



GLOBAL TASK FORCE ON  
**CHOLERA CONTROL**



**ENDING CHOLERA**  
A GLOBAL ROADMAP TO 2030



This report was developed by the secretariat of the Global Task Force on Cholera Control (GTFCC) with input and support from the following partners: the Bill & Melinda Gates Foundation; the Centers for Disease Control and Prevention (CDC); Global Health Visions; Gavi, the Vaccine Alliance; International Federation of the Red Cross (IFRC); Johns Hopkins University; Médecins Sans Frontières (MSF); The Mérieux Foundation; the Task Force for Global Health; UNICEF; the Veolia Foundation; WaterAid; and from the WHO Health Emergencies Programme (WHE); Immunization, Vaccines and Biologicals (IVB); and Public Health, Environmental and Social Determinants (PHE) departments as well as the regional offices at the World Health Organization.

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## 1. EXECUTIVE SUMMARY

*Ending Cholera—A Global Roadmap to 2030* operationalises the new global strategy for cholera control at the country level and provides a concrete path toward a world in which cholera is no longer a threat to public health. By implementing the strategy between now and 2030, the Global Task Force on Cholera Control (GTFCC) partners will support countries to **reduce cholera deaths by 90 percent**. With the commitment of cholera-affected countries, technical partners, and donors, as many as 20 countries could eliminate disease transmission by 2030.

The strategy focuses on the 47 countries affected by cholera today, and consists of multi-sectoral interventions in two main types of cholera-affected geographies, supported by a nimble and effective coordination mechanism:

- 1. Early detection and quick response to contain outbreaks:** The strategy focuses on containing outbreaks—wherever they may occur—through early detection and rapid response, which are critical elements for reducing the global burden of cholera. Through interventions like robust community engagement, strengthening early warning surveillance and laboratory capacities, health systems and supply readiness, and establishing rapid response teams, we can drastically reduce the number of deaths from cholera even in fragile settings.
- 2. A targeted multi-sectoral approach to prevent cholera recurrence:** The strategy also calls on countries and partners to focus on cholera “hotspots”, the relatively small areas most heavily affected by cholera, which experience cases on an ongoing or seasonal basis and play an important role in the spread of cholera to other regions and areas. Cholera transmission can be stopped in these areas through measures including improved water, sanitation, and hygiene (WASH) and through use of oral cholera vaccines (OCV). In Africa alone, 40 to 80 million people live in cholera hotspots.



**3. An effective mechanism of coordination for technical support, advocacy, resource mobilisation, and partnership at local and global levels:** The GTFCC provides a strong framework to support countries in intensifying efforts to control cholera, building upon country-led cross-sectoral cholera control programs, and supporting them through human, technical and financial resources. As a global network of organisations, the GTFCC is positioned to bring together partners from across all sectors, and offers an effective country-driven platform to support advocacy and communications, fundraising, inter-sectoral coordination, and technical assistance.

Implementing these strategic approaches will require aligning existing health and WASH resources to the *Global Roadmap*. This alignment represents a sound investment because it channels resources to areas most in need, and begins to reduce the significant economic burden of cholera, which costs an estimated \$2 billion per year globally in health care costs and lost productivity<sup>1</sup>. The *Roadmap* offers an estimate of the cost of controlling cholera in the Democratic Republic of Congo (DRC) that helps to demonstrate the resource needs for controlling cholera at country level over the next ten years. The DRC case study shows that the **successful implementation of the *Global Roadmap* may allow up to 50 percent cost savings compared with the ongoing average yearly cost of continuously responding to emerging cholera outbreaks<sup>1</sup>. Most importantly, the proposed long-term cholera control investments will also significantly reduce the impact of all water-related diseases, while contributing to improvements in poverty, malnutrition, and education, thereby representing a significant step toward the achievement of the Sustainable Development Goals (SDGs) for the world's poorest people and toward a world free from the threat of cholera.**

<sup>1</sup> See page 21 for details on the case study and underlying assumptions.



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## 2. ENDING CHOLERA—A CALL TO ACTION

Cholera is a disease of inequity—an ancient illness that today sickens and kills only the poorest and most vulnerable people. The map of cholera is essentially the same as a map of poverty. Every death from cholera is preventable with the tools we have today, putting the goal of ending its public health impact within our reach. Cholera can be controlled with a multi-sector approach—including basic water, sanitation, and hygiene (WASH) services, and oral cholera vaccines (OCV).

**Yet in 2017, cholera continues to hit communities already made vulnerable by tragedies such as conflicts and famines. Yemen currently faces the world's largest cholera outbreak, with over 600,000 suspected cases and more than 2,000 deaths reported since April<sup>2</sup>. Over 800 people have died of cholera in Somalia since the beginning of the year, and over 500 in the DRC. Haiti has now reported over 1 million cases with over 10,000 deaths since the beginning of the 2010 outbreak.**

Armed with the technical knowledge and tools, and an increasing global supply of OCV, now is the time to accelerate sustainable action against cholera at country, regional, and global levels. Ending cholera is not only an incredible opportunity, it is a moral obligation and a critical step towards achieving the SDGs.

On October 4, 2017, the Global Task Force on Cholera Control (GTFCC) has convened a high-level meeting of officials from cholera-affected countries, donors, and technical partners to affirm their commitment to ending cholera as a threat to public health by 2030. The meeting, which marks the official launch of the strategy, will seek to solidify concrete commitments from key partners:

- From cholera-affected countries, to implement evidence-based cholera control and elimination plans;
- From GTFCC partners, to their active involvement as technical experts; and
- From key donors, to support the global mechanism and/or the country programs.

**By implementing the 2030 strategy, with a focus on the 47 countries affected by cholera today, the GTFCC partners will support countries to reduce cholera deaths by 90 percent. As many as 20 countries could eliminate the disease as a threat to public health by 2030.**

### 3. CHOLERA TODAY

While safe drinking water and advanced sanitation systems have made Europe and North America cholera free for decades, **the disease still affects at least 47 countries across the globe, resulting in an estimated 2.9 million cases and 95,000 deaths per year worldwide<sup>3</sup> (see Annex A).**

**Cholera is a stark marker of inequality**, disproportionately affecting the poorest and most vulnerable populations around the world and within each affected country. The disease is usually transmitted through faecally contaminated water or food, and given that the incubation period is relatively short (2 hours to 5 days), the number of cases can rise exponentially—leaving a high number of deaths in its wake.

Cholera control is both a matter of emergency response in the case of outbreaks, and a matter of development when the disease is endemic in high-risk areas. Effective cholera prevention and control interventions are well known and rely to a great extent on the implementation of integrated and comprehensive approaches that involve activities both inside and outside of the health sector, including:

- *Enhanced epidemiological and laboratory surveillance to identify endemic areas and detect, confirm, and quickly respond to outbreaks*
- *Universal use of safe water and basic sanitation*
- *Community engagement for behavioural changes and improved hygiene practices*

- *Quick access to treatment (Oral Rehydration Solution (ORS), which can successfully treat most cases, and intravenous fluids and antibiotics for severe cases)*
- *Protection with safe and effective OCV*

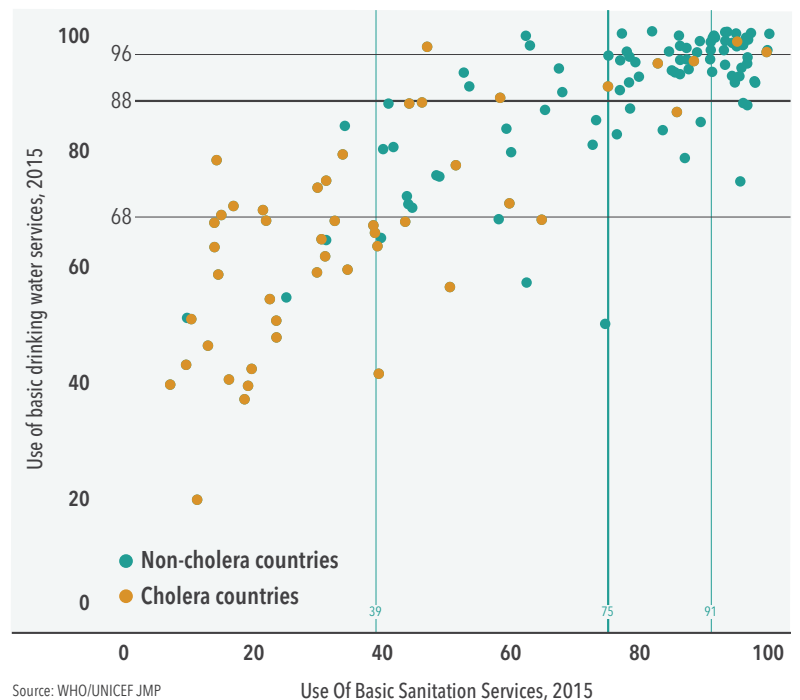
The persistence of cholera today and the geographic and temporal pattern of cholera outbreaks show that, despite ongoing efforts, current strategies have failed to control cholera in endemic areas, let alone to prevent outbreaks. The vast majority of cholera control activities have been focused on emergency response to outbreaks, which reduces the number of cases and deaths but does not have significant effect on the prevention of cholera. Long-term WASH programs are too few and do not regularly prioritize areas most affected by cholera. **Worldwide, 844 million people still lack access to even a basic drinking water source, more than 2 billion drink water from sources that are faecally contaminated, and 2.4 billion are without basic sanitation facilities, exposing them to a range of water-related diseases including cholera<sup>4</sup>.** As illustrated in Figure 1, households in cholera-affected countries are largely below the global mean with regard to access to basic water and sanitation services.

**Cholera is preventable with the tools we have today, putting the goal of ending it within reach.** More proactive and targeted measures to prevent cholera through investments in WASH, improved health systems, and large-scale use of OCV for those most in need are urgently required.

Cholera "hotspots" are specific and relatively small areas where the cholera burden is most concentrated and that play a central role in the spread of cholera.

**Figure 1:** 138 low- and middle-income countries (World Bank definitions) with reported access to water and sanitation

*Basic water and sanitation coverage among 138 low- and middle-income countries*



## 4. A RENEWED STRATEGY TO END CHOLERA

**The overall objective of the renewed strategy is to reduce the mortality resulting from cholera by 90 percent by 2030, and to eliminate cholera in as many as 20 countries.**

This will be achieved through multi-sectoral interventions to (i) prevent cholera through the implementation of a set of measures—such as long-term WASH—in areas most affected by cholera (“hotspots”) and (ii) by containing outbreaks through early detection and rapid response to alerts.

**Cholera “hotspots”** are specific and relatively small areas where the cholera burden is most concentrated. Cholera hotspots play a central role in the spread of the disease to other regions or areas. They have been identified across many endemic countries and see recurrent and predictable cholera outbreaks, often coinciding with the rainy season. Inside these areas, cholera-related fatality rates are high, access to health care is limited, and people make do with poor water quality and sanitation systems. Targeting cholera hotspots in priority geographies will help focus control programmes on the most vulnerable populations and reduce inequities in both affected countries and globally, with a long-term impact on all water-related diseases. **In Africa alone, 40 to 80 million people live in cholera hotspots** (see details per country in Annex B).

**Ending cholera is an important achievement in its own right, and represents a critical step towards achieving the SDGs<sup>5</sup>.** The SDGs provide a comprehensive framework to work from, with cholera serving as a proxy measure for progress across a number of goals. Achieving the ambition of the SDGs will require focusing on the poorest and most vulnerable populations (those most often affected by cholera), ensuring no one is left behind. Ending cholera outbreaks lies at the centre of the sustainable development agenda, both as an explicit target for combatting water-related diseases within Goal 3 (“ensuring healthy lives and wellbeing for all”), as well as a proxy measure to track progress towards the achievement of Goal 6 (“access to water and sanitation for all”).

Although the interventions to prevent and control cholera are well known, they have not been used optimally or appropriately adapted to local contexts, nor supported with adequate human and financial resources. More than 80 percent of affected countries report insufficient financing to meet their WASH targets, and capital investments are only one-third of what they need to be to reach the SDGs by 2030. At the same time, global

### Cholera elimination:

Any country that reports no confirmed cases with evidence of local transmission for at least three consecutive years and has a well-functioning epidemiologic and laboratory surveillance system able to detect and confirm cases. (See glossary in Annex D.)

water and sanitation aid has declined in recent years, dropping from US \$10.4 billion in 2012 to US \$8.4 billion in 2015.<sup>7</sup> Although the Millennium Development Goals (MDGs) target of halving the proportion of people without access to improved sources of water was achieved in 2010, **cholera hotspots have not met the MDG standards for WASH and must be targeted with the highest priority to achieve cholera control and to make progress toward the SDGs.**

The *Global Roadmap* will help to address these challenges by coordinating the efforts of countries, donors, and technical partners, and working across sectors to deliver comprehensive approaches to cholera. Better targeting of interventions to high-risk populations, and bridging the humanitarian and development divide, are principles that will drive the long-term approach for drastically reducing the cholera burden and eliminating the disease in several countries.

### The Global Task Force on Cholera Control

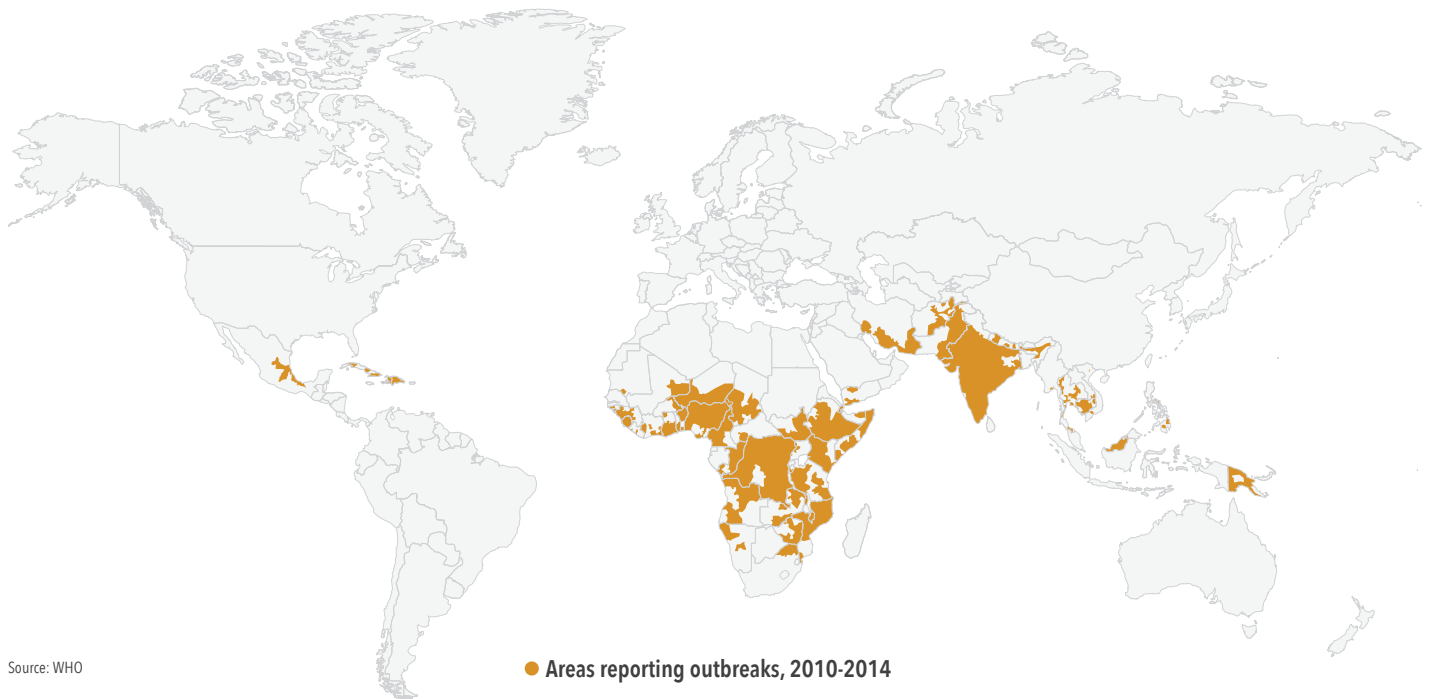
**The Global Task Force on Cholera Control (GTFCC) is a global network of organisations that brings together partners involved in the fight against cholera across all sectors, offering an effective country-driven platform that promotes a multi-sectoral, well-coordinated approach.** The GTFCC provides a strong framework to support countries in intensifying efforts to control cholera.

Created in 1992, the GTFCC became inactive after the elimination of cholera in the Americas. The 2011 World Health Assembly resolution 64.15 “Cholera mechanisms for control and prevention” requested that the WHO Director-General revitalise the GTFCC. Since its revitalisation in 2014<sup>8</sup>, the GTFCC has **created new energy around cholera control** and played a critical role in coordinating multi-sector partners and activities.

Climate change, urbanization, and population growth are likely going to increase the risk of cholera in the coming years.



**Map 1.** Areas reporting cholera outbreaks 2010–2014



Source: WHO



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Promoting access to a basic level of water and sanitation access in cholera-endemic areas is a step up the SDG ladder toward “universal access to safely managed water and sanitation.” The investment required to meet the SDG definition for “safely managed” water and sanitation access is three times higher than the cost to meet the MDG definition of access to water and sanitation<sup>6</sup>. A basic level of WASH services not only prevents cholera, but also fulfils the human right to access to water and sanitation.

## Oral Cholera Vaccines

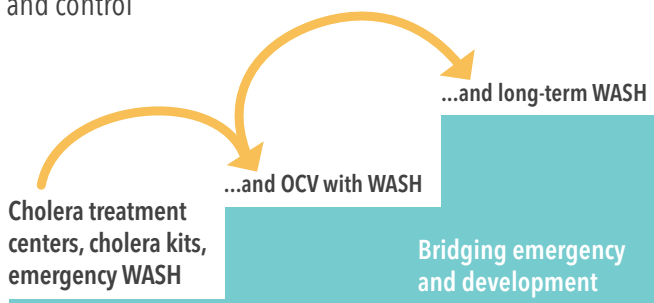
With the creation of the OCV stockpile in 2013<sup>9</sup>, and long-term funding support from Gavi, the Vaccine Alliance, OCV has now become available in large quantities. OCV is a game-changer in the fight against cholera. It takes effect immediately and also works to prevent cholera locally for two to three years, effectively bridging emergency response and longer-term cholera control with a WASH focus, demonstrating that cholera is not inevitable and that cholera control is not beyond reach.

OCV presents an opportunity to mobilise resources and partners for WASH by:

- **Defining areas to prioritise:** OCV will be used in cholera hotspots and will facilitate the identification of priority areas in countries.
- **Demonstrating immediate impact:** OCV helps to dispel the notion that cholera is inevitable, thereby breaking the vicious cycle of inaction and defeatism, motivating national governments and partners, and buying time to implement WASH programmes.

**It is critical that we use the opportunity to act now—when cholera control is within reach—to ensure access to the basic WASH solutions.** Climate change, urbanization, and population growth will likely increase the risk of cholera in the coming years. According to UN Habitat, the share of Africans living in urban areas is projected to grow from 36 percent in 2010 to 50 percent by 2030, while the number of slum dwellers in Sub-Saharan Africa will grow in tandem with growth in the region's urban population (in 2010, 60 percent of the urban population in sub-Saharan cities already lived in slums)<sup>11,ii</sup>. The pressure on infrastructure will therefore continue to increase, likely worsening access to safe water and basic sanitation for the most vulnerable populations. **The basic WASH package with safe water is the minimum required to reduce water-related disease risks like cholera.**

**Figure 2:** From preparedness and response to prevention and control



ii. UN-Habitat defines slums as a contiguous settlement that lacks one or more of the following five conditions: access to clean water, access to improved sanitation, sufficient living area that is not overcrowded, durable housing and secure tenure.

## OCV since the creation of the stockpile<sup>10</sup>

There are currently three WHO prequalified OCVs, two of them available through the global stockpile (Euvichol and Shanchol). Two doses of OCV are protective for at least three years with average efficacy of about 58 percent and effectiveness of 76 percent, although this is lower in children younger than five years.

Since its creation in 2013, with 56 campaigns conducted in 15 countries and more than 13 million doses administered, the OCV stockpile has allowed for an increasing trend toward cholera vaccine use in affected countries. This contrasts starkly with the previous 15 years (1997–2012) when just 13 campaigns were conducted and 1.4 million doses were used. Although the use of OCV in non-emergency situations to contribute to the control of endemic cholera has been increasing, most of the use has been during emergency situations.

Most of the doses produced since 2013 have entered the stockpile, which has increased from approximately two million per year during 2013–2014 to seven million in 2016, with 17 million anticipated for 2017 and over 25 million from 2018 onwards.

## Basic WASH package means:

- **Basic water supply:** access to safe drinking water sources (either household connection, public standpipe, borehole, protected dug well, protected spring, or rainwater collection) within a 30-minute round-trip plus household or other disinfection<sup>12</sup>
- **Basic sanitation:** access to improved sanitation facilities (connection to a public sewer, connection to a septic system, pour-flush latrine, simple pit latrine, ventilated improved pit latrine)
- **Basic hygiene:** access to a hand-washing station with soap and water for every household
- **Community engagement** to manage WASH resources and to promote safe hygiene practices

## CASE STUDY:

### Hygiene promotion through routine immunisation programme in Nepal

Nepal has made significant progress in reducing child mortality over the past few decades, yet diarrhoeal diseases remain a leading cause of child mortality. Lack of access to safe drinking water and improved sanitation, coupled with inadequate hygiene practices, contribute significantly to this burden.

A pilot project was initiated in 2014 by the Nepal Ministry of Health, Child Health Division, and WaterAid to determine an effective hygiene promotion intervention that could be integrated within the Expanded Programme on Immunisation and implemented nationwide.

Unlike traditional hygiene promotion programmes, the package goes beyond handwashing with soap and toilet use by further promoting other healthy behaviours such as exclusive breastfeeding for the first six months of life, faeces management including of child faeces, and water/milk treatment.

The pilot was conducted in four districts targeting 35,000 mothers/caregivers with children aged 0-12 months, and around 800 health workers and 2,200 female community health volunteers mobilised every month to run the sessions. The total programmatic cost of developing and rolling out this innovative hygiene promotion intervention in the four districts was US \$550,000 (US \$16 per target beneficiary).

This hygiene promotion intervention has been effective in improving key hygiene behaviours in all districts, and it has strengthened the routine immunisation programme. The immunisation coverage has gone up and vaccine wastage and drop-out rates have reduced in all four districts. The period prevalence of diarrhoea among children under age one has gone down from 20 percent (at baseline) to 5 percent during the follow-up survey among the intervention group.

The baseline and evaluation results show that integrating hygiene promotion through a routine immunisation programme is possible and such an approach can be scaled up nationwide and expanded in other countries.





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## 5. ENDING CHOLERA—A GLOBAL ROADMAP TO 2030: VISION, TARGET, AND STRATEGIC AXES

The *Global Roadmap to 2030* sets out a vision for a world in which cholera is no longer an active threat to public health. Achieving the overall objective of the renewed strategy—**reducing the mortality resulting from cholera by 90 percent by 2030**—relies on strong commitments from countries, partners, and donors to collectively engage in the fight against cholera. The *Global Roadmap* is based on three strategic axes:

- Axis 1:** Early detection and quick response to contain outbreaks at an early stage;
- Axis 2:** A multisectoral approach to prevent cholera in hotspots in endemic countries; and,
- Axis 3:** An effective mechanism of coordination for technical support, resource mobilisation, and partnership at the local and global level.

### AXIS 1—Early detection and response to contain outbreaks

**Too many countries are still facing large outbreaks with high case fatality rates when containment is possible.**

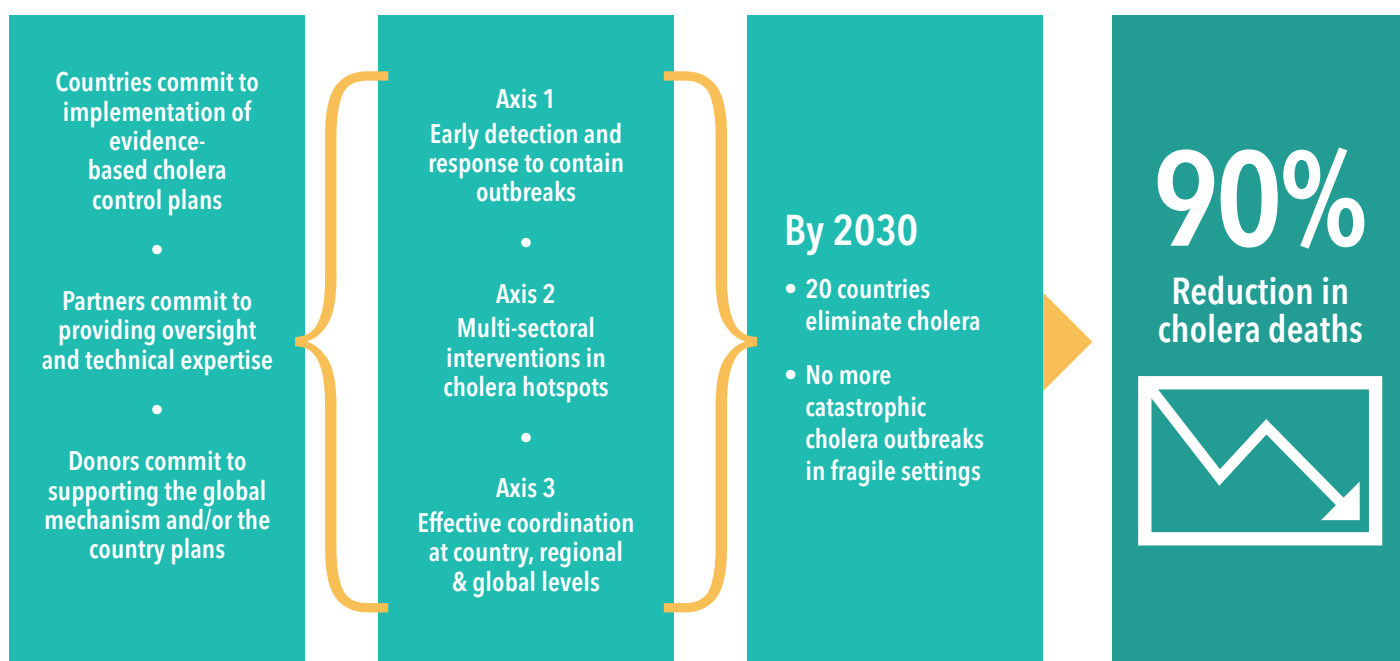
In settings where basic infrastructure is not available and minimum requirements for safe water and basic sanitation have not yet been met, including during humanitarian crises, the presence or introduction of *Vibrio cholerae* in the environment results in huge cholera outbreaks, evolving very quickly with devastating consequences.

**The first step in controlling cholera and dramatically reducing the number of cholera deaths is to support countries to strengthen their capacities for preparedness, early detection, laboratory confirmation, and immediate and effective response to outbreaks in order to reduce their impact.**

The containment of outbreaks can be achieved by the effective implementation of the following activities at the country level:

- Strengthening of integrated **early warning surveillance systems**, including the confirmation of suspected cholera cases (requiring laboratory culture capacity and rapid diagnostic tests) at the peripheral level. Well-performing laboratories are critical to confirm *Vibrio cholerae* as the causative agent and to monitor outbreaks, including testing for antibiotic susceptibility of the bacteria and tracking strains. Surveillance data is a key element to help all sectors prioritize areas for intervention.
- **Pre-positioning stocks** of essential supplies (ORS, IV fluids, cholera kits, High Test Hypochlorite), cold chain equipment, and other treatment and infection prevention and control supplies for patients' care at strategic locations in order to strengthen national rapid response capabilities.
- **Preparedness of WASH systems**, including monitoring of water quality in community water supplies and piped networks.
- **Preparedness of the health care system**, set-up of dedicated health care facilities (Cholera Treatment Centres (CTCs) and Cholera Treatment Units (CTUs)) and training of health workers.

**Figure 3:** Theory of change of the *Global Roadmap*



- Preparedness for implementation of **WASH response** through strengthening of chlorination of community water supplies and monitoring water quality in piped networks.
- **Improved health care facility infrastructure**, including WASH in facilities, availability of supplies, infection prevention and control, medical technologies, and decentralized access to health care (Oral Rehydration Points (ORP)), together with better community awareness and mobilisation. Early detection and timely and effective case management of cholera reduce the case fatality rate to less than one percent.
- **Establishment of WASH and Health Rapid Response Teams** for field investigation, risk evaluation, and immediate response.
- **Maintenance of stocks of WASH supplies** (rapid microbial test kits, chlorine tests, water disinfection technologies including chlorine, water tanks, and hygiene kits), and monitoring and enforcing food safety and water quality standards at all levels.
- **Specific WASH interventions to prevent disease spread**, such as increased use of safe water and effective water treatment at point of use, implemented effectively at large scale without delay.
- **Community engagement** and community-based interventions promoting hygiene practices.
- Implementation of reactive large-scale **mass vaccination campaigns with OCV**, to be initiated as soon as cases are confirmed for maximum impact.
- Establishing contingency agreements with governments, agencies and suppliers to ensure efficient planning and coordination for **effective supply management**, including rapid procurement, importation, warehousing and prompt distribution of equipment and other resources for immediate response.

## AXIS 2—Prevention of disease occurrence by targeting multi-sectoral interventions in cholera hotspots

The core of this renewed strategy is to break the silos at national and global levels to implement integrated, multi-sectoral actions in cholera hotspots. This requires cholera to be elevated as a priority in affected countries through its inclusion in national policies and plans, either as a stand-alone plan or embedded within broader disease control initiatives, or within national health, WASH and development, and SDG implementation plans where relevant. The GTFCC has developed a guidance tool to support countries in the update or development of multi-sectoral, costed, national cholera control plans in alignment with the principles of the *Global Roadmap*.

The implementation of interventions at country level is defined by two characteristics:

### 1. Targeted: Identifying of hotspots requiring priority action and analysis of local transmission pattern

Accurate morbidity, mortality and environmental data on cholera are fundamental for cholera control as they form the basis for the development of national plans, allowing the prioritization of vulnerable populations and high-risk areas.

Risk and vulnerability assessment in hotspots should include the identification of vulnerable populations and specific local risk factors, as well as a mapping of existing safe water sources, sanitation systems, capacities for surveillance (including laboratory), existing isolation treatment facilities and quality of health service delivery (including community-based ORPs and referral systems for severe cholera cases), and community engagement.

### 2. Multi-sectoral: Implementing a package of selected effective control measures adapted to the local transmission pattern

Once identified, cholera hotspots must become the primary targets of multi-sectoral interventions that include:

- Strengthening of epidemiological **surveillance** of clinically suspect cholera cases, complemented by a strong laboratory capacity at the peripheral level to detect outbreaks early and monitor cholera burden accurately. Strengthening routine surveillance, including through capacity building for laboratory staff, is essential to understand the burden and risk, inform the response, and track progress towards control and elimination.
- Implementation of adapted **long-term sustainable WASH** solutions to ensure use of safe water, basic sanitation and good hygiene practices to populations most at risk of cholera. In addition to cholera, such interventions prevent a wide range of other water-related illnesses like typhoid and dysentery, while contributing to achieving goals related to poverty, malnutrition, and education.
- Strengthening of **health care systems** to anticipate cholera outbreaks (readiness) through capacity building of staff involved in all aspects of cholera response, and pre-positioning of resources for patient diagnostics (lab reagents, rapid tests), patient care (ORS, IV fluids) and emergency WASH intervention (chlorine and other types of water treatment, soap).
- **Large-scale use of OCV** combined with WASH interventions such as water treatment at the point of use and handwashing promotion, to immediately reduce the disease burden while longer-term cholera control strategies are put in place.
- Implementation of hygiene promotion, risk communication and social mobilisation strategies for **strong community engagement**.
- **Cross-border collaboration** and building of a strong sub-regional preparedness and response strategy.

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## AXIS 3—An effective mechanism of coordination for technical support, resource mobilisation, and partnership at local and global levels

The *Global Roadmap* is a compelling country-driven, multi-sectoral strategy that provides the platform for achieving the goal of ending cholera as a public health issue by 2030. **Its implementation relies on the capacity and willingness of countries, partners and donors to coordinate and align interventions in cholera hotspots and for outbreak containment.**

The GTFCC provides a framework in which this coordination can effectively take place by building upon:

### 1. Nationally-led cross-sectoral cholera control programs

Multi-sectoral action must be led by national governments of cholera-affected countries, with support from the GTFCC partners. Developing and strengthening multi-sectoral policy frameworks, partnerships, and cross-sectoral coordination mechanisms at different levels of government and across sectors, underpins the process for how countries can progress towards cholera control or elimination.

National Cholera Control Programmes must be set up in each country. The National Programmes will work at the operational level and should include representation from each of the different ministries, agencies, and partners involved in cholera-control efforts. The structure of the National Programme will be tailored to each country's specific needs and conditions and will ideally operate at two levels (political and technical). Because of its multi-sectoral nature, the National Programme should report directly to the government (ideally to the President or Prime Minister) and have its head nominated by the executive branch.

The National Programmes will define and implement the national control plans. The GTFCC will support the National Programmes via secondment of resources that ensure the technical, strategic, and financial cooperation with the global effort.

### 2. The GTFCC as a strong coordination platform

The goal of the GTFCC is to support national and inter-country capacities by providing a strong platform for advocacy and communications, fundraising, inter-sectoral coordination, and technical assistance.

The current structure of the GTFCC has served very well the needs of cholera control in the past 25 years. Its

revitalisation in 2014 has been successful in “creating an important dynamic around cholera and playing a critical role in coordinating partners and activities,” and by (i) “producing technical guidance; (ii) supporting cholera control activities in countries; and (iii) increasing the visibility of cholera”<sup>13</sup>. Yet the implementation of the *Global Roadmap* radically changes the scenario with a broader scope, a larger number of players, and a much stronger focus on implementation at the country level—which requires a strengthened governance structure to successfully achieve its goals. A new governance design that leverages the GTFCC role allows the many additional challenges and requirements of the *Global Roadmap* to be addressed.

In this set up, the GTFCC represents the global technical, administrative, and operational dimension of the *Global Roadmap*. The GTFCC supports countries in their plans' development and implementation; it is responsible for advocacy and communication activities; and it provides the administrative and reporting infrastructure for the *Global Roadmap*. It has three main components:

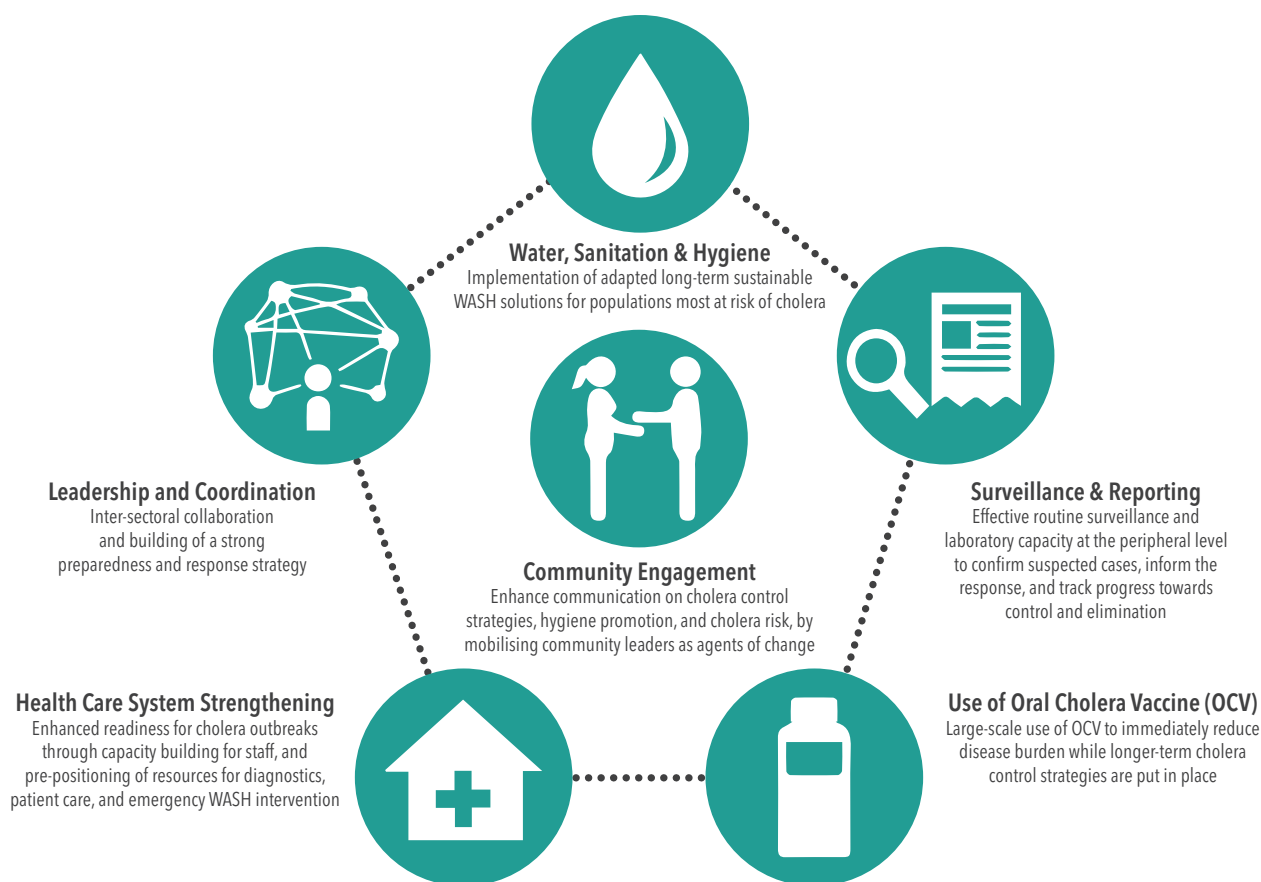
- **The secretariat of the GTFCC (hosted by WHO):** The secretariat is responsible for managing all global technical, operational, administrative, and financial dimensions of the strategy. It is headed by a WHO officer and is composed of 5–7 technical members from different sectors, some from partner agencies, and 2–4 administrative/project management staff.
- **Technical Working Groups (WGs):** The WGs provide the technical/scientific input and are composed of experts from partner agencies and independent members. The members act in their personal capacities and are overseen by an independent head appointed by the secretariat. The WGs are tasked with advising on technical and scientific matters, covering all aspects of cholera control, developing tools and technical guidance, and providing technical expertise to the countries.
- **Country Support Group:** Representing the operational support for the *Global Roadmap*, the Country Support group is comprised by: (a) few permanent staff persons seconded by the partner agencies and deployed at country/inter-country level based on needs; and (b) a varying amount of additional resources mobilised according to needs (i.e. outbreaks). The main task of the group is to provide support to the National Cholera Control Programmes, complementing local experts and resources, integrating sectors, building capacities, and ensuring the delivery of material resources (e.g. diagnostic, treatment, and WASH supplies).



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**Figure 4:** Multi-sectoral interventions to control cholera



Since 2014, thanks to the support of the Bill & Melinda Gates Foundation, the GTFCC network has been fully operational and very active. All partners involved in the various aspects of cholera control are now part of the GTFCC and/or its Working Groups.

Working Groups have been established in key areas of cholera prevention and control: (i) Case management; (ii) Policy and advocacy; (iii) Epidemiology/surveillance; (iv) Laboratory/ surveillance; (v) OCV; and (vi) WASH. The Working Groups meet on an annual basis, to coordinate activities and develop guidance documents. Support to countries is implemented on an ongoing basis, on all aspects of cholera control.

Overall, the dynamic created by the revitalisation of the GTFCC demonstrates that affected countries, partners and donors can be mobilised to control cholera.

**Some key numbers since 2014:**

- 4 GTFCC meetings
- 15 Working Group meetings
- 7 technical notes published
- 6 newsletters issued, 1 revised cholera factsheet
- 6 requests for OCV approved by the OCV Working Group
- Between June 2016 and June 2017, visits to 17 countries to support cholera interventions

## 6. ROLLING OUT THE GLOBAL ROADMAP

Cholera has been a neglected issue within national, regional, and global health agendas despite its high burden and the continued risk of emergence and re-emergence. As an issue which cuts across multiple sectors, **controlling cholera sustainably requires the highest level of political commitment within governments** and full support of partners to generate collaborative operational structures, effectively use available resources, and contain outbreaks.

All countries reporting cholera can expect support from the GTFCC for the development and implementation of their plan toward cholera control or elimination. As a first step, a tool to guide the development of cholera control programmes has been developed, highlighting key components to be considered by governments. GTFCC resources and support will differ from one country to another and will be adapted to country specific contexts and needs.

### Adapting the *Roadmap* to country settings

Some countries are in a position to eliminate cholera in the near future whilst others, affected by conflicts and political instability, are likely to struggle to improve sustainable access to safe water and sanitation at all.

Given these varying contexts, the objectives have to be adapted to the specific realities of each affected country:

- Countries where improvement in WASH in hotspots can be achieved in the short- to mid-term and with strong capacity to contain outbreaks, whether regularly declaring cholera cases or not, should be capable of **eliminating cholera before 2030**.
- Endemic countries where improvements in WASH will require important mid- to long-term investments, as well as countries in fragile contexts or humanitarian crisis situations regularly affected by outbreaks, with limited capacity to respond, are likely to target **reduction in mortality**, rather than elimination, within the given timeframe.
- Because cholera will not be eradicated and will likely remain in the environment, the GTFCC will also establish a **mechanism to monitor countries** that are not currently (or are no longer) affected by cholera but where cholera could re-appear due to external events such as conflict, natural disaster, or political crisis impacting the national infrastructures and increasing the risk of cholera.

Due to the nature of cholera, unpredictable and explosive outbreaks are likely to happen again in the future. However, with improved early response, large outbreaks—such as we see today in Yemen—should be contained at an earlier stage.

## TIMELINE

**The success of the implementation of the *Global Roadmap* relies on countries' engagement, and political willingness to effectively control cholera.** It also relies on the capacity of global partners to effectively support countries in their efforts. Scaling up efforts gradually will be critical to the success of this initiative, drawing on lessons learnt along the way and promoting the exchange of lessons learnt amongst countries.

### 2017

4th October—Call to Action Meeting to launch the *Global Roadmap*

First three countries to develop cholera control costed plans based on the *Global Roadmap*

Strengthening of the GTFCC secretariat to increase technical support available to countries

### 2019

Resource mobilisation meeting: presentation of results to date and the way forward

### 2018

World Health Assembly resolution at WHA

Discuss cholera at the SDG 6 high level political forum

Develop an investment case on cholera

Additional 3 to 5 countries to develop cholera control plans with support from the GTFCC

Organisation of workshop to promote the exchange of lessons learnt between countries

Development of operational guidance on integrated approaches, particularly on OCV and WASH

Appointment of cholera focal points at national level and reinforcement of multi-sectoral cholera platforms at regional level

Development of process for certification of cholera-free countries

## 7. MONITORING FRAMEWORK

### Monitoring framework 2017-2030

The GTFCC has developed a high-level monitoring framework to assess progress against key milestones, which is aligned with SDG milestones. This contains both output and outcome indicators aligned with the three axes of the strategy. This monitoring framework (see Annex C) is not intended to be a full monitoring and evaluation plan but aims instead to provide an overview of progress against the *Roadmap's* major objectives. As detailed national plans are developed by countries, in-depth monitoring and evaluation plans will also be developed.

### Risks and mitigation

The renewed strategy was developed taking into consideration the challenges of implementation of the three main axes. Yet unexpected factors and external risks can compromise progress towards ending cholera. The following risks have been identified as well as activities to mitigate these risks:

- **Insufficient funding:** The implementation of multi-sectoral interventions will need to be adequately funded to achieve the objectives. A large number of WASH programmes are already in place in cholera-affected countries. The GTFCC is setting up a financing mechanism to support countries to fill the gaps to ensure successful implementation of their plans. Yet aligning different partners and sources of funding to prioritise interventions in cholera hotspots may be challenging.

*Risk mitigation activities:* Communicating progress achieved and success stories will be key to incentivising countries, partners, and donors to align resources to control cholera. A framework will be developed as part of country-level plans, and cross-border workshops will be organised to increase the exchange of information and advocate for development donors to target resources in cholera hotspots.

- **Insufficient availability of vaccines:** The availability of OCV has significantly increased since the creation of the OCV stockpile in 2013. Through 2017, a total of 17 million doses were contracted and the production capacity has now reached at least 25 million doses a year. However as country demand materialises, the use of OCV will increase and more doses will be needed to meet all demands. Currently, partners and Gavi, the Vaccine Alliance have estimated the demand forecast at 44 million, 59 million and 76 million doses for 2018, 2019 and 2020 respectively. However, with improved WASH conditions, the demand for OCV should stabilise and effectively reduce over the long term, allowing better management of supply and demand.

*Risk mitigation activities:* The GTFCC will continue to work with Gavi, the Vaccine Alliance and producers to shape the market and increase supply availability, while reaching out to new manufacturers to incentivise the development of new cholera vaccines with possible longer-term effectiveness.

- **Lack of political will or commitment:** The success of the *Global Roadmap* relies on countries' commitment to prioritise cholera control, starting with the involvement at the highest levels of government to ensure that all relevant national ministers (beyond the health sector) are adequately involved.

*Risk mitigation activities:* Focusing on cholera is a priority to reach SDG targets. The GTFCC will push for cholera to be included as an indicator in the high level political forum on SDG 6 to be held in 2018<sup>14</sup>, thereby raising cholera control on national agendas. Overall, the GTFCC will take every opportunity to advocate for cholera control globally and nationally, through its support to countries and with stronger visibility from the key leaders.

- **Unexpected events increasing the risk of cholera (e.g., natural disaster, conflict, etc.):** Unfortunately, cholera is likely to occur when infrastructures collapse because of natural causes like floods or due to conflicts, or political instability. There are currently 47 countries affected by the disease but cholera may also affect other countries in the future, particularly where conflicts have destroyed health systems and infrastructures such as in Syria, and where cholera either is present or can be easily introduced due to population movement.

*Risk mitigation activities:* A process for monitoring countries is being developed as part of the *Global Roadmap*, based on a series of indicators that will trigger increased support from the GTFCC (for example a sudden drop in DTP3 coverage indicating health system disruption, or an increased number of internally displaced persons). Strengthening cross-border coordination and surveillance, and systematic use of OCV for refugees or other displaced groups staying in high-risk areas will be critical to reduce the risk of introduction into new areas. In case of natural disasters such as Hurricane Matthew in Haiti in October 2016 or recent floods in Sierra Leone, an emergency stock of OCV will always remain available and vaccination of vulnerable populations will systematically be supported, as recommended by the revised OCV position paper<sup>15</sup>.



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## 8. FINANCING THE GLOBAL ROADMAP

**Cholera has a significant economic burden on cholera endemic countries, with an estimated annual cost of about US \$2 billion globally.**<sup>16</sup> A large portion of the cost is due to productivity losses and out-of-pocket expenditure rather than the cost of treatment. The families affected most are those who can afford it least.

The financial investment needed to achieve the required WASH coverage to control cholera has often been regarded as prohibitive and as a result the onus has been placed on emergency response to outbreaks because this approach has lower short-term costs. Yet WASH interventions can have impact far beyond cholera, preventing a range of enteric and diarrheal diseases. In addition, interventions to address cholera often come from multiple funding sources—sometimes within the same organisations—and have often been uncoordinated and not targeted at cholera hotspots. In particular, OCV is being rapidly integrated into cholera control plans with no clear linkages to WASH investments.

The case study of a large and complex country such as DRC provides an indication of the cost of implementing the *Global Roadmap* strategy at country level over 10 years. **As outlined in Table 1 below, we estimate that the total cost to control cholera in DRC hotspots will be between US \$607 million and US \$1.1 billion over 10 years, assuming a target population living in hotspots of between 5 and 6 million people.** This costing overview offers greater clarity on the key cost components and their potential range. However, the cost for DRC cannot be extrapolated to other geographies to determine a global cost given the particular country-specific epidemiological context and needs.

Many of these resources have already been committed to WASH interventions but do not specifically target cholera hotspots. For example, focusing new SDG WASH projects on cholera hotspots may not require additional investments. Moreover, other health investments could be leveraged. In particular, Global Polio Eradication Initiative (GPEI) resources (including surveillance) that are still operational after 2020 could be repurposed for cholera control in many contexts.

As the DRC case study shows, a long-term investment would put the country on a trajectory of sustainability for cholera financing. By reducing the number of cases, the annual emergency cholera expenditure will be significantly reduced while contributing to national WASH targets. **Preliminary estimates indicate that the successful implementation of the cholera control strategy may allow up to 50 percent savings compared to the perpetual average yearly cost of continuously responding to emerging cholera outbreaks with OCV vaccination and a basic package of WASH interventions<sup>iii</sup>.**

<sup>iii</sup> This assumes the average annual cost of the last three years (Year 8, 9, and 10) of the baseline cholera emergency response is about \$51 million per year (based on a no-change scenario). This is compared with a cost of \$27 million in Year 10 of the proposed cholera plan in DRC.

### Description of WASH interventions and related costs

- **Emergency WASH interventions: US \$5 to \$10 per person per outbreak response:** Most cholera outbreaks are characterised by a rapid peak in cases, and if responded to quickly and effectively, a sharp decline in cases can be observed in a few weeks. In these cases, and where typically WASH access is poor, responders will focus the WASH interventions on providing household water treatment materials for the affected population and temporary WASH services at Cholera Treatment Centres (CTCs). Both interventions are combined with hygiene promotion and cholera awareness campaigns. More severe outbreaks will typically require a far greater, more expensive emergency WASH component.
- **Investment in developmental, long-term WASH programming to provide sustainable and affordable services to the target population: US \$40 to \$80 per person over a ten year period:** Provision of all three WASH components: (a) safe and adequate water supply within 30-minute round trip, (b) basic sanitation, and (c) hygiene promotion/behavioural change campaigns, including the required HR capacity building, are established through WASH projects with a three- to five-year implementation period. This estimate represents the capital cost or initial investment cost.
- **Operation and maintenance (O&M) considerations and costs:** For short-term emergency WASH, O&M is minimal and included in the US \$5 to \$10 scenario. For longer-term developmental WASH programming, most governments expect the recipient communities to either raise community funds to access O&M services (especially common in rural settings) or individuals and families will pay WSPs (WASH Service Providers—such as municipalities, water and sewerage bodies or companies) the normal fees or tariffs for accessing WASH services.

As a general rule or government policy, in most cases, WASH services in emergencies may be provided free of charge. In long-term development contexts, WASH services are expected to be self-financing, and certainly not provided free of charge even among low-income populations.

### Next steps: Toward a cholera investment case

The overall cost of implementing the *Global Roadmap* will depend on a number of factors. Cost estimates will rely on countries' in-depth mapping of cholera hotspots, the proportion of urban versus rural areas, and their key priorities. **Work has already started and a cholera investment case will be developed in the first half of 2018,** identifying funding gaps and existing investments to be retargeted to cholera hotspots.

## Financing goals and funding framework

The successful implementation of the renewed cholera strategy depends on the achievement of multiple financing goals:

- Ensure the continuation and strengthening of the current funding streams to agencies involved in the implementation of cholera control national plans;
- Increase the domestic funding to ensure long-term sustainability of the national cholera control programme;
- Fill existing and emerging country and global funding gaps for the implementation of the new strategy; and
- Secure sufficient financial resources to establish and maintain a country support structure that can help National Programmes in the implementation of their plans.

The achievement of these goals should be sought with the following guiding principles:

- Transparency in allocation and utilisation of resources
- Effective fund stewardship
- Limited administrative costs
- Professional financial management

To achieve these goals while adhering to the guiding principles, the GTFCC will need to reinforce its **cholera-specific advocacy function**. The main objectives of this effort will be to generate and communicate evidence and advocate for the necessary funding to be made available to the countries and partners for the implementation of the strategy. For implementation of the *Global Roadmap*, funding requirements will include existing financing streams, which will need to be maintained, new financing streams, which will be required for new or intensified activities, and financing for the coordination mechanism at global and country levels.

The success of the strategy will also rely on sufficient funding for the following enabling components:

- **In-country cholera-specific interventions** including the strengthening of surveillance, as well as the provision of technical support to countries via the GTFCC.
- The financing of **OCV procurement** for countries not eligible for Gavi support.
- The ongoing **functioning of the GTFCC** to ensure alignment, prioritisation, and coordination of activities at global and country levels; to serve an advocacy and communications function; and to implement selected operational research projects.

**The GTFCC will invite all key stakeholders to reconvene early in 2019 to take stock of the first 18 months of implementation of the *Global Roadmap*, and mobilise resources to end cholera as a threat to public health by 2030.**

## Methodology:

These calculations were developed using data from various sources including IFRC WASH budgets, country cholera plans for DRC, and global reports including Hutton and Varughese, 2016<sup>17</sup>. Population data for DRC hotspots, number of health zones, and cholera cases were taken from Bompangue, D. 2014<sup>18</sup>. Data were compared and validated with experts and the DRC team.

## Key assumptions:

- All costs are in constant 2017 US dollars (no inflation rate applied)
- 10-year projection
- Population growth rate of 3.2 percent—source: UNDP
- 90 percent decline in cholera incidence over the 10 years, with more rapid rate of decline from year six
- OCV preventive vaccination is assumed to take place every three years in hotspot populations; OCV emergency campaigns are assumed to be provided only to at-risk populations outside hotspots
- Total WASH investment in affected health zones split in two tranches: 75 percent invested in the first five years with the remainder invested in the remaining five years
- WASH operation and maintenance costs (domestically financed) to start in year three to ramp up from 25 percent in year three to 100 percent in year 10 in all affected health zones irrespective of their evolving “hot spot” status
- Capital investments in surveillance in health zones to include an initial investment of \$50,000 in year one and \$25,000 per year thereafter

Ongoing surveillance continues in affected health zones irrespective of their evolving hotspot status. These costs cover strengthening of existing systems and increase of diagnostic capacity for cholera in existing laboratories.

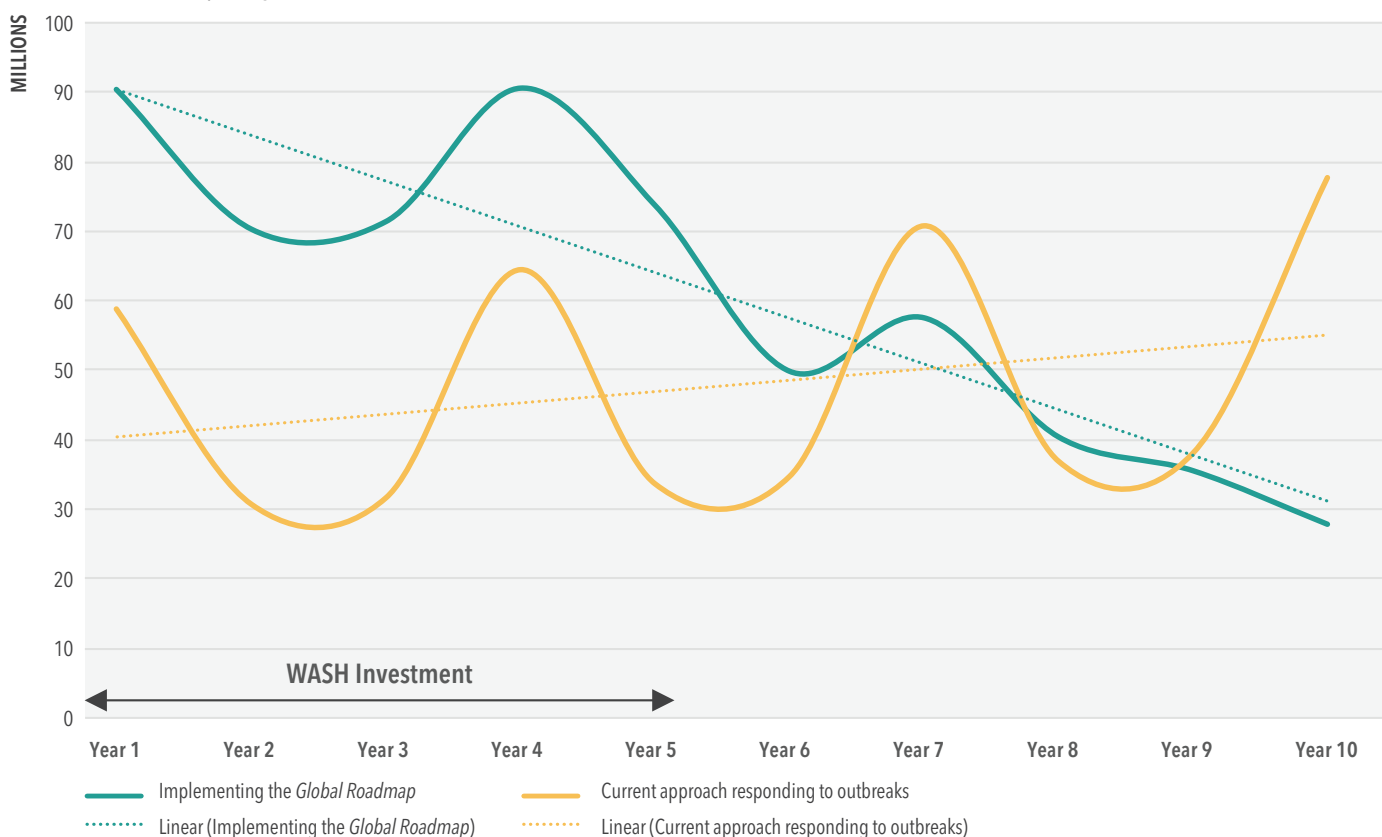
**Table 1.** Cost of controlling cholera in DRC

	LOW SCENARIO IN US \$		HIGH SCENARIO IN US \$	
AXIS 1: Early detection and response to outbreaks	Cost component	Total for cost component over 10 years	Cost component	Total for cost component over 10 years
Emergency water and sanitation services	6 per person in outbreak (in hotspots and outside) <sup>1</sup>	209 million	12 per person in outbreak (in hotspots and outside) <sup>1</sup>	418 million
Patient care (ORS, IV fluids)	24.3 per case per yr <sup>2</sup>	4 million	26.5 per case per yr <sup>2</sup>	4 million
Emergency human resources provision (additional staff for coordination)	300,000 <sup>3</sup>	3 million	500,000 <sup>3</sup>	5 million
Mass vaccination (OCV) campaigns (3 campaigns, incl. op costs and social mobilisation)	4 per person per outbreak (outside hotspots only) <sup>4</sup>	70 million	6 per person per outbreak (outside hotspots only) <sup>4</sup>	105 million
<b>Total cost of Axis 1</b>		<b>286 million</b>		<b>532 million</b>
Axis 2: Multi-sectoral interventions in hotspots				
Basic WASH including "hardware", software (social mobilisation and community engagement) and health and WASH HR capacity building	40 per person in health zones <sup>5</sup>	193 million	80 per person in health zones <sup>5</sup>	386 million
OCV	4 per person in hotspot per year <sup>4</sup>	50 million	6 per person in hotspot per year <sup>4</sup>	75 million
Strengthening laboratory capacity: including diagnostics (laboratory reagents, rapid tests)	50,000 <sup>6</sup>	2 million	50,000 <sup>6</sup>	2 million
Epidemiological surveillance	0.3 per person in health zones <sup>7</sup>	17 million	0.6 per person in health zones <sup>7</sup>	33 million
Programme management and technical assistance at country level	500,000 fixed cost <sup>8</sup>	5 million	500,000 fixed cost <sup>8</sup>	5 million
WASH O&M costs (domestically financed)	1.5 per person in health zones <sup>9</sup>	50.5 million	2 per person in health zones <sup>9</sup>	67 million
<b>Total cost of Axis 2</b>		<b>317 million</b>		<b>569 million</b>
Axis 3: Global coordination				
Share of cost global coordination mechanism	500,000 <sup>10</sup>	5 million	500,000 <sup>10</sup>	5 million
<b>Total cost of cholera control in DRC</b>		<b>607 million</b>		<b>1.1 billion</b>

<sup>1</sup> Assume short-term, localised outbreaks. WASH interventions: providing HHWT household water treatment materials for affected population, temporary WASH services at CTCs, hygiene promotion and cholera awareness campaigns. <sup>2</sup> See IVI 2010 An Investment Case for the Accelerated Introduction of Oral Cholera Vaccines. <sup>3</sup> WHO estimated range. <sup>4</sup> \$6 estimated by Pezzoli L et al. Deployments from the oral cholera vaccine stockpile, 2013-2017. WER;2017,92,32:437-452. \$4 in low scenario includes potential price reduction of OCV. <sup>5</sup> Includes capital costs for a) safe and adequate water supply near home b) basic sanitation c) hygiene promotion/behavioural change campaigns linked to HR capacity building for 3 to 5 years implementation period. Based on IFRC data for 18 countries where they have WASH interventions. <sup>6</sup> WHO estimated fixed cost of \$50,000 in Y1 and \$25,000 per year thereafter. <sup>7</sup> WHO estimated range based on other types of disease surveillance. <sup>8</sup> WHO estimated costs. <sup>9</sup> WHO estimated costs. Assumes starting in Y3 with ramp up thereafter. <sup>10</sup> WHO estimate.

**Figure 5:** Investing in the *Global Roadmap* vs the status quo

Preliminary estimates indicate that the successful implementation of the control strategy may allow up to 50% savings compared to the perpetual average yearly cost of continuously responding to emerging cholera outbreaks with OCV vaccination and a basic minimal package of WASH interventions.



## The economic investment case for increasing access to water, sanitation, and hygiene

The economic benefits arising from increased coverage of WASH are vast, elevating the importance of achieving WASH targets 6.1 and 6.2 of the SDGs, which call for universal access to safe water, and sanitation and hygiene, respectively.

- 1. Inadequate sanitation and water supply makes countries poorer:** The economic costs of not investing in water and sanitation are very significant. For 26 countries spread across South Asia, Southeast Asia and Africa, with a population in 2006 of 2.3 billion people, economic losses caused by poor sanitation alone amounted to about US \$80 billion annually, or US \$35 per person per year<sup>19</sup>.
- 2. The economic benefits of both water supply and sanitation indicate excellent value for money:** Attaining universal water supply and sanitation will have total annual benefits of US \$220 billion. An update provided by WHO in 2012 showed that combined water supply and sanitation interventions have a US \$4.30 return for every dollar spent<sup>20</sup>.
- 3. The benefits from investments in water and sanitation are underestimated:** Returns would be much higher than currently estimated if all benefits from investments in water supply and sanitation services were to be included, such as exports, tourism, waste reuse, water quality savings, and social benefits (such as gender equity, safety, and dignity). However, no studies include all the potential benefits due to lack of underlying data, challenges in attributing broader changes over time to improved water and sanitation (i.e. determination of causality), as well as difficulties in converting social impacts to monetary values.



## 9. CONCLUSION

It has been 150 years since the world's high-income countries achieved control of cholera, thanks to the implementation of safe piped water, sewerage systems, and basic hygiene principles. However, the world's poorest remain at risk: at the beginning of the 21st century, millions of people still lack access to safe drinking water and basic sanitation facilities. The burden of cholera remains high in those groups and stands to worsen if we fail to act. Further conflict, climate change, urbanization, and population growth will create an increased risk of cholera in the coming years.

**Now is the time to accelerate action against cholera at country and global levels.** The tools and technologies we need to control cholera are already well known and readily

available to us. The challenge is to ensure that investments in cholera control—particularly in WASH—are prioritised by donors and governments in cholera-affected countries, and are focused on cholera hotspots and rapid response capabilities.

Recent developments in the production capacities and delivery of OCV have shown that innovation in the domain of cholera control can yield significant progress for both cholera-endemic areas and in outbreak situations. **Now is the time for technical partners, donors, and countries to commit to achieving full implementation of the *Global Roadmap*—an integrated cholera control strategy—using modern methods to tackle an old disease and save lives.**



## ANNEXES

### ANNEX A. Estimation of the disease burden of cholera by country

by Ali et al., Johns Hopkins University

	Nb of cases per year (Conservative): Incidence rate estimate 50% of original estimate	Nb of cases per year (Liberal): Incidence rate estimate 150% of original estimate	Nb of deaths per year (Conservative): CFR 1% for all countries	Nb of deaths per year (Liberal): CFR 5% for all countries
Afghanistan	14,670	44,011	293	1,467
Angola	8,211	24,632	164	821
Bangladesh	54,526	163,578	1,091	5,453
Benin	8,274	24,821	165	827
Bhutan	329	988	7	33
Burkina Faso	12,898	38,695	258	1,290
Burundi	9,971	29,914	199	997
Cambodia	496	1,487	10	50
Cameroon	10,518	31,555	210	1,052
Cape Verde	190	570	4	19
Central African Republic	5,742	17,226	115	574
Chad	10,197	30,591	204	1,020
China	4,542	13,626	91	454
Comoros	437	1,312	9	44
Congo	6,743	20,230	135	674
Côte d'Ivoire	28,844	86,533	577	2,884
Democratic Republic of the Congo	94,531	283,592	1,891	9,453
Djibouti	342	1,026	7	34
Dominican Republic	1,703	5,109	96	482
Eritrea	10,908	32,725	218	1,091
Ethiopia	137,611	412,832	2,752	13,761
Gabon	1,043	3,128	21	104
Gambia	538	1,613	11	54
Ghana	20,866	62,598	417	2,087
Guinea	8,918	26,755	178	892
Guinea-Bissau	1,269	3,808	25	127
Haiti	16,428	49,284	2,106	10,529
India	337,594	1,012,782	6,752	33,759
Indonesia	1,149	3,448	23	115
Jamaica	27	82	0	3
Kenya	55,637	166,910	1,113	5,564
Kiribati	3	10	0	0

Lao People's Democratic Republic	166	499	3	17
Lesotho	2,973	8,920	59	297
Liberia	3,246	9,737	65	325
Madagascar	17,918	53,753	358	1,792
Malawi	14,713	44,140	294	1,471
Mali	10,909	32,727	218	1,091
Marshall Islands	1	2	0	0
Mauritania	2,671	8,013	53	267
Micronesia (Fed. States of)	4	12	0	0
Mozambique	39,306	117,919	786	3,931
Namibia	2,963	8,890	59	296
Nauru	0	1	0	0
Nepal	15,189	45,568	304	1,519
Niger	14,463	43,390	289	1,446
Nigeria	110,198	330,595	2,204	11,020
Palau	0	1	0	0
Papua New Guinea	189	566	4	19
Philippines	1,215	3,644	24	121
Rwanda	9,753	29,259	195	975
Saint Lucia	3	9	0	0
Sao Tome and Principe	132	396	3	13
Senegal	6,216	18,649	124	622
Sierra Leone	5,004	15,013	100	500
Solomon Islands	18	54	0	2
Somalia	6,084	18,253	122	608
South Sudan	14,713	44,138	294	1,471
Sudan	21,634	64,901	433	2,163
Swaziland	1,026	3,078	21	103
Tajikistan	23	69	0	2
Timor-Leste	469	1,407	9	47
Togo	5,486	16,459	110	549
Uganda	44,863	134,589	897	4,486
United Republic of Tanzania	80,952	242,856	1,619	8,095
Vanuatu	5	15	0	1
Yemen	8,773	26,319	175	877
Zambia	13,746	41,237	275	1,375
Zimbabwe	15,692	47,077	314	1,569
	<b>Cases per year conservative</b>	<b>Cases per year liberal</b>	<b>Deaths per year conservative</b>	<b>Deaths per year liberal</b>
Total	<b>1,335,874</b>	<b>4,007,622</b>	<b>28,558</b>	<b>142,786</b>

## ANNEX B. Estimates of population living in hotspots

by Moore SM, Azman AS, Mckay H, Lessler J (in prep), Johns Hopkins University

### Mapping methodology

A Bayesian modeling framework was used to map cholera case reports from 2010-2016 to underlying incidence rates, following similar methods described in Moore et al, 2016<sup>21</sup>. The entire study region was divided into 20x20 km grid cells and the annual cholera incidence in each grid cell,  $\lambda_i$ , was modeled using a log-linear regression equation,

$$\log(\lambda_j) = \beta_0 + \beta_p X_{p,j} + \psi_j,$$

with covariates  $X_{p,j}$  and spatially-correlated random effects,  $\psi_j$ . Each observation,  $Y_i$  was mapped to the underlying grid cells that are within area  $i$  and modeled according to a Poisson distribution:

$$Y_i \sim Pois(E_i).$$

The expected number of cases,  $E_i$  for each observation is the sum of the expected number of cases in each grid cell included in the observation area:

$$E_i = \sum_{j=1}^{N_i} \lambda_j \times p_j$$

where  $p_j$  is the size of the population in grid cell  $j$ . Multiple observations for the same area covering different temporal periods or from different sources were treated as independent observations, and data from different, but overlapping, spatial scales were also treated as independent observations. The covariates included in our analysis were level of access to improved drinking water, level of access to improved sanitation, population density, distance to the nearest coastline, and distance to the nearest major waterbody (lake, river, or reservoir).

### Estimation of population at risk

The maps of estimated annual cholera incidence were used to identify grid cells where cholera incidence was moderate to high, falling into one of three incidence groups; 1-5 per 10,000, >5-10 per 10,000, and >10 per 10,000. The number of people living in grid cells falling into each incidence group was then aggregated by district (ISO administrative level 2), and then further by country. An entire district was considered to be at risk of exceeding one of three thresholds (1, 5, or 10 per 10,000) if at least 100,000 people or at least 10 percent of the district population lived in a grid cell where the annual incidence exceeded the threshold.

Bangladesh (70 million) and India (375 million) figures are based on national estimations, conducted by respective Ministries of Health<sup>22</sup>.

Region	Country	>10 per 10,000 (95% CrI) - Total		
AFRO	Angola	395,696	(71,659	- 1,225,652)
	Burundi	559,929	(559,929	- 559,929)
	Benin	64,297	(0	- 354,901)
	Botswana	0	(0	- 0)
	Burkina Faso	542,544	(0	- 542,544)
	Central African Republic	71,156	(0	- 92,801)
	Cote d'Ivoire	1,049,005	(0	- 1,530,320)
	Cameroon	4,598,018	(3,210,631	- 5,641,237)
	Democratic Republic of Congo	23,856,539	(20,246,528	- 27,702,957)
	Republic of Congo	162,024	(0	- 241,054)
	Eritrea	0	(0	- 184,507)
	Ethiopia	5,967,606	(2,171,438	- 11,360,308)
	Gabon	0	(0	- 0)
	Ghana	7,976,232	(6,057,512	- 9,035,911)
	Guinea	2,628,214	(2,395,007	- 3,294,971)
	Gambia	0	(0	- 0)
	Guinea-Bissau	127,953	(66,099	- 197,252)
	Equatorial Guinea	0	(0	- 0)
	Kenya	2,843,874	(1,879,012	- 4,099,104)
	Liberia	181,714	(99,856	- 434,411)
	NA	0	(0	- 0)
	Madagascar	0	(0	- 0)
	Mali	146,167	(0	- 701,814)
	Mozambique	1,626,425	(676,216	- 2,463,809)
	Mauritania	47,214	(0	- 47,214)
	Malawi	461,497	(100,828	- 873,783)
	Namibia	0	(0	- 342,420)
	Niger	784,421	(0	- 2,064,362)
	Nigeria	8,885,306	(6,690,121	- 14,121,092)
	Rwanda	0	(0	- 0)
	Senegal	0	(0	- 0)
	Sierra Leone	4,306,623	(2,114,589	- 5,328,026)
South Sudan	979,262	(430,238	- 1,718,093)	
Swaziland	0	(0	- 0)	
Chad	3,243,983	(2,114,280	- 4,489,554)	
Togo	621,488	(0	- 621,488)	
Tanzania	6,512,525	(4,558,569	- 8,938,694)	
Uganda	1,492,246	(1,389,935	- 1,941,594)	
South Africa	0	(0	- 0)	
Zambia	426,062	(0	- 997,509)	
Zimbabwe	443,201	(0	- 716,815)	
	<b>AFRO Total</b>	<b>81,001,221</b>	<b>(54,832,447</b>	<b>- 111,864,126)</b>
EMRO	Afghanistan	19,800,896	(18,562,744	- 20,846,221)
	Djibouti	141,422	(0	- 201,744)
	Iran	0	(0	- 581,856)
	Iraq	1,547,763	(420,256	- 2,643,056)
	Pakistan	14,439,694	(4,284,163	- 22,191,832)
	Somalia	5,790,001	(4,608,390	- 6,624,358)
	Sudan	0	(0	- 0)
	Syria	0	(0	- 0)
	Yemen	3,426,912	(1,906,681	- 5,735,003)
		<b>EMRO Total</b>	<b>45,146,688</b>	<b>(29,782,234</b>
	<b>TOTAL</b>	<b>126,147,909</b>	<b>(54,832,447</b>	<b>- 170,688,196)</b>

## ANNEX C. Monitoring framework

Global Roadmap: Three Axes	Indicator	OUTCOME INDICATORS			
		Baseline (2017)	2020	2025	2030
<b>1:</b> <b>Early detection and response to contain outbreaks</b>	Severity of outbreaks as measured by number of deaths from cholera	Uncontrolled cholera outbreaks in Yemen (estimated 2000 deaths) and the Horn of Africa (estimated 800 deaths)	Reduce outbreak deaths by 20%	Reduce outbreak deaths by 50%	There are no more large, country-wide, uncontrolled cholera outbreaks
<b>2:</b> <b>Prevention of disease occurrence by targeting multi-sectoral interventions in cholera hotspots</b>	Number of currently endemic countries that eliminate cholera as a threat to public health	47 countries remain affected by cholera	2 countries eliminate cholera	5 countries eliminate cholera	Up to 20 countries eliminate cholera
<b>3:</b> <b>An effective mechanism of coordination for technical support, resource mobilisation and partnership at local and global level</b>	Number of countries with fully funded multi-sectoral cholera control plans aligned to the <i>Global Roadmap</i>	3 countries with fully funded multi-sectoral cholera control plans aligned to the <i>Global Roadmap</i>	12 countries with fully funded multi-sectoral cholera control plans aligned to the <i>Global Roadmap</i>	37 countries with fully funded multi-sectoral cholera control plans aligned to the <i>Global Roadmap</i>	All countries with cholera hotspots are implementing fully funded multi-sectoral cholera control plans
<b>IMPACT:</b> <b>Reduction in deaths from cholera</b>	<b>Impact indicator:</b> Reduction in cholera deaths compared with the 2017 baseline	<b>Estimated 95,000 deaths per year</b>	<b>Reduce cholera deaths by 20% compared with 2017 baseline to 76,000 or fewer deaths per year</b>	<b>Reduce cholera deaths by 50% from 2017 baseline to 47,500 or fewer deaths per year</b>	<b>Reduce cholera deaths by 90% from 2017 baseline to 9,500 or fewer deaths per year</b>

## ANNEX D. Glossary

### Acronyms

CTC	cholera treatment centre
CTU	cholera treatment unit
GTFCC	Global Task Force on Cholera Control
GPEI	Global Polio Eradication Initiative
DRC	Democratic Republic of Congo
JMP	Joint Monitoring Programme for Water Supply, Sanitation and Hygiene
HTH	high test hypochlorite
HR	human resources
HHWT	household water treatment
IDP	internally displaced person
IV	intravenous
MDG	Millennium Development Goals
OCV	oral cholera vaccine
O&M	operation and maintenance
ORP	oral rehydration point
ORS	oral rehydration solution
PCR	polymerase chain reaction
SAGE	Strategic Advisory Group of Experts on immunization
SDG	Sustainable Development Goal
UN	United Nations
UNDP	United Nations Development Programme
WASH	water, sanitation and hygiene
WG	working groups
WHO	World Health Organization

### Case definitions

#### Acute watery diarrhoea (AWD)

Acute watery diarrhoea is an illness characterized by three or more loose or watery (non-bloody) stools within a 24-hour period.

#### Suspected cholera case

In areas where a cholera outbreak has not been declared: Any patient aged two years and older presenting with acute watery diarrhoea and severe dehydration or dying from acute watery diarrhoea.

In areas where a cholera outbreak is declared: any person presenting with or dying from acute watery diarrhoea.

#### Confirmed cholera case

A suspected case with *Vibrio cholerae* O1 or O139 confirmed by culture or PCR polymerase chain reaction and, in countries where cholera is not present or has been eliminated, the *Vibrio cholerae* O1 or O139 strain is demonstrated to be toxigenic.

### Cholera endemic area, cholera hotspot, cholera outbreak, cholera alert and cholera elimination

#### Cholera-endemic area

An area where confirmed cholera cases, resulting from local transmission, have been detected in the last three years. An area can be defined as any subnational administrative unit including state, district or smaller localities.

*Note: Any country that contains one or more subnational administrative units that are endemic, as defined above, is considered a cholera-endemic country.*

#### Cholera hotspot

A geographically limited area (e.g. city, administrative level two or health district catchment area) where environmental, cultural and/or socioeconomic conditions facilitate the transmission of the disease and where cholera persists or re-appears regularly. Hotspots play a central role in the spread of the disease to other areas.

#### Cholera outbreak

A cholera outbreak is defined by the occurrence of at least one confirmed case of cholera and evidence of local transmission.

Outbreaks can also occur in areas with sustained (year-round) transmission, and are defined as an unexpected increase (in magnitude or timing) of suspected cases over two consecutive weeks of which some are laboratory confirmed. Such increases should be investigated and responded to appropriately through additional outbreak response and control measures.

#### Cholera alert

A cholera alert is defined by the detection of two or more people aged two years and older (linked by time and place) with acute watery diarrhoea and severe dehydration or dying from acute watery diarrhoea from the same areas within one week of one another

OR

(b) One death from severe acute watery diarrhoea in a person at least five years old

OR

(c) One case of acute watery diarrhoea testing positive for cholera by rapid diagnostic test (RDT) in an area (including those at risk for extension from a current outbreak) that has not yet detected a confirmed case of cholera.

#### Cholera elimination

Any country that reports no confirmed cases with evidence of local transmission for at least three consecutive years and has a well-functioning epidemiologic and laboratory surveillance system able to detect and confirm cases.

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## END NOTES

- <sup>1</sup> WHO commissioned a report from McKinsey in late 2016 on the economic case for emergency response, which included estimates on the overall economic burden of cholera. This report is cited herein as *McKinsey Emergencies Economic Case, 2017*.
- <sup>2</sup> *Yemen cholera response*. Daily Epidemiological Update. 4 September 2017.
- <sup>3</sup> Ali M, Nelson AR, Lopez AL & Sack DA. *Updated Global Burden of Cholera in Endemic Countries*. PLoS Negl Trop Dis 2015,9(6).
- <sup>4</sup> WHO/UNICEF *Progress on Drinking Water and Sanitation: 2017 Update and SDG Baseline* World Health Organization and UNICEF: Geneva, Switzerland and New York City, NY, USA, 2017. <http://apps.who.int/iris/bitstream/10665/258617/1/9789241512893-eng.pdf?ua=1>
- <sup>5</sup> *The Sustainable Development Goals*, United Nations, <http://www.un.org/sustainabledevelopment/sustainable-development-goals>
- <sup>6</sup> WHO/UNICEF Joint Monitoring Programme (JMP), *Definitions of Indicators*. [http://www.who.int/water\\_sanitation\\_health/monitoring/jmp04\\_2.pdf](http://www.who.int/water_sanitation_health/monitoring/jmp04_2.pdf)
- <sup>7</sup> *UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2017 report, Financing universal water, sanitation and hygiene under the Sustainable Development Goals*, World Health Organization, UN-Water, 2017.
- <sup>8</sup> *The Global Task Force on Cholera Control*, World Health Organization, [http://www.who.int/cholera/task\\_force/en/](http://www.who.int/cholera/task_force/en/)
- <sup>9</sup> *Oral cholera vaccine stockpile*, World Health Organization, [http://www.who.int/cholera/vaccines/ocv\\_stockpile\\_2013/en/](http://www.who.int/cholera/vaccines/ocv_stockpile_2013/en/)
- <sup>10</sup> Pezzoli L et al. *Deployments from the oral cholera vaccine stockpile, 2013-2017*. The Weekly Epidemiological Record, World Health Organization, WER;2017,92,32:437-452.
- <sup>11</sup> *World City Report 2016, Urbanization and Development: Emerging Futures*, UN Habitat, 2016, <http://wcr.unhabitat.org/wp-content/uploads/2017/02/WCR-2016-Full-Report.pdf>
- <sup>12</sup> WHO/UNICEF *Progress on Drinking Water and Sanitation: 2017 Update and SDG Baseline* World Health Organization and UNICEF: Geneva, Switzerland and New York City, NY, USA, 2017. <http://apps.who.int/iris/bitstream/10665/258617/1/9789241512893-eng.pdf?ua=1>
- <sup>13</sup> Conclusion of the Independent Review of the GTFCC conducted by Cambridge Economic Policy Associates Ltd, July 2017
- <sup>14</sup> *Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all*, Sustainable Development Knowledge Platform, United Nations, <https://sustainabledevelopment.un.org/sdg6>
- <sup>15</sup> *Cholera vaccines: WHO position paper–August 2017*. Weekly epidemiological record, World Health Organization, WER;2017,92,34:477-500.
- <sup>16</sup> *McKinsey Emergencies Economic Case, 2017*.
- <sup>17</sup> Hutton G, Varughese M, *The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation and Hygiene*, World Bank Group, January 2016.
- <sup>18</sup> Bompangue D et al. *Cholera Global Situation and Hotspots Identification in the AFRO Region: Preparation for Guidelines Revision*, WHO and CNRS, 2014.
- <sup>19</sup> *Economics of Sanitation Initiative*, Water and Sanitation Program, <http://www.wsp.org/content/economic-impacts-sanitation#top>
- <sup>20</sup> Hutton G, *Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage*, World Health Organization, 2012. [http://www.who.int/water\\_sanitation\\_health/publications/global\\_costs/en/](http://www.who.int/water_sanitation_health/publications/global_costs/en/)
- <sup>21</sup> Moore SM, Azman AS, Zaitchik BF, et al. *El Niño and the shifting geography of cholera in Africa*. Proc Natl Acad Sci USA 2017;90:201617218. <https://www.ncbi.nlm.nih.gov/pubmed/28396423>
- <sup>22</sup> Fifth meeting of the Initiative against Diarrheal & Enteric diseases in Asia (IDEA), Hanoi 6-9 March 2017.

