but this appeared to be more closely linked to availability of funds and not a clear protocol or threshold.
- Specific efforts were required to bridge the sectoral silos and facilitate information sharing across sectors as well as implementation of joint activities.

Stigma

- Stigma related to the identification of additional cholera cases during the CATI activities in the neighboring HHs of an index case. A certain resistance to accept a diagnosis from nonmedical personnel was reported. CATI teams would, therefore, focus their effort to encourage HHs with suspected cholera cases to seek care at the health facility and to consult with a medical professional.

Resources

- Although detailed reports on the cost per CATI were not readily available nor discussed during the interviews, respondents considered CATI an expensive intervention given the number of people that could be reached and the size of the outbreaks.
- There were not enough supplies to visit an agreed-upon number of HHs consistently. Implementing NGOs often resorted to targeting a number of HHs based on the supplies they had available. Teams reportedly left in the mornings with the supplies, and if additional cases or HHs needed the activities, they were assisted so long as the teams had enough supplies. The NGOs reported that the number of HHs visited ranged from five to 20 given the limited supplies.

PARTICIPANTS

We interviewed persons from the London School of Hygiene & Tropical Medicine, Médecins Sans Frontières, Ministry of Public Health, Solidarités

International, UNICEF, and an independent consultant, all of whom had firsthand experience working in cholera in DRC sometime between 2003 to 2020. The affiliations reported for the interviewees were at the time of the interview and not necessarily when they were working in DRC. The views expressed in this report are those of the authors and do not necessarily reflect the official policy or position of those interviewed or their organizations.

LESSONS LEARNED

(1) DRC has been instrumental in developing various strategies such as **'Quadrillage'** and **CATIs** that have helped the overall global planning and response to cholera epidemics.

(2) **Surveillance data** is essential in implementing CATI-like approaches, and this was highlighted across most of the interviews. Timely access to surveillance or line list data was recognized as key to identify the most affected areas, or to target HHs with cholera cases, and trigger the implementation of response activities. Active daily surveillance is one of the pillars of UNICEF's CATI and CORT strategy.

(3) **Effective communication with affected communities** is a key tool to increase awareness and reduce stigma around cholera. Multiple channels to reach a variety of population groups have been successfully used in DRC; for example, door-to-door activities have been implemented at the same time as mass communication, as well as engaging with community or religious leaders to leverage the trust the community has in their leaders.

(4) The establishment of **clear protocols** for CATI activation, team composition, methods of choosing numbers of neighboring HHs around the case HH, and other components are important for predictable and systematic response.

(5) **Flexible resources** that allow for rapid implementation of CATIs and the possibility of expanding and reducing teams in different geographical areas are important, but not always available.

II. RETROSPECTIVE CASE STUDY ON CASE AREA TARGETED INTERVENTIONS IN HAITI (2010–2019)

SUMMARY

HAITI

The large-scale cholera outbreak in Haiti (2010–2019) continued for nearly a decade and affected the entire country. Several national and international actors responded to the crisis. Case area targeted intervention (CATI) was one of the approaches adopted by the responders to reduce community transmission of the disease. The CATI approach includes implementing a set of surveillance, health, and water, sanitation, and hygiene (WASH) activities in the identified case and surrounding neighbors' households.

The objective of this report is to summarize the CATI experience in Haiti by interviewing key personnel who were involved in the response. We conducted nine key informant interviews including personnel from United Nations agencies, government branches, and non-governmental organizations (NGOs) to learn about the CATI implementation process, coordination, success, challenges, and lessons learned. We noted that over time the approach evolved by (1) combining government-implemented health interventions and NGO-implemented WASH interventions to be delivered by a single CATI team; (2) strengthening the coordination between health and WASH actors; (3) building community surveillance, laboratory capacity, and data sharing; (4) standardizing the implemented health and WASH activities to be delivered in all departments in the country; and (5) integrating the CATI approach as a complement to the ongoing holistic response strategy.

As echoed by the interviewees, the main success of this approach was the ability to target preventive

interventions to the high-transmission-risk households by engaging the multidisciplinary skills of the different actors. Insufficient coordination among different actors at the initial stage of the response was reported as one of the most common challenges. Last, we summarized a set of lessons learned to aid in improving future CATI approaches in Haiti and similar contexts.

BACKGROUND

While targeted WASH interventions to rapidly confine cholera cases have been studied retrospectively, the evidence of health interventions and their integration with those of WASH are scarce. Documenting health interventions in cholera response together with their integration with WASH in rapid response teams (RRTs), as well as the epidemiological/surveillance components, can inform future cholera outbreak responses. For this research at present, RRTs will be defined as CATIs that occur at the household level.

CATIs are the focus of a research study conducted by the Center for Humanitarian Health at the Johns Hopkins Bloomberg School of Public Health titled *Cholera rapid response teams in humanitarian and fragile settings*. This study entails four main components: (1) a systematic review of peer-reviewed literature; (2) a landscape analysis of grey literature; (3) a retrospective study of implemented CATI; and (4) a prospective assessment of CATIs during a cholera response. The peer-review literature report on CATIs, as well as the grey literature review and landscape analysis report, were published in August 2020.

	WASH	HEALTH
Government branches	<ul style="list-style-type: none"> • National Directorate for Water and Sanitation Authority (DINEPA) • Emergency Response Department 	Ministry of Public Health and Population (MSPP) <ul style="list-style-type: none"> • Decentralization Support Unit • Division of Epidemiology, Laboratory, and Research (DELR) • Directorate for Health Promotion and Environment Protection
Funding/technical support agencies	<ul style="list-style-type: none"> • UNICEF • World Bank 	<ul style="list-style-type: none"> • Pan American Health Organization (PAHO/WHO) • Centers for Disease Control and Prevention (CDC)
Implementing organizations	<ul style="list-style-type: none"> • Action contre la Faim • Agency for Technical Cooperation and Development • Solidarités International • Intermon Oxfam • Zanmi Lasante (Partners in Health) • French Red Cross 	<ul style="list-style-type: none"> • Médecins Sans Frontières (MSF) • Médecins du Monde (MdM) • Partners in Health • International Organization for Migration (IOM)

Table 3: List of WASH and health actors* involved in the CATI implementation

*Some actors were involved for certain locations of the country and for certain duration of the outbreak.

For the retrospective component, our aim is to document the retrospective evidence of CATI approaches in different cholera outbreaks. Since some of the details of WASH interventions have been recorded recently,⁶ we aim to complement that work by focusing primarily upon the health interventions and their integration with those of WASH from previous RRT/CATI documentation, as well as the epidemiological/surveillance components. Four countries have been selected for the retrospective components, namely, Haiti, the Democratic Republic of the Congo, Yemen, and Zimbabwe.

This summary focuses on Haiti and presents information derived solely from the key informant interviews and reports and internet links shared

by the interviewees for the retrospective component. It does not include information from grey reports or peer-reviewed articles. These retrospective summaries are intended to complement the other components of the research study.

Cholera targeted interventions

In Haiti, the cholera CATIs started in 2013. The intervention was financially supported by UNICEF and the World Bank. NGOs in the 10 departments in Haiti formed WASH rapid response teams with technical support from UNICEF. The number of teams per department and the size of these teams varied. The Directorates of Health offices in all 10 departments established mobile rapid intervention teams called Équipes Mobiles d'Intervention Rapide (EMIRA). Each EMIRA team had 10 trained staff. By 2014

⁶ UNICEF. *Global review of WASH components in rapid response mechanisms and rapid response teams—Haiti, Nigeria, South Sudan and Yemen*. UNICEF, New York, 2018.

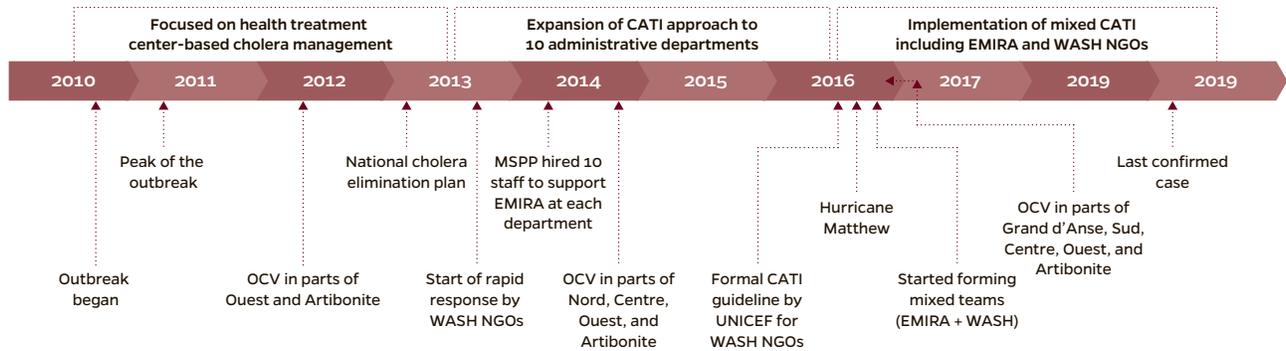


Figure 1: Key events related to the CATI approach in Haiti's cholera outbreak

all departments had at least one EMIRA team and several NGO WASH response teams.

Initially, the WASH and health activities were implemented separately. Health and awareness interventions were conducted by EMIRA teams overseen by the Ministry of Public Health and Population (Ministère de la Santé Publique et de la Population [MSPP]). WASH activities were implemented through WASH RRTs supported by UNICEF and primarily undertaken by NGOs (Table 3).

In 2016, mixed teams were formed combining the NGO WASH team members and MSPP/EMIRA members to improve logistical efficiency, response timeliness, and cost effectiveness, and to ensure a more coordinated response. These consisted of three- to four-member teams and included a team lead, a nurse (from EMIRA), a WASH person, and a driver (who also undertook some interventions). The mixed team strategy was adopted gradually across the country, and by 2017 all 10 departments had mixed teams responding to cholera outbreaks.

TIMELINE

The outbreak began in October 2010 with the last confirmed cholera case reported in February 2019. It started in the Central department and spread to all 10 departments of the country. The key events related to the CATI approach along this time frame is presented in Figure 1. While the oral cholera vaccine

(OCV) campaign was not implemented as an individual case targeted activity, several OCV campaigns were carried out by the responders targeting local hot spots and high-risk areas.

ACTORS

The implementation of the CATI approach was a collaborative effort by the government of Haiti, donors, technical support agencies, and implementing partners (Table 3).

CATI IMPLEMENTATION

Alert and flow of information

Each reported cholera case triggered an alert to undertake a CATI. There were three mechanisms to trigger an alert: (1) cases arriving at the health care facilities or treatment institutions; (2) community health workers reporting suspected cases to the corresponding treatment facilities; and (3) other sources (e.g., local elected officials, DINEPA's commune-level agents, etc.) that could report suspected cases. As this was a very large epidemic, it was not possible to have a CATI for every case reported, and thus prioritization criteria to implement CATIs were created. CATIs were prioritized by case clusters, dehydration status of the patient, diarrheal deaths, and areas with previous culture positivity cases (after improvement of the lab testing capacity occurred).

Once an alert was generated, the CATI teams were deployed to implement the activities. Initially, the number of cases were published weekly by MSPP; the reports were aggregated and did not contain individual case information. At the beginning (2013–2015), access to the line lists was not easy in all of the departments. However, the addition of EMIRA member in the mixed team improved the access to data. To improve rapid response, Pan American Health Organization (PAHO), Centers for Disease Control and Prevention (CDC), and MSPP developed the national cholera surveillance system (NCSS) in mid-2017, which summarized and published daily reports from departments and communes. Standard line lists were introduced at the cholera treatment centers (CTCs), and the line list information, including the address of the patient, was shared with the CATI teams. PAHO and UNICEF improved the laboratory testing capacity of the country by supporting the Laboratoire National de Santé Publique (LNSP) and Saint-Marc Laboratory. The suspected case testing increased from 20% to 95% between 2016 to 2018. From 2018, lab test results were made available online, which was used by actors to identify clusters of positive cases to send follow-up teams for hygiene promotion and community case investigation.

To monitor the commune outbreak severity from the central level, a three-level (**red**, **orange**, and **green**) alert system was introduced in 2013. For each commune, the severity level was determined by the number of deaths, culture positive cases, and total suspected cases during the past seven days.

Implementation

CATI teams traveled to the site in project vehicles. Before the mixed team formation in 2016, the WASH and health activities were completed on the same day or on separate days by the two distinct teams. After the mixed teams were formed, the activities were completed, in principle, on the same day (Table 4); if the case and surrounding neighboring households were missing, the team went back another day to complete the activities. For nearby communities, the CATI team completed

the activities and came back on the same day; for remote areas, if needed, CATI teams stayed in the community up to one to two weeks to respond to local outbreaks.

The number of CATIs completed per day depended on the distance of the case household from the CTC; fewer CATIs were completed per day if the travel time was longer (range: between one and five CATIs per team per day). Implemented WASH and health interventions did not change between the case and the neighbors' households. Local CATI team members helped with the case household identification in the community. Typically, all suspected cases were responded to by the CATI team. Rapid diagnostic tests were sporadically used to verify the suspected cases, which stopped in 2015 because of unavailability at the CTCs and inconsistent results. Culture test confirmation was not used to verify cases before sending a CATI team, as that would take several days to obtain the test result causing delay in the response. For community health worker reported cases, before sending the CATI team, the health worker or the nearest health centers were contacted to verify the increased acute watery diarrhea rate in the area. At a given time, there was only one definition of a suspected case. However, the definition modified over time.

Adaptable criteria were used for neighbor selection depending on the context and density. Five to 20 households or a 50- to 100-m radius was used for selecting the households around the case households. Adjacent houses were prioritized. In urban areas, all households of the case household's street (for small streets) were selected in the event of a localized outbreak or cluster of cases. Ultimately, it was up to the team leader to make the decision as to how to choose the neighbor household selection. Before 2016, GPS coordinates of the case household were inconsistently collected. In cases where the address was inaccurate as reported by the CTC or from a community health worker, the CATI team asked community members to identify the specific case household. If a new case was found while implementing CATI, the ring was expanded to

WASH INTERVENTIONS

Household activities

- Household disinfection
- Latrine disinfection
- Hygiene education session
- Aquatab distribution
- Water storage container distribution
- Water collection container/jerrycan
- Water quality monitoring
- Household cholera kit distribution
- Hygiene kit distribution
- Soap distribution
- Laundry powder distribution
- Chlorinated solution distribution

Community

- WASH assessment
- Health promotion
- Aquatab distribution
- Bucket chlorination
- Chlorination at water point
- Latrine construction in public areas
- Water point rehabilitation
- Waste management
- Garbage holes dug
- Cholera kit distribution
- Hygiene kit distribution
- Safe burials
- Community volunteer training

HEALTH INTERVENTIONS

Household activities

- Oral cholera vaccine
- Chemoprophylaxis
- Referrals to CTC
- ORS distribution
- Case identification

Community/health care facility-based activities

- Oral cholera vaccine
- Chemoprophylaxis
- ORT through mobile clinics

Table 4: List of interventions commonly implemented as part of the CATI approach

Note: interventions implemented in Haiti are checked.

include the new case and their neighbors. If there was a second case reported that was situated inside a previously completed CATI ring, the case and new neighbors (not reached previously) would receive full CATI interventions without repeating activities in the first CATI ring. However, this depended on the duration between the first CATI implementation and the identification of the second case.

The **red**, **orange**, and **green** alert system was used to identify communes with a higher number of cases and deaths. While in **red** communes the CATI approach was not replaced with mass community interventions targeting the entire population, broader WASH community activities were conducted to reduce the transmission.

CATI ACTIVITIES

Activities between case and neighbors' households were broadly the same in Haiti in terms of case investigation and health promotion. Additionally, the contaminated surfaces of the case household and latrine were disinfected by spraying liquid chlorine solution. The members in the case household (nonpregnant adults) also received single-dose antibiotic chemoprophylaxis when a nurse was part of the CATI team. At the case and neighbors' households, 10–15 strips of 33-mg Aquatabs (100 tablets for urban, 150 tablets for rural), or one-month equivalent local liquid chlorine, 80-g soap bars (three in urban, five in rural), educational material, five sachets of ORS, and a 20-liter bucket with tap and lid were provided. Additionally, the CATI team also assessed the WASH condition of the case and neighbors and tested water in the case household for free chlorine residual (FCR). FCR was occasionally tested at the water collection point and neighbor household. Bucket chlorination was started if the water source was contaminated or in the absence of water test results, if the source was used by several households. DINEPA was informed if infrastructural repair/rehabilitation was needed. While DINEPA was not part of the CATI team, the organization worked with the EMIRA and NGO WASH teams to ensure chlorinated drinking water in the affected communities.

COORDINATION

Regular weekly meetings were conducted with MSPP, DINEPA, WHO, and UNICEF among other organizations. Weekly epidemiological reports were presented in these meetings to analyze the situation and select response priorities. UNICEF (embedded in DINEPA) led the WASH cluster and PAHO/WHO led the health cluster. The cluster system ended in 2013 in Haiti. UNICEF and PAHO/WHO coordinated the WASH and health NGOs, respectively. UNICEF started monthly coordination meetings with WASH NGOs in 2014, which were modified to monthly cholera partners coordination meetings by adding

PAHO and health NGOs in 2015. Since mid-2016, weekly meetings were also conducted at the department level with the WASH NGOs by UNICEF. The department meeting frequencies changed based on the magnitudes of the local outbreaks. UNICEF primarily supported the CATIs together with Action Contre la Faim, Agency for Technical Cooperation and Development, Solidarités International, Intermon Oxfam, Zanmi Lasante, and French Red Cross, while DINEPA primarily worked on both reactive chlorination of water systems and longer-term infrastructure WASH projects. DINEPA has the most capacity at the central level and its involvement in the cholera response differed at local levels depending on the priorities. There was some disagreement between the WASH and health sectors regarding the WASH in health care facilities responsibilities.

Initially, the coordination among the EMIRA and WASH RRTs to visit the same case households for a CATI was often difficult. The EMIRA teams did not have sufficient logistical support, particularly functioning vehicles. Sometimes the interventions were incomplete if either team was not able to go to the geographical area where the CATI was to occur. In some instances, the WASH team would take an EMIRA member into their vehicle when going to a response to complete the full CATI intervention. This practice eventually led to the formation of the mixed team combining WASH and health staff.

CHANGES OVER TIME

- **Mixed team formation.** Initially, the WASH and health activities were implemented by separate teams. To improve efficiency, mixed teams were formed with three to four members combining the EMIRA and NGO WASH teams. This occurred for a variety of reasons including logistical issues.
- **Sharing of case data.** In the beginning, aggregated case information by commune was shared with the WASH partners every week. The aggregated information did not have specific locations of the cases and caused delays in response. Eventually, to improve targeting, specific line lists

with locations were shared with the WASH teams at the CTC directly. However, this access was not consistent geographically and temporally. The EMIRA teams always had access to the line lists at the CTC level.

- **Coordination.** WASH and health sectors improved coordination gradually. UNICEF advocated to improve the cholera case targeting and PAHO strengthened the laboratory testing capacity, which enabled CATI teams to prioritize confirmed cases.

OVERALL SUCCESSES AND CHALLENGES

Successes⁷

- **Implementing the CATI approach.** Starting the CATI approach was considered by many as a success in preventing and reducing the community transmission of cholera. This was a new concept in Haiti, and the CATI approach allowed the targeting of specific cases and resources instead of mass campaigns and attempting to control the cholera outbreak solely at the community level.
- **Standardized implementation and indicators.** The development of a consistent protocol to implement CATIs despite different implementing partners in different departments (however, the method to choose the neighboring households from the identified case was context specific and was decided by the CATI team lead); eventually, standard CATI indicators were developed and used in reports by all partners from all departments.
- **Coordination/collective approach.** Government branches, UN agencies, and NGOs worked together in the response, and the coordination improved over time. Despite the different administrative mechanisms (e.g., funding, recruitment, logistics) of these organizations, the CATI approach was eventually implemented in all departments in Haiti.

- **Line list sharing.** A central system to collect, organize, and publish the line lists from commune and departments was eventually developed. This required improving confidence and trust among all players over time.
- **Integration of health, WASH, and surveillance.** Eventually, the CATIs were implemented in an integrated approach combining WASH and health interventions with the sharing of line lists; this was an important accomplishment, as many CATI or CATI-like responses in other countries provide predominantly WASH activities.

Challenges

- **Coordination.** While ultimately improved, initially the coordination between WASH and health/surveillance was not particularly smooth. At the central level, separate meetings were held between WASH and health partners. At the department levels, line lists were not initially shared with the WASH CATIs in each department. Eventually, combined meetings were conducted on cholera coordination including partners from both clusters.
- **Sustainability.** The national system did not (and still does not) have the capacity and resources to adequately implement CATIs once outside funding was stopped. The CATI approach (EMIRA plus WASH) was implemented as an additional activity in response to the cholera outbreak and was not established as an integral component of the national outbreak response mechanism.
- **Amount of funding.** Overall, it appears that there were more resources for the WASH CATIs than for the EMIRA. Additionally, the capacity and organizational systems of receiving and utilizing external fund were limited within MSPP. In fact, the limited resources to adequately implement activities appear to be one reason that the integration of the CATIs occurred.
- **Priorities set by international actors.** In the first few years of the outbreak, the primary focus of the international support was reportedly on case

⁷ Note that success for this report refers to the CATI mechanism of implementation and NOT the control of cholera.

management at the health care facilities. Fewer resources were mobilized to support community-targeted activities and even less so for CATIs. Over time, the importance of controlling the community spreading became more apparent for donors and other actors, and more resources were distributed to community-level activities, and eventually to support CATI activities.

- **Inadequate number of nurses.** There were not enough nurses to accompany all CATI teams as they were needed at the CTCs.

PARTICIPANTS

We interviewed persons from the Agency for Technical Cooperation and Development, Department of Health Promotion and Environmental Protection, Hôpitaux de Marseille (France), International Organization for Migration, National Directorate of Potable Water and Sanitation, University of Notre Dame (Haiti), Pan American Health Organization, and UNICEF, all of whom had firsthand experience working in cholera in Haiti sometime between 2010 and 2020. The affiliations reported for the interviewees were at the time of the interview and not necessarily when they were working in Haiti. The views expressed in this report are those of the authors and do not necessarily reflect the official policy or position of those interviewed or their organizations.

LESSONS LEARNED

(1) Community- and household-based interventions.

Early implementation of community-based and household responses (i.e., CATIs) could have reduced transmission of cholera (according to participants; we do not have these data to support this).

(2) Local CATI team members. Having local team members as part of the CATI was helpful to identify locations of the case households once the CATI team was in the community.

(3) Standardized CATI protocols. Developing a standardized CATI protocol that allowed for flexibility regarding the selection of neighboring households by the team leader according to context (e.g., urban vs rural, time to travel to CATI).

(4) Standardized CATI indicators. Developing and reporting on key CATI indicators (e.g., number of cases reported by CTC that were responded to by a CATI within 48 hours) appeared to have improved the intervention. UNICEF's project agreements with NGOs had indicators to monitor the partners.

(5) Centralized database. The database with cases reduced duplication and resulted in an improved ability to analyze trends and locate hot spots.

(6) Integration of health and WASH CATIs. Integration of health and WASH CATIs was more effective than having two separate CATIs. Such early integration may have also addressed some of the early issues of line list sharing.

(7) Integration of CATI into the national system. The need to integrate a CATI or CATI-like mechanism into the national systems with sufficient funding was mentioned by the participants. It is reasonable to not maintain the entire response team during non-outbreak periods. However, there should be procedures to retain contingency pools of trained personnel and incorporate the lessons learned into the national outbreak response strategies.



III. RETROSPECTIVE CASE STUDY ON CASE AREA TARGETED INTERVENTIONS IN YEMEN (2016–2020)

SUMMARY YEMEN

Yemen is the largest humanitarian crisis in the world today. It is extremely difficult to work in such an insecure environment. While there are many lessons to be learned from the response to one of the largest cholera epidemics ever recorded, we want to clearly acknowledge the challenges in working in such a complex environment and the many successes that have been achieved by everyone toiling tirelessly during an active conflict in one of the poorest and most food-insecure countries in the Middle East and North Africa.

The cholera outbreak in Yemen began in October 2016 and was still continuing during the time of the report in December 2020. The outbreak affected the entire country. The Ministry of Public Health and Population (MoPHP) and Ministry of Water and Environment (MoWE) responded to the outbreak with support from United Nations (UN) agencies and international non-governmental organizations (NGOs). The case area targeted interventions (CATIs) were one of the approaches adopted by the responders to reduce community transmission of cholera. MoPHP and MoWE implemented individual rapid responses by employing the CATI approach. The MoPHP primarily focused on health and surveillance activities, and MoWE concentrated on water, sanitation, and hygiene activities.

The objective of this case study is to summarize the CATI experience in Yemen by interviewing essential personnel involved in the response. We conducted eight key informant interviews with participants from UN agencies and international NGOs to learn

about the CATI implementation process, coordination, successes, and challenges, and lessons learned. There were many challenges to implementing CATIs, including the following: (1) two parallel systems of CATI approaches were implemented by MoPHP and MoWE with marginal overlap of activities; (2) coordination among and between agencies and ministries was challenging throughout the epidemic; (3) immediate access to case information and rapid implementation of CATIs were hampered by the ongoing conflict, limited access, and bureaucracy; and (4) the rapid diagnostic tests (RDTs) for cholera surveillance were used widely and in a different manner than is recommended in global guidance.

Yemen is a divided nation at war. The two de facto governments in the south and the north responded with humanitarian agencies to interrupt large-scale community transmission of one of the largest cholera outbreaks ever recorded. The direct involvement of government offices was considered one of the major successes in implementing the Yemen CATI approach. Despite the ongoing conflict and constant challenges, all actors established and gradually improved the CATI response mechanism over time, enabling CATIs to occur in all districts in the country.

BACKGROUND

While targeted water, sanitation, and hygiene (WASH) interventions to rapidly confine cholera cases have been studied retrospectively, the evidence of health interventions and their integration with those of WASH are scarce. Documenting health interventions in cholera response together

with their integration with WASH in rapid response teams (RRTs), as well as the epidemiological/surveillance components, can inform future cholera outbreak responses. For this research at present, RRTs will be defined as CATIs that occur at the household level.

CATIs are the focus of a research study conducted by the Center for Humanitarian Health at the Johns Hopkins Bloomberg School of Public Health titled *Cholera rapid response teams in humanitarian and fragile settings*. This study entails four main components: (1) a systematic review of peer-reviewed literature; (2) a landscape analysis of grey literature; (3) a retrospective study of implemented CATI; (4) a prospective assessment of CATIs during a cholera response. The peer-review literature report on CATIs, as well as the grey literature review and landscape analysis report, were published in August 2020.

For the retrospective component, our aim is to document the retrospective evidence of CATI approaches in different cholera outbreaks. Since some of the details of WASH interventions have been recorded recently,⁸ we aim to complement that work by focusing primarily upon the health interventions and their integration with those of WASH from previous RRT/CATI documentation, as well as the epidemiological/surveillance components. Four countries have been selected for the retrospective components, namely, Haiti, the Democratic Republic of the Congo, Yemen, and Zimbabwe.

This summary focuses on Yemen and presents information derived solely from the key informant interviews and reports and internet links shared by the interviewees for the retrospective component. It does not include information from grey reports or peer-reviewed articles. These retrospective summaries are intended to complement the other components of the research study.

The cholera outbreak in Yemen started in October 2016. The ongoing conflict in the country, which has essentially been divided into two, has significantly deteriorated the existing health and WASH services, which were very limited to begin with; this has played a pivotal role in the spread and severity of the outbreak. In May 2017, the MoPHP declared a state of emergency due to the cholera outbreak. In June 2017, a total of 250,000 suspected cases were reported from 20 of the 22 governorates in Yemen.

The UN and international humanitarian organizations, already responding to the conflict in Yemen, also began responding to a massive cholera epidemic. Yemen is one of the poorest and most food-insecure countries in the Middle East and North Africa. The current conflict has added to the already extremely difficult situation in Yemen, making it the world's worst humanitarian crisis today. Without a doubt, Yemen is one of the most dangerous and insecure countries on the globe in which to provide humanitarian programs. Despite severely limited access and unreliable supply routes due to the conflict, the humanitarian actors together with the de facto two Yemeni governments in the south and the north responded and eventually controlled one of the largest cholera epidemics ever recorded; indeed, many would say the largest cholera outbreak ever recorded. The responders employed a rapid response mechanism (RRM) by sending RRTs to implement preventive health, surveillance, and WASH activities in the suspected or confirmed cholera cases' household, surrounding neighbors' households, and if relevant at communal points (e.g., source waterpoint) to reduce community transmission.

Cholera targeted interventions

In both the north and south of Yemen, there were two separate RRM systems for health (including epidemiological surveillance) and WASH interventions led by WHO and UNICEF, respectively, in conjunction with the two governments. Unlike

⁸ UNICEF. *Global review of WASH components in rapid response mechanisms and rapid response teams—Haiti, Nigeria, South Sudan and Yemen*. UNICEF, New York, 2018.

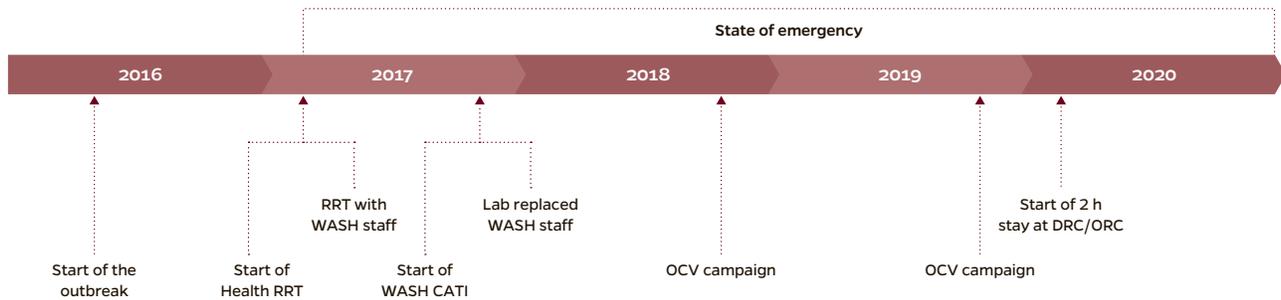


Figure 2: Timeline of the Yemen 2016–2020 cholera outbreak

some other countries, the RRTs responded independently to provide health and WASH interventions. Through iterations over time, the coordination between the health and WASH RRTs improved. Besides cholera, the health RRTs in Yemen were also involved in other disease outbreaks such as measles, diphtheria, and dengue, while the WASH teams explicitly targeted cholera cases. Hereinafter, we will refer to health RRTs as ‘RRTs’ and WASH RRTs as ‘CATIs’ for clarity; however, for this case study, we are referring to those interventions provided to suspected or confirmed cholera cases’ household and the surrounding neighbors’ households by the health RRT and WASH CATI teams to interrupt cholera community transmission.

The health RRTs, supported by WHO, began to operate in May 2016. In total, 23 teams were based at the governorate level and were composed of staff from the governorate health offices that operated under MoPHP. The teams were gradually positioned at the district level from May 2017 to December 2017 to improve the rapid response. During the time of the interviews from July to September 2020, there were 333 health RRTs (1,665 staff) in total with one team per district. There were five members in a team consisting of a surveillance officer (as the team lead), the head of the district health office, a physician, a laboratory, and a health education officer. At the beginning of the outbreak, these teams were equipped with RRT kits that included oral rehydration salts (ORS), Aquatabs, transport media, and medication.

Afterward, in May 2017, the governorate-level teams were modified to facilitate coordination at the national level and served as backup support for the newly implemented district teams. The composition of the RRTs evolved. Initially, the district health RRTs had a WASH staff in the team. However, in August 2017, when separate WASH CATIs were created, the WASH staff from the health RRTs was excluded, and a lab staff was included.

The existing surveillance system in Yemen is called Electronic Disease Early Warning System (eDEWS). This system was introduced in 2013 in four governorates. During the time of interviews, eDEWS included 1,991 sites in all 22 governorates covering all major health care facilities.

The WASH CATIs were supported by UNICEF and began to operate in August 2017. The CATI teams were based at the governorate level and composed of personnel from the General Authority for Rural Water Supply Projects (GARWSP), which operated under the Ministry of Water and Environment (MoWE). Although the teams were managed by the governorate offices, they operated at the district level, and staff were positioned at the districts. There were about 750 teams during the time of the interviews (2020); however, the team numbers were going to be reduced to 350 in the coming months because of reduced funding and a decline in recent cholera incidence. The WASH CATIs had five to seven members with one female member to communicate with the females at the household. While the members of the WASH teams were not

	WASH	HEALTH
Ministries	MoWE	MoPHP
Funding/technical support agencies*	UNICEF	WHO
Implementing government partner	GARWSP	Governorate and district health offices

Table 5: List of actors involved in the implementation

*World Bank was a major funder to both UNICEF and WHO.

all WASH professionals/engineers, they had basic training on behavior change awareness and water disinfection.

TIMELINE

The outbreak started in October 2016. The state of emergency was declared in May 2017. The health RRT started in May 2017, and the WASH CATI started in August 2017. Two mass OCV campaigns were completed in August 2018 and August 2019. The key milestones related to the CATI approach is presented in Figure 2.

ACTORS

Government counterparts are the implementing partners for both health RRTs and WASH CATI teams (Table 5). The health interventions were supported by WHO, and WASH interventions were supported by UNICEF.

CATI IMPLEMENTATION

Alert and flow of information

Health RRTs could receive alerts at the district health offices through multiple surveillance routes—from health care facilities (e.g., diarrhea treatment center [DTC], oral rehydration corners [ORCs], and other health care centers), media alerts reporting cases or clusters of cases, and communities reporting cases

to the 28 emergency operations centers (EOCs). The central EOC met on a weekly basis with electronic disease early warning system (eIDEWS) focal points, the head of EOC, WHO and UNICEF representatives, and governorate EOCs to discuss the epidemiological situation, response, and allocation of resources. Before deploying a health RRT, the case information was verified by calling the case's phone number (usually included in the line lists provided by the health care facilities). If unable to reach the case household, the team would call the focal person/community leader of the area (a person who knows community members) to verify. RRTs also verified the case information with the corresponding health care facility that provided care to the case. RRTs used mobile phones, the internet, or paper-based information to verify the reported case before sending an RRT. Additionally, there was a common task force between the Health and WASH partners where MoPHP shared confirmed cases, a cluster of cases, and cases from new areas with MoWE.

WASH CATIs did not have direct access to the case information. The practice of obtaining case information during the time of the interviews involved multiple steps. As mentioned above, alerts for cholera cases or clusters of cases were generated based on different sources of information. From the districts, this information was sent to the governorate level. The governorates then compiled all line lists and shared those centrally with the MoPHP. The MoPHP reviewed the data, removing duplicates, and then shared that with MoWE and central EOCs. The MoWE then shared the data with the corresponding

governorates to deploy CATIs. There were delays in this process during the first part of the cholera outbreak; however, this improved over time.

In some areas, UNICEF and WASH CATI teams were able to establish quicker information flow mechanisms that allowed WASH CATIs to receive case information from the governorate health office directly. For instance, in Sana'a, a WhatsApp group was established, including the WASH CATIs and the surveillance officer from the governorate health office. The surveillance officer shared case information in the WhatsApp group as cases were reported to the health office. This system allowed WASH CATIs to access information quickly.

UNICEF supported MoWE to analyze the data and prioritize. MoWE and UNICEF agreed on criteria to select priority areas, including those cases with a positive RDT, a higher number of cases from one particular area (i.e., a hot spot), and cases from areas that had not previously reported cholera cases. Additionally, the scientific committee, the cholera task force, and UNICEF introduced a criterion to include new cholera cases in the line list. Initially, any patient who would visit any health care facility, including community-based ORCs, was included in the line list. This situation allowed non-severe and suspected patients without cholera to be included in the line list merely if they visited the ORCs or health centers. With this recent modification, if a patient is released from the ORC in <2 hours, he/she is not included in the line list. Therefore, this change permitted the inclusion of cases from ORCs with a minimum of two hours of observation and thus reduced the total number of cases to be reported in the line lists.

Implementation

Health RRTs were deployed to respond to suspected cases or clusters of cases. At the beginning of the epidemic, it took a long time to receive line lists as they had to be sent to the central level, reviewed and approved, and then sent back to the governorate and then districts. Eventually, this was changed, and the line lists from DTCs and ORCs were sent to the district health office daily, where the surveillance officer

made the decision to send an RRT based on the cluster of cases, deaths, and cases from new areas. As mentioned, eDEWS, media alert, and community reported cases were also considered in the decision making, and a verification step was completed before sending the RRT to the case's household. Later in the process, the community leaders were informed about the deployment of an RRT to facilitate local access and coordination. The teams targeted to respond within 24–48 hours of alert generation at the district health offices. However, there were delays related to data/line list delays, security and access as conflict-affected/front-line areas of the country required prior permission from the local authority to send RRTs. The RRTs from one district could come to support another district in instances of a higher number of reported cases. Additionally, the governorate CATI could also support the district teams.

Guidelines for choosing the number of houses in health RRTs varied between urban and rural areas. In rural areas, 10–20 households were usually selected. Generally, households that used the same water source were selected for the interventions. In urban areas, the selection was less systematic and depended on population density and dwelling arrangements. The interventions included random investigation in the surrounding household for suspected cases. Often a community member who was familiar with the neighborhood was requested to assist the RRT.

WASH CATIs were also deployed to both individual cases and clusters of cases. Generally, the flow of information was slower for WASH CATIs. As mentioned, in some instances, UNICEF and MoWE created informal data-sharing mechanisms (e.g., WhatsApp groups) to expedite data delivery to the governorate WASH CATI teams. Once the information was received, the CATIs were deployed to the site. The response time depended on the distance of the sites and the access in those areas. It was mentioned by some interviewees that having a government WASH CATI implementation partner was beneficial. In Yemen, both national and international NGOs needed approval to go visit the field. These approvals

WASH INTERVENTIONS*

Household activities

- Household disinfection†
- Latrine disinfection†
- Hygiene education session
- Aquatab distribution
- Water storage container distribution
- Water collection container/jerrycan
- Water quality monitoring
- Cholera kit distribution
- Hygiene kit distribution
- Soap distribution
- Laundry powder distribution
- Chlorinated solution distribution

Community

- WASH assessment
- Health promotion
- Aquatab distribution
- Bucket chlorination
- Chlorination at water point
- Latrine construction in public areas
- Water point rehabilitation
- Waste management
- Garbage holes dug
- Cholera kit distribution
- Hygiene kit distribution
- Safe burials
- Community volunteer training

HEALTH INTERVENTIONS

Household activities

- Oral cholera vaccine
- Chemoprophylaxis†
- Referrals to CTC
- ORS distribution
- Case identification
- Health awareness

Community/health care facility-based activities

- Oral cholera vaccine‡
- Chemoprophylaxis
- ORT through mobile clinics
- Health awareness

Table 6: Health and WASH activities completed as part of the intervention at households and in communities

*Ticked interventions were implemented in Yemen. †Activities previously implemented but discontinued during the time of the interviews. ‡While multiple OCV campaigns were conducted in Yemen, none were part of CATI.

could take several days, depending on the region. The government CATI teams were able to circumvent this approval process and therefore were able to deploy rapidly.

Initially, the WASH CATIs covered approximately 100 households around the case. However,

since November/December 2019, the coverage was reduced to approximately 20 households. The household selection depended on the field context and was decided by the team lead on site. The WASH CATIs could target an entire village for intervention if a cluster of cases were reported from that area.



CATI ACTIVITIES

The health RRTs implemented both household and community targeted activities (Table 6). Household (case plus neighbors) activities included case investigation using symptoms of a suspected cholera patient, inquiring about water sources and any recent travel. If a suspected case was found, the team conducted an RDT (please see below for testing strategy) and subsequently collected stool samples for positive RDT results (note this occurred later in the epidemic; at the beginning of the epidemic, the ability to culture samples was very limited, and thus RDTs were mostly used). The teams provided health education related to cholera transmission and prevention. If any new and symptomatic cases were found during the investigation, RRTs stabilized the cases and referred them to the health care facilities. In early 2019, RRTs started distributing oral rehydration salt (ORS) and water chlorination tablets to the household. Antibiotic chemoprophylaxis was implemented early on, but then stopped in mid-2019 as earlier investigation by the national scientific committee found antibiotic microbial resistance in the country. The teams also collected water samples from a proportion of the total households and the main water source. Additionally, the health RRTs contacted the governorate WASH CATI teams if source water chlorination and/or infrastructural interventions were needed in the area.

Testing strategy

Regular RDTs and culture tests were carried out in Yemen as part of the surveillance activities. The health RRTs conducted RDTs and collected stool samples during the response. At the time of the interviews, for every 10 suspected cases, one RDT was conducted, and for every 10 positive RDT results, one stool sample was collected for culture test. This is not a typical strategy that is recommended for cholera surveillance as it is quite expensive and labor intensive.⁹ Furthermore, at the early stage of the outbreak, there was confusion

as to whether RDTs were being used to diagnose individual cases.

WASH CATIs completed awareness sessions at the case and neighbors' households, and checked free chlorine residual at the household water and main water sources. If the chlorine concentration was below the recommended level, the team chlorinated the source water. From early 2020, the WASH CATI teams started doing case investigations using a questionnaire. During the time of the interview, WASH CATI activities did not include household and toilet disinfection; however, those were done previously by the team. The items distributed by the team included water chlorination tablets, jerrycan, soap, and behavior change communication materials. WASH teams did not distribute ORS to the households, nor did they conduct RDTs. The interventions and distributed items did not vary between the case and neighbors' households.

Note that although Table 6 shows which types of interventions were provided, it should not be interpreted that the health RRTs provided only those interventions under health and the WASH CATIs provided those interventions under WASH. In fact, there was duplication, as discussed above, where the health RRTs did at times provide water chlorination tablets and tested water samples. Furthermore, WASH CATIs undertook cholera case investigations.

COORDINATION

Significant challenges of establishing and maintaining effective coordination between health and WASH actors and between UN agencies and their government counterparts were reported by all interviewees. However, the coordination improved over time, enabling a more collaborative environment. Specific tasks and responsibilities for the actors were eventually defined, and overlaps were reduced to improve the response. However, all of this has taken time and

⁹ GTFCC. *Interim technical note: the use of cholera rapid diagnostic tests*. Global Task Force on Cholera Control, Geneva, 2016. https://www.who.int/cholera/task_force/Interim-guidance-cholera-RDT.pdf.

energy. As in many settings, politics and personalities hampered the response at different times.

Regular monthly meetings were held with the national cholera task force, cholera scientific committee, and health and WASH actors. Additionally, MoPHP and MoWE annually shared respective lessons learned. Eventually, WASH and health actors participated in each other's cluster meetings. However, coordination among the clusters and WHO and UNICEF was problematic at times, particularly at the beginning of the epidemic.

Data sharing was a significant impediment early on during the response, and some problems still remain, although much improved. In the beginning of the outbreak, all of the line lists at the district level were sent to the central level, and it took days, sometimes weeks, for the line lists to be compiled and shared by the MoPHP with health partners, who then would share with WASH partners. Ultimately, ways were found to circumvent the central level by working with MoPHP at the governorate and district levels, but this took time to implement. Meanwhile, UNICEF and the other WASH actors had to figure out other ways to receive information from the line lists at the governorate and district levels to respond quickly; some WASH CATIs established access through personal connections with the district and governorate health offices. While the data sharing among the health RRTs and WASH CATIs still needs further improvement to respond rapidly, the interviewees reported that it has improved from the beginning of the epidemic. The case information sharing between MoPHP and MoWE has improved both in terms of data quality and speed. Additionally, WHO aims to upgrade the eDEWS system and distribute data collection tablets to teams, which will further improve the quality of the data.

It was mentioned by the interviewees that reinstating the governorate-level health RRTs to coordinate among the district teams and with other governorates helped to support communication. The governorate RRTs were able to coordinate among the district teams and to send support to one district from another if needed.



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Separating the health RRTs and WASH CATIs was deemed practical by some interviewees in implementing interventions. Interviewees reported that considering the unstable political situation and centralized decision-making environment in Yemen, the separate implementation approach allowed two ministries to respond using their own organizational structures, given the integration was fraught with political and monetary implications. For instance, to incorporate health expertise in the WASH team, UNICEF proposed adding a local nurse who would accompany the team during responses. The proposal was not approved at the central level by MoPHP. However, for much of the response, health RRTs were based at the district level and WASH CATIs at the governorate level. There was not a well-coordinated response where both teams were visiting communities at the same time, and there were times when one team would visit a community and another would not, depending upon prioritization and capacity.

Defining specific tasks for health and WASH actors also helped the coordination. Initially, in the response, there were overlaps in terms of activities completed by the health RRTs and WASH CATIs. The

MoPHP and MoWE reviewed the issue at the central level and eventually divided some of the responsibilities between the two actors to minimize the overlap. Separate terms of references were developed for health and WASH teams. However, there is still an overlap of interventions between the two sectors.

The integration of health and WASH teams was a topic of discussion between the ministries during the time of the interviews. However, both ministries preferred to have their individual teams in the response. Unfortunately, we were unable to interview any representative from MoPHP and MoWE.

CHANGES OVER TIME

Governorate and district health RRTs. Initially, the health RRTs were based at the governorate level. To increase the response capacity and timeliness, the governorate RRTs were disbanded, and district-based RRTs were introduced. This significantly increased the numbers and capacity of the health RRTs. However, to improve coordination among the districts and with other governorates, the governorate health RRTs were reinstated. Currently, each district and governorate have one RRT. The WASH CATIs only exist at the governorate level.

Team composition and scope of work. Early composition of the health RRTs included a WASH member who was part of the RRT. However, the WASH member was discontinued from the team when GARWSP, supported by UNICEF, began implementing separate WASH interventions. The WASH CATI teams did not have health personnel in the team at any time of the response. Nevertheless, the terms of reference (TOR) of the WASH team have evolved over time.

Data sharing. The line list data with case information were centralized at the MoPHP level and not shared with MoWE at the beginning of the

epidemic. Weekly district-level summaries were shared without specific information about the case locations; these were not considered useful by the WASH CATIs. There were concerns about the data quality and possibly data manipulation. Ultimately, there were discussions to resolve the issue at the central level. Currently, the situation has improved with MoPHP releasing the data in two to three days. However, workarounds have been found at the governorate and district levels, particularly for the WASH CATIs, to receive line lists in a timely manner to be able to respond rapidly.

Cholera testing strategy by health RRTs. As reported earlier, the cholera testing strategy changed over time. Initially, the health RRTs were performing RDTs for all suspected cases. Afterward, the strategy changed, and one in every 10 suspected cases was tested using RDT, and a stool sample for culture testing was collected from one in every 10 RDT-positive cases. However, as mentioned previously, this does not follow regular guidance regarding the use of RDTs and cultures.

OVERALL SUCCESSES AND CHALLENGES

Successes¹⁰

- **Extreme context.** The ability to respond to perhaps the largest cholera outbreak in recorded history amid a conflict was considered a success. Despite security concerns, limited access, international sanctions, and political instability, the UN agencies with their government counterparts were able to implement a response under extreme conditions. While the policies, programs, and coordination needed much improvement over time, it is important to recognize that community- and household-targeted interventions are inherently difficult to implement in a conflict setting.
- **Government ministries implemented interventions.** Government ministries implemented

¹⁰ Note that success for this report refers to the CATI mechanism of implementation and NOT the control of cholera.

health and WASH interventions. The capacity to establish a working partnership with ministries and government offices was reported as a success. Working closely with the government ministries allowed for the UN and NGOs to have easier access to the field as travel approval process was easier to receive and improved the rapidity of the response.

Challenges

- **Lack of integration of the health and WASH response.** A major difficulty reported by the interviewees was the lack of integration of health and WASH interventions into a combined team response. The health RRTs responded to noncholera outbreaks such as measles, diphtheria, and dengue, whereas the WASH CATIs were only focused on cholera. Therefore, in terms of outbreak response, the health teams had a wider scope compared to WASH teams. Politics, power, and funding by government actors appeared to play a major role in ensuring integration did not occur. Therefore, both the difference in scope between health and WASH teams and the reluctance to integrate them were considered as significant challenges that hampered the response.
- **Data sharing.** The large delays in data sharing due to centralization and the reluctance of the MoPHP initially to share with MoWE at the beginning of the outbreak was consistently reported as a major challenge. Rapid response interventions' success can be greatly affected by their ability to access data quickly. The delay in obtaining case data was reported as a challenge by multiple interviewees.

PARTICIPANTS

We interviewed persons from the Canadian Red Cross, the International Rescue Committee, UNICEF, and WHO, all of whom had firsthand experience working in cholera in Yemen sometime between 2014 to 2020. The affiliations reported for the interviewees were at the time of the interview

and not necessarily when they were working in Yemen. The views expressed in this report are those of the authors and do not necessarily reflect the official policy or position of those interviewed or their organizations.

LESSONS LEARNED

(1) Testing strategy. The use of RDT was reduced to perform one RDT test for every 10 suspected cases. It improved resource utilization compared to testing every suspected case. However, as mentioned above, this is not a typical strategy that is recommended for cholera surveillance.¹¹

(2) Shortening the WASH CATI coverage. Reducing the coverage from 100 households to 20 households was reported as a lesson learned. It was done to improve the 'effectiveness and efficiency' of the response.

(3) Repeating activities by the health and WASH teams. The corresponding ministries and UN agencies reduced the amount same of activities carried out by the health RRTs and WASH CATIs. While there are still similar tasks completed by both teams (e.g., water testing, case investigation, etc.), the level of overlap has been reduced over time.

(4) Revision in the criteria for the patients to be included in the line lists. This revision was also reported as a lesson learned. This allowed avoiding the cases that came to DTCs and ORCs and left in less than two hours. This reduced the total number of cases in the line list.

(5) Placing teams at district and governorate levels. Working at the district levels allowed for quicker responses when line lists were made available. However, having teams at the governorate level improved coordination and communication.

¹¹ GTFCC. *Interim technical note: the use of cholera rapid diagnostic tests*. Global Task Force on Cholera Control, Geneva, 2016. https://www.who.int/cholera/task_force/Interim-guidance-cholera-RDT.pdf.

IV. RETROSPECTIVE CASE STUDY ON CASE AREA TARGETED INTERVENTIONS IN ZIMBABWE (2018–2019)

SUMMARY ZIMBABWE

The cholera outbreak in Zimbabwe began on September 6, 2018, and the last confirmed case was reported in March 2019. The outbreak primarily affected the City of Harare (CoH). The CoH's Environmental Health Division played a pivotal role in the response and was supported by the United Nations (UN) organizations and international non-governmental organizations. Case area targeted interventions (CATIs) were one of the approaches adopted by the responders to reduce community transmission of cholera. The CATI approach included implementing a set of surveillance and water, sanitation, and hygiene activities in the identified case and surrounding neighbor households.

The objective of this report is to summarize the CATI experience in Zimbabwe by interviewing key personnel who were involved in the response. We conducted four key informant interviews, including UN agencies, government division, and technical support agency, to learn about the CATI implementation process, coordination, successes and challenges, and lessons learned. We found that (1) the CATI teams were assigned to the health care facilities from the beginning of the response; (2) the teams had daily access to the new case information from the three cholera treatment facilities; (3) the teams included trained community volunteers in the response; and (4) standard intervention protocol and documentation forms were used throughout the response.

As echoed by the interviewees, the CATI approach's main success was the ability to assign CATI teams

to the health care facilities, which enabled daily access to the line lists. The absence of a health professional or nurse in the CATI team was noted in the Zimbabwe response; however, some interviewees deemed this appropriate considering the Harare context. Last, we summarize a set of lessons learned to aid in improving future CATI approaches in Zimbabwe and similar contexts.

BACKGROUND

While targeted water, sanitation, and hygiene (WASH) interventions to rapidly confine cholera cases have been studied retrospectively, the evidence of health interventions and their integration with those of WASH are scarce. Documenting health interventions in cholera response together with their integration with WASH in rapid response teams (RRTs), as well as the epidemiological/surveillance components, can inform future cholera outbreak responses. For this research at present, RRTs will be defined as case area targeted interventions (CATIs) that occur at the household level.

CATIs are the focus of a research study conducted by the Center for Humanitarian Health at the Johns Hopkins Bloomberg School of Public Health titled *Cholera rapid response teams in humanitarian and fragile settings*. This study entails four main components: (1) a systematic review of peer-reviewed literature; (2) a landscape analysis of grey literature; (3) a retrospective study of implemented CATI; (4) a prospective assessment of CATIs during a cholera response. The peer-review literature report on CATIs, as well as the grey literature review and landscape analysis report, were published in August 2020.

For the retrospective component, our aim is to document the retrospective evidence of CATI approaches in different cholera outbreaks. Since some of the details of WASH interventions have been recorded recently,¹² we aim to complement that work by focusing primarily upon the health interventions and their integration with those of WASH from previous RRT/CATI documentation, as well as the epidemiological/surveillance components. Four countries have been selected for the retrospective components, namely: Haiti, the Democratic Republic of the Congo, Yemen, and Zimbabwe.

This summary focuses on Zimbabwe and presents information derived solely from the key informant interviews and reports and internet links shared by the interviewees for the retrospective component. It does not include information from grey reports or peer-reviewed articles. These retrospective summaries are intended to complement the other components of the research study.

The recent cholera outbreak in Zimbabwe started in September 2018. The first rapid diagnostic test (RDT) confirmed case was reported in the city of Harare (CoH) on September 6, 2018. Zimbabwe's Ministry of Health and Child Care (MOHCC) declared a cholera outbreak based on the RDT results and subsequent culture confirmation. The outbreak mainly affected Glenview and Budiro neighborhoods of the city. However, other areas in the Harare Province were affected by the outbreak.

Over 10,000 cases were reported during the outbreak, with the last confirmed case reported on March 12, 2019. Cholera patients were primarily treated in three health care facilities: Glenview cholera treatment center (CTC), Budiro CTC, and Beatrice Road Infectious Diseases Hospital (BRIDH). All three health care facilities were supported by the World Health Organization (WHO) for case management.

Cholera targeted interventions

At the onset of the outbreak, CoH's Environmental Health Division deployed nine infectious disease control teams. These teams were composed of environmental health staff, technicians, and volunteers. The teams conducted contact tracing and case investigation at the case households (not surrounding neighbors), distributed water chlorination tablets (not systematically), and conducted hygiene promotion sessions at the case household.

In October 2018, UNICEF proposed to provide technical and financial support to the CoH's Environmental Health Division, which is under City Health Department, in response to the outbreak. Specifically, UNICEF proposed to provide vehicles and drivers for the teams, provide per diems to the volunteers, ensure adequate supplies are available for the teams to distribute preventive items at the household level, train staff on systematic implementation of the activities, and improve the database management at the health care facilities. The CoH approved the proposal. UNICEF worked with Oxfam and GOAL to provide this logistical support. The US Centers for Disease Control and Prevention (CDC) provided technical assistance for training, data collection, and monitoring system development. Finally, the CATI approach began on November 6, 2018. Initially, there were eight CATI teams with a plan to increase the number to 10 teams in the event of increased cholera cases. The CATI teams were composed of CoH Environmental Health Division staff, technicians, volunteers, and a driver (who also helped with logistical and CATI activities) hired by the two NGOs. All CATI teams were assigned to one of the three health care facilities.

TIMELINE

The outbreak began on September 6, 2018, with the last confirmed cholera case reported on March 12, 2019. The outbreak mainly affected the

¹² UNICEF. *Global review of WASH components in rapid response mechanisms and rapid response teams—Haiti, Nigeria, South Sudan and Yemen*. UNICEF, New York, 2018.

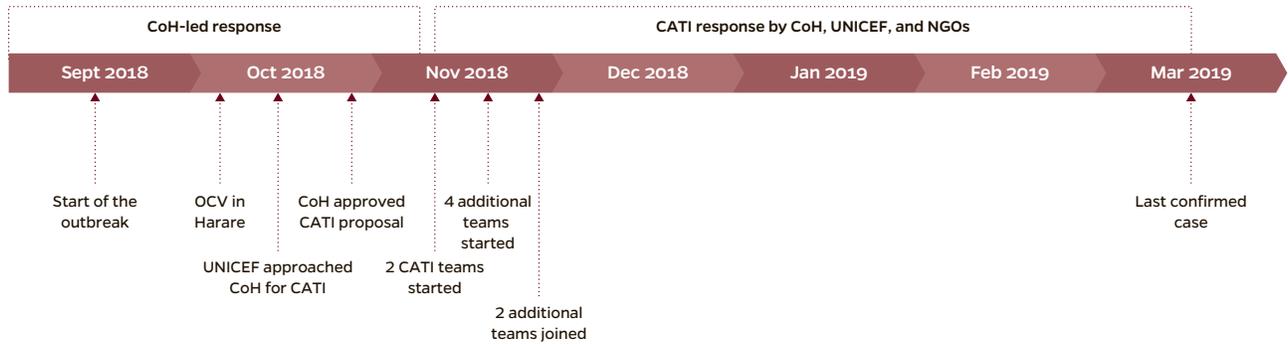


Figure 3: Timeline of the Zimbabwe 2018–2019 cholera outbreak

	WASH	HEALTH
Government branches	CoH’s Environmental Health Division	CoH’s Environmental Health Division
Funding/technical support agencies	<ul style="list-style-type: none"> • UNICEF • CDC* 	<ul style="list-style-type: none"> • WHO* • CDC*
Implementing organizations	<ul style="list-style-type: none"> • GOAL • Oxfam 	No health partner for CATI implementation; health facilities supported by GOAL and Oxfam; CoH’s Health Information Unit supported line list data management

Table 7: List of actors involved in the implementation

*Did not participate in the direct implementation.

city of Harare. There were three case incidence peaks during September 5–12, September 15–24, and September 25 to October 2. The number of cases plateaued after October 4 with <100 cases per day. The critical events related to the CATI approach along this time frame are presented in Figure 3. While the oral cholera vaccine (OCV) campaign was not implemented as an individual case targeted activity, a two-dose OCV campaign was carried out in the city of Harare to prevent new cases.

ACTORS

The implementation of the CATI approach was a collaborative effort by the CoH’s Environmental

Health Division (staff and local volunteers, many of whom had environmental health education), UNICEF, GOAL, Oxfam, CDC, and the three health care facilities that were supported by WHO (Table 7).

CATI IMPLEMENTATION

Alert and flow of information

Each CATI team was assigned to one of the three health care facilities. The teams had access to the new patient information from the line lists maintained at the health care facilities. Every morning the CATI team leaders of a particular facility would examine the line list and identify new cases admitted on the previous day. Once the new cases were identified, the CATI teams would decide on which

team would go to which neighborhood to implement the CATI activities. Additionally, a WhatsApp group was formed to communicate among the CATI teams and share information on the caseload of the line list at the health care facilities. This allowed the CATI leaders to monitor whether a large number of cases were admitted in one health care facility and respond and share resources.

Consequently, the CATI teams at that facility needed additional support to respond to all the cases. In such circumstances, CATI teams from the other two health care facilities were mobilized for support. CATI teams also collected cholera case information at the household and surrounding neighbors and implemented activities if they found any new cases while implementing CATI in the community. In such situations, they referred the case to the nearby health care facility and expanded the CATI radius to include the new case and their neighbors.

The CATI teams were deployed for any suspected cases admitted to the health care facilities. Periodic RDTs and culture confirmation tests were conducted from the stool samples collected from the patients at the health centers but were not used for CATI targeting. Cases from new areas/neighborhoods without previous cases were prioritized for CATI response.

Implementation

The CATIs aimed to respond to at least 80% of the suspected cases within 48 hours of admission while responding to 100% of the suspected cases. The teams were able to respond to 73% of cases within 48 hours. Each team aimed to complete four CATIs per day; however, the actual number of CATIs completed per day varied depending on the travel time to the site and the number of households covered by the activities. Since most of the outbreak was in the city, the travel time was shorter compared to remote and insecure areas with limited transportation and access.

Each CATI team comprised four members: one environmental health team leader (CoH), two

environmental health volunteers (CoH), and one driver who also acted as a logistician and support staff (Oxfam, Goal). Each team had one project vehicle to go to the suspected case's neighborhood. After receiving the case address from the health care facilities, the team traveled to the specified address. Every morning, the vehicles were prepared with the required equipment and supplies to complete the targeted number of CATIs.

After arriving at the case household, the guideline was to select 10 to 20 households neighboring the suspected cases. However, upon arrival at the case household, the team leader decided the actual number of neighbors depending on the household density and dwelling arrangement. There was not a specific radius where the number of neighboring households was chosen that fell within a specific radius of the suspected case's household. In the case of apartment buildings, all households on the floor of the case were to be included. Again, the final decision was made by the CATI team leader.

After arriving at the case household, the team leader sought permission to conduct the interventions. The following activities were completed at the case household by two team members: (1) GPS coordinate collection; (2) case investigation and referral of symptomatic persons (note that there was no trained health personnel such as nurses who were part of the CATI team, so case investigation and referral were undertaken by environmental health personnel who underwent training in contact tracing, case investigation, and symptom-based surveillance); (3) hygiene message delivery; (4) three strips of Aquatabs (67 mg), one bar of soap, 20-L bucket, 20-L jerrycan, and information/education/communication (IEC) materials distribution; (5) disinfection of toilet with 2% high test hypochlorite (HTH) chlorine solution; (6) disinfection of bathroom, kitchen, and other contaminated surfaces with 0.2% HTH chlorine solution; (7) request to family members to clean the clothes and bedding of the patient; and (8) tested free chlorine residual of stored or tap water.

ACTIVITIES¹³

Activities between case and neighbors' households were broadly the same in Zimbabwe in terms of case investigation, health promotion, household disinfection, and item distribution (Table 8).

The other two team members visited the surrounding neighbor's households and completed the following activities: (1) hygiene message delivery (door-to-door or in groups); (2) three strips of Aquatabs, one bar of soap, four IEC materials distribution per household; and (3) case investigation and referral of symptomatic persons. If a household was not present during the visit, the team went back to the next day to conduct the activities.

Furthermore, at the community level, the CATI team (1) undertook sewer system leakage investigation; and (2) looked for nearby food vendors to deliver hygiene message, soap, Aquatabs, and bucket with a tap.

The CATI team did not distribute any oral rehydration salt (ORS) and did not administer any antibiotic chemoprophylaxis. Identified cases were referred to one of the three health care facilities and received treatment such as oral rehydration therapy (ORT) and antibiotic chemoprophylaxis there. An OCV campaign targeting the population of Harare was conducted in October 2018 (not part of CATI). As mentioned above, there were no health care professionals, such as nurses, who were part of the CATI teams.

To ensure the quality and consistency of the activities, a response protocol was followed, and four checklist forms were used: (1) assignment form to track which team will go to which case; (2) supply form to ensure same items were distributed by all CATI teams; (3) household barrier form to ensure all activities were completed at the case and neighbors' households; and (4) case investigation checklist was

used to identify suspected cases. Additionally, a post distribution monitoring form to check the performance of the CATI team was completed 7–14 days after the initial visit. These forms were important to facilitate uniform data collection, verification, and take necessary action, as needed (e.g., sending follow-up teams to complete activities that were not completed on the previous day). The assignment and supply forms were filled out before the team would start for that day. The household barrier form was filled out at the case and neighbors' households while implementing the CATI activities. The household barrier form included checkboxes to record all activities and distributed items. The case investigation form was filled out at the case and neighbors' households and included questions related to symptoms, exposure, treatment, and contacts. The assignment, supply, and household barrier forms were given to the data clerk every evening to enter the information into the database, and the case investigation form was sent to the CoH Health Department. UNICEF supported the data entry system by providing staff and equipment.

COORDINATION

The implementation of the CATI approach in Zimbabwe was a combined effort of the government (CoH), UN agencies, NGOs, and volunteers. The CoH's Environmental Health Division deployed the infectious disease control unit to implement a cholera case targeted intervention, including case investigation, referral, water testing, chlorine distribution, and hygiene promotion. This approach was only concentrated at the case household and did not include neighbors. Note that the Environmental Health Division is under the City Health Department. Therefore, one of the common difficulties of obtaining immediate access to the line lists observed in other contexts was not encountered in Zimbabwe. Additionally, UNICEF's existing partnership with two NGOs (GOAL and Oxfam) expedited CATI

¹³ Note that CATI interventions only refer to individual household interventions and not community interventions. However, all activities were recorded here since they may affect the transmission of cholera.

WASH INTERVENTIONS

Household activities

- Household disinfection
- Latrine disinfection
- Hygiene education session
- Aquatab distribution
- Water storage container distribution
- Water collection container/jerrycan
- Water quality monitoring
- Cholera kit distribution
- Hygiene kit distribution
- Soap distribution
- Laundry powder distribution
- Chlorinated solution distribution

Community

- WASH assessment
- Health promotion
- Aquatab distribution
- Bucket chlorination
- Chlorination at water point
- Latrine construction in public areas
- Water point rehabilitation
- Waste management
- Garbage holes dug
- Cholera kit distribution
- Hygiene kit distribution
- Safe burials
- Community volunteer training

HEALTH INTERVENTIONS

Household activities

- Oral cholera vaccine
- Chemoprophylaxis
- Referrals to CTC
- ORS distribution
- Case identification

Community/health care facility-based activities

- Oral cholera vaccine*
- Chemoprophylaxis
- ORT through mobile clinics

Table 8: List of interventions commonly implemented as part of the CATI approach

*The above-reported OCV campaign was not implemented as part of the CATI approach.

activation by reducing the time needed to establish a new project agreement and program setup. The WASH Sector was co-led by the Ministry of Water and UNICEF. There was an Emergency Strategic Advisory Group (ESAG), which held weekly meetings to update about the outbreak and provide technical support to the WASH implementing partners intervening on other components of the response (door-to-door hygiene campaign, bucket

chlorination, etc.). Moreover, the involvement of the CDC to provide training and establish implementation and monitoring system was also helpful for the project.

CATI was implemented jointly by the government, NGOs, and UNICEF. The CATI in Harare started late in the outbreak, almost two months after its onset. UNICEF proposed the CATI approach to CoH about a

month after the outbreak confirmation, and it then took three weeks to prepare and launch the first teams. Both of these delays may have caused a loss of the opportunity to stop the transmission at the early stage of the outbreak.

Unlike CATI experiences in the other countries that we studied, the direct involvement of clinically trained health workers, such as nurses, was missing from the Zimbabwe CATI response. However, the Zimbabwe CATI teams had environmental health officers who underwent contact tracing and surveillance training. WHO supported the case management at the health care facilities and the Ministry of Health and Child Care supported CoH with laboratory testing. However, no health partner was directly involved in the actual CATI implementation at the households; they did provide data that allowed the CATIs to function. When asked whether it was considered to have a nurse or another type of clinical health care professional as part of the CATI team to undertake case investigation and referral, and provide ORS and prophylactic antibiotics, most persons stated it was not discussed or believed it was not needed.

CHANGES OVER TIME

The key change over time in Zimbabwe CATI experience was the support of UNICEF in strengthening the CoH's initiative to target cases. Initially, the CoH-led intervention focused on case identification and surveillance using Environmental Health Division teams and unpaid community volunteers and the interventions only focused case household. Additionally, there were inadequate vehicles, equipment, and insufficient items at the initial phase of the response. UNICEF standardized the activities, provided training, mobilized and provided funds to hire additional vehicles, and maintained the availability of items to be distributed. The later phase of the program also included incentives for the community volunteers who were paid through the CoH through UNICEF funding.

¹⁴ Note that success for this report refers to the CATI mechanism of implementation and NOT the control of cholera.



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OVERALL SUCCESSES AND CHALLENGES

Successes¹⁴

- **CoH's involvement from the beginning.** CoH's Environmental Health Division initiated the targeted approach after the declaration of the outbreak. This provided an enabling environment for UNICEF to start the CATI initiative. As the city was adopting a case targeted intervention (although it only included case household), it was easier to transform the initiative to a standard CATI intervention.
- **Health care facility-based CATI team.** One major success of the Zimbabwe response was to assign the CATI teams to the health care facilities. This allowed the teams to have direct access to the case addresses from the line lists and to rapidly respond. This may have occurred due

to Environmental Health Division being part of the Health Department, as opposed to in other countries where the Ministry of Health and Ministry of Water are separate and have separate CATI teams.

- **Rapid response rate.** Overall, the teams were able to respond to over 73% of the cases within 48 hours of admission. The two main factors that contributed to the rapid response rate are daily access to the line lists and relatively short travel time from health care facilities to the case households.
- **UNICEF’s partnership with NGOs.** The existing in-country partnership with GOAL and Oxfam expedited the activation process. By extending the existing partnership to incorporate CATI intervention, it was quicker to process contracts/agreements to start implementation.
- **Community volunteers.** Having a group of environmental health volunteers was a distinct advantage. The volunteers had relevant educational backgrounds and thus did not require substantial resources for capacity building. They strengthened the CATI teams’ capacity by providing awareness-raising sessions to the surrounding neighbors and implementing communal activities. They were motivated to work with the EHD as many were unemployed and searching for employment. The incentives from UNICEF through the CoH was also an important motivation.
- **Implementation and monitoring mechanisms.** The development and implementation of a standard implementation protocol and multiple monitoring forms were also a success of the response. These allowed the CATI teams to follow a standard operating procedure and facilitated regular tracking of the response against the epidemic.

Challenges

- **Absence of health interventions.** Both WASH and health interventions are considered important to prevent community transmission of cholera. The Zimbabwe CATI intervention did not include direct health interventions such as

ORS distribution and antibiotic chemoprophylaxis administration at the household. There was one OCV campaign during the outbreak in the CoH. However, the environmental health officers undertook case investigation and referral of symptomatic cases, and this may have compensated for the targeted health interventions to some extent.

- **Delay in starting the CATI intervention.** Despite GOAL and Oxfam’s presence in the country and UNICEF’s partnership, it took approximately two months from the declaration of the outbreak to start the CATI response. This delay may have prevented the opportunity to interrupt the transmission at the early stage of the outbreak.

PARTICIPANTS

We interviewed persons from the Centers for Disease Control and Prevention, City of Harare Health Department, and UNICEF, all of whom had firsthand experience working in cholera in Zimbabwe sometime between 2018 and 2019. The affiliations reported for the interviewees were at the time of the interview and not necessarily when they were working in Zimbabwe. The views expressed in this report are those of the authors and do not necessarily reflect the official policy or position of those interviewed or their organizations.

LESSON LEARNED

Inclusion of health care personnel and health interventions. Multiple interviewees mentioned that the inclusion of health care personnel with targeted health interventions could have strengthened the capacity of the CATI approach to prevent community transmission of cholera. Particularly, the inclusion of ORS in the distributed items could have supported mild cases, which may not have needed to be referred to health care facilities for treatment.

ANNEX I. KEY INFORMANT INTERVIEW QUESTIONNAIRE

CHOLERA RAPID RESPONSE TEAMS (RRTS) IN HUMANITARIAN AND FRAGILE CONTEXTS:

THE RETROSPECTIVE COMPONENT: KEY INFORMANT INTERVIEWS (SHORT)

Target interviewee: Key personnel involved with case area targeted interventions (CATIs) in cholera outbreaks.

Format: Semi-structured questionnaire.

Interview date: _____
Name of interviewee: _____
Organization: _____
Position: _____

INTERVIEW CONSENT

I work at the Center for Humanitarian Health at Johns Hopkins Bloomberg School of Public Health. We are asking you to participate in a research study about the cholera rapid response teams (RRTs) in humanitarian and fragile contexts. We want to learn about the cholera case area targeted interventions (CATIs) activation, interventions, delivery mechanisms, response timeliness, coordination, and lessons learned. Specifically, we want to focus on the health and surveillance interventions and their integration with those of WASH from previous outbreak response experiences. I would like to ask you some questions about your experience with CATIs in humanitarian responses that you have specifically been involved in implementing.

The interview should take approximately 50 minutes. All the information obtained will remain strictly confidential within the study team and any information provided will not be attributed directly to individuals, but organizations will be mentioned. The use of the information collected will only be for analysis. This is a voluntary interview and you can choose not to answer any or only certain part of the questions. However, we do hope that you will participate since your views are important.

- Do you agree to this interview? **Yes/No**
- We would like to record this interview. Do you agree to this? **Yes/No**
- Do you have any questions?
- **OK, we will begin now.**

GENERAL INFORMATION

- Can you please tell me about your involvement in the cholera response (Professional role? Where were you based? What was your period of involvement in the response?)

BACKGROUND INFORMATION ON THE OUTBREAK

- Who were the target population (Host/Refugee/IDP/Mixed [specify])?
- What was the geographic coverage of the CATI approach [national, #, name of districts]?

CATI ACTIVATION

- Can you please describe the CATI activation process?
- Were there any criteria for CATI activation?
- How were the criteria selected and by whom?
- Were you able to follow the planned activation criteria during implementation?

ACTORS (ORGANIZATION LEVEL)

- Can you describe the actors involved in the CATI approach and what they did (WASH/Health/Surveillance)?

IMPLEMENTED ACTIVITIES

- Which health interventions were implemented?
- Which WASH interventions were implemented?
- Which surveillance activities were implemented?
- Were there any difference in implemented activities between case and neighbor households?

CATI COMPOSITION, ROLE, AND TRAINING (TEAM LEVEL)

- CATI Team composition by sector [WASH, health, surveillance, logistics, nutrition, other?]
- What role/tasks was given to each team member during the CATI implementation
- Were all CATI staff employed by one organization?
- Was any training provided to the CATI members?

CATI IMPLEMENTATION RULES (PLAN + IMPLEMENTATION)**Notification**

- How have the CATI teams been informed about case households (from CTC to CATI team)?
- Which data sources were used (line lists, house to house investigation, community rumor, other)?
- Was there a clear plan of information flow from CTC and CATI?

Preparation

- After receiving the notification of a case, how did the team prepare for the CATI implementation?
- Was there any change from the initial plan?

Travel

- How did CATI teams travel to the sites?

Case household identification

- How was the case household identified in the community?
- Did you use GPS to record locations?
- What was done if the case household was not found? (e.g. did the team go back, other?)

Radius selection and neighbor identification

- How was the radius of the CATI defined during planning?
- What was the radius?
- How were the neighbors selected during implementation? (Radius or number of households? Did the radius change between urban and rural areas?)
- What was done if neighbors were not present at the household? (e.g. did the team go back, other?)

COORDINATION

- Did any coordination guidelines for the CATI approach exist?
- Which actions were taken to ensure coordination between stakeholders? [MoH, UN WASH and health clusters, partner organizations]
- Which difficulties/challenges did you encounter in coordinating with stakeholders?

CHANGES OVER TIME

- Was it necessary to adapt the initial activation/ implementation plan over time?
- Throughout the implementation, did any interventions modify, introduce, or discontinue?
- Throughout the implementation, was the CATI team composition modified?
- Throughout the implementation, were there any changes in the sources of surveillance data?
- Throughout the implementation, was there any change in coordination strategy?

OVERALL SUCCESSES AND CHALLENGES

- Based on your experience, can you identify any best practices of CATI implementation?
- Based on your experience, could you share the key challenges of CATI implementation?

OTHER

- Did you use any guidelines/protocols/standard operating procedures for CATI implementation?
- Do you recommend other key personnel involved with the CATI approach that we can interview?

ADDITIONAL DOCUMENTS FOR REVIEW

Document	Source

ADDITIONAL CONTACTS TO INTERVIEW

Contact Name	Role, Organization, Contact Information

ACTIVITY LIST**WASH INTERVENTIONS****Household activities**

- Household disinfection
- Latrine disinfection
- Hygiene education session
- Aquatab distribution
- Water storage container distribution
- Water quality monitoring
- Cholera kit distribution
- Hygiene kit distribution
- Soap distribution
- Laundry powder distribution
- Chlorinated solution distribution

Community

- WASH assessment
- Health promotion
- Aquatab distribution
- Bucket chlorination
- Chlorination at water point
- Latrine construction in public areas
- Water point rehabilitation
- Waste management
- Garbage holes dug
- Cholera kit distribution
- Hygiene kit distribution
- Safe burials
- Community volunteer training

HEALTH INTERVENTIONS**Household activities**

- Oral cholera vaccine
- Chemoprophylaxis HH distribution
- Referrals to CTC
- ORS distribution
- Case identification

Community /health care facility-based activities

- Oral cholera vaccine
- Chemoprophylaxis through CTC
- ORT through mobile clinics

ANNEX II. STEPS OF THE QUADRILLAGE APPROACH (DRC)

STEP	ACTIVITIES	TEAM COMPOSITION
Micro planning (7 days)	All planning activities in central level (Terms of reference, administrative)	Central Coordination: PNECHOL-MD
	Logistic preparation (kits for community intervention)	Central Coordination: PNECHOL-MD
	Training of trainers	Experts of PNECHOL-MD
	Provide requested information for the planning and preparatory activities with local actors	Manager of health zone, actors of local Red Cross
Quadrillage (14 days in the field)	Presentation of the approach to local authorities	PNECHOL-MD Expert
	Training of local teams	PNECHOL-MD Expert
	Deep investigation of the factors of persistence of the cases	PNECHOL-MD Expert and manager of health zone
	Field survey to cover the intervention areas (the grid)	PNECHOL-MD Expert and manager of health zone and Local Red Cross Team members
	Final adjustment of the micro planning of the grid intervention	PNECHOL-MD Expert
	Lobbying activities for the support of local authorities	PNECHOL-MD Expert and manager of health zone
	Public launching ceremony of the activity by local leaders	PNECHOL-MD Expert and manager of health zone and local leaders
	Provision of cholera treatment kits (at the treatment center)	PNECHOL-MD Expert
	Provision of community kits to teams for household activities	PNECHOL-MD Expert
	Provision of kits for community actions at the public areas (market, ...)	PNECHOL-MD Expert
	Daily field activities	PNECHOL-MD Expert
Exit strategy	To end if: — 'O' case reported in epidemic area — Return to the usual threshold for endemic-epidemic areas	PNECHOL-MD expert, expert of health zone and the local Red Cross team members





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