



Republic of Rwanda
Ministry of Health



IDENTIFICATION OF PRIORITY AREAS FOR MULTI-SECTORAL INTERVENTIONS (PAMIs) FOR CHOLERA ELIMINATION FOR RWANDA

ANALYSIS REPORT



August 2026

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Executive Summary

In response to the global cholera resurgence in 2023-2024, Rwanda's Ministry of Health (MoH), WHO, Africa CDC, ECSA-HC, and national stakeholders convened a workshop to assess and validate priority areas for multi-sectoral interventions (PAMIs) for cholera elimination that was conducted from 21st to 24th July 2025 in Kigali city, Rwanda. Following systematic collection and analysis of secondary data on recent cholera cases and vulnerability factors by a core team including the Ministry of Health (MoH and districts' health Units staff, WHO, local stakeholders from WASAC (Water and Sanitation Corporation), district authorities, and the Rwanda Biomedical Centre, participated in validation exercises. Several districts and sectors were identified as PAMIs based on vulnerability indices, including water access, sanitation coverage, population density, and cross-border movements. Moderate to low-risk areas will continue to undergo surveillance monitoring. The next phase focuses on developing a comprehensive National Cholera Elimination Plan (2026-2030) aligned with Rwanda's Vision 2050 and health sector priorities.

Abbreviations

CED	Centre for Enteric Disease
CFR	Case Fatality Rate
DHS	Demographic Health Survey
GDP	Gross Domestic Product
GTFCC	Global Task Force on Cholera Control
IDSR	Integrated Disease Surveillance and Response
IMT	Incident Management Team
NCP	National Cholera Plan
NdoH	National Department of Health
NHLS	National Health Laboratory Service
NICD	National Institute for Communicable Diseases
NMC	Notifiable Medical Condition
NMCSS	Notifiable Medical Condition Surveillance System
NRL	National Reference Laboratory
OCV	Oral Cholera Vaccine
PAMIs	Priority Areas for Multi-sectoral Interventions
PCR	Polymerase Chain Reaction (PCR)
RTC	Right to Care
VRAM	Vulnerability Risk Assessment and Mapping
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Foreword:

The ongoing challenge of cholera in the African Region calls for a unified, multi-sectoral approach through the WHO and GTFCC's "Ending Cholera – a Global Roadmap to 2030", which aims to reduce cholera deaths by 90% and stop transmission in up to 20 countries by 2030.

Rwanda, having experienced periodic cholera outbreaks often linked to cross-border transmission from neighbouring countries, faces unique challenges due to its mountainous terrain, high population density, and position in the Great Lakes region. Following recent regional cholera resurgence in 2023-2024, Rwanda directed development of a comprehensive National Cholera Elimination Plan, with the first step being identification of Priority Areas for Multi-sectoral Interventions (PAMIs) to effectively target elimination efforts and optimize resource allocation.

This report from the stakeholder validation workshop identifies key cholera priority areas for targeted interventions, emphasizing multi-sectoral collaboration among government agencies, development partners, and communities to leverage Rwanda's strong health system and coordination mechanisms in preventing future outbreaks within the country's unique geographic and demographic context.



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General information on Rwanda

The Republic of Rwanda is located in Central Africa, just south of the equator, between latitudes 1°4' and 2°51' south and longitudes 28°63' and 30°54' east. It borders Burundi to the north, Tanzania to the east, the Democratic Republic of the Congo to the west, and Uganda to the south. The distance between the Indian Ocean and the Atlantic Ocean for Rwanda, a landlocked country, is about 1,200 kilometres and 2,000 kilometres, respectively.



Figure 1. Administrative map of Rwanda

The population of Rwanda is 13,246,394 people as of the August 2022 Rwanda Population and Housing Census, with a roughly equal gender ratio of 48.5% males and 51.5% females. In comparison to the 4,831,527 inhabitants in 1978, this represents a significant demographic shift, demonstrating substantial growth over time. Notably, the population increased by 2.7 million between 2002 and 2012, representing a growth rate of 2.3%. After the turbulent 1990s, which were characterized by war's devastation and the tragic Tutsi Genocide in 1994, which resulted in a 1.2% growth rate from 1991 to 2022, Rwanda now has an annual growth rate of 2.3%, resuming its historical growth trajectory. (NISR, 2022).

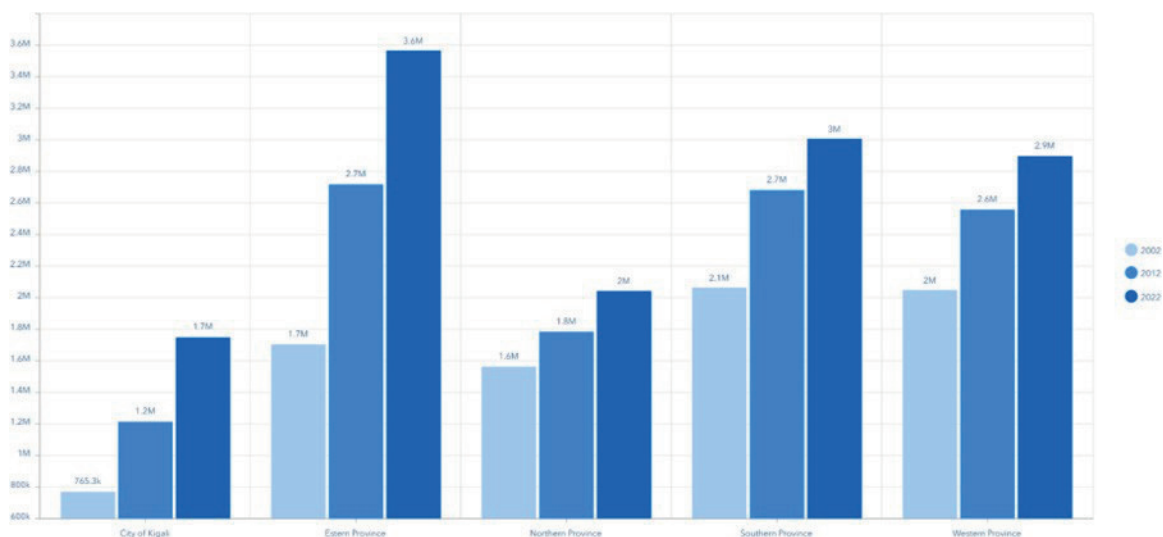


Figure 2: Annual growth rate of Rwanda for 2002, 2012, and 2022 (NISR, 2022).

This population is not evenly distributed among the provinces of Rwanda. With 26.9 % people, the Eastern Province leads the way as the most populous province. The Western Province is home to 21.9 % of people, whereas the Southern Province is home to 22.7% of people, and 15.4% of people reside in the Northern Province. In contrast, the City of Kigali, which is home to 1,745,555 people, has the smallest but nevertheless significant population. This diversified demographic landscape provides important information about the social and geographic makeup of Rwanda.

Over the past two decades, Rwanda has faced a wide range of hazards, including outbreaks of diseases such as cholera, measles, rubella, epidemic typhus, meningococcal meningitis, seasonal influenza, food poisoning, Rift Valley Fever, and COVID-19, as well as natural and technological disasters such as volcanic activity, earthquakes, landslides, chemical incidents, and floods.

A national all-hazards risk assessment was conducted in January 2023 using the WHO Strategic Tool for Assessing Risks (STAR), during which 26 hazards were evaluated. Cholera ranked third among the assessed hazards, with a very high-risk level. These findings informed a hotspot mapping exercise conducted in September 2024, which identified five high-risk districts in the Western Province; unfortunately, all located along the border with the Democratic Republic of Congo (DRC).

After a decade of being cholera-free, Rwanda reported sporadic imported cholera cases linked to an influx of refugees fleeing civil unrest in the DRC. An imported case refers to a situation where a country that is largely free of cholera suddenly reports cases due to cross-border transmission, often caused by population movement from a neighbouring country experiencing active cholera outbreaks.

Furthermore, results from the cholera hotspot mapping indicated that less than 5%

of high-risk geographic areas had experienced outbreaks in the previous five years, providing valuable insight for developing the national cholera elimination plan. The first step in this process was drafting the national multi-sectoral cholera elimination plan (NCP). This draft plan is currently being finalized during the same workshop convened to validate the Provincial All Hazards Multi-Sectoral Implementation (PAMI) plans, held in Kigali from July 21–24, 2025. This marks Rwanda's first PAMI process, which brings together multidisciplinary and multisectoral stakeholders to build consensus on coordinated actions toward cholera elimination.

Epidemiology of Cholera in Rwanda

Cholera is an acute diarrheal illness resulting from gastrointestinal infection by the toxin-producing bacterium *Vibrio cholerae* serogroups O1 or O139. The World Health Organization defines a cholera outbreak or epidemic as the occurrence of at least one laboratory-confirmed case with evidence of local transmission in an area where cholera is not endemic. The disease spreads primarily through inadequate access to safe water and poor sanitation infrastructure.

According to World Health Organization. (2023) on *Cholera – Key facts*, an estimated 1.3 to 4 million people around the world get cholera each year, and 21,000 to 143,000 people die from it. People who get cholera often have mild symptoms or no symptoms, but cholera can manifest as a severe disease. Approximately 1 in 10 people who get sick with cholera will develop severe symptoms such as watery diarrhea, vomiting, and leg cramps. In these people, rapid loss of body fluids leads to dehydration and shock. Without treatment, death can occur within hours. The increase in natural disasters like floods and droughts increases the possibility of the occurrence of cholera outbreaks. Preventive measures include improving water, sanitation, and hygiene (WASH) conditions, and the targeted use of oral cholera vaccine (OCV) anchored on strong and robust risk communication and community engagement.

Rwanda recorded its first cases of cholera in 1996 following the return of refugees from camps in the Democratic Republic of Congo (DRC), where an established surveillance model revealed 48 positive cases for *Vibrio cholerae* O1 (Brown et al., 1997). According to the investigation reports of 2015 to 2020, 1256 suspect cases were recorded at health facilities, most of cases were recorded in the districts bordering the Lake Kivu, especially Rubavu, Rusizi and Nyamasheke. 27 deaths due to cholera were reported from the 3 most affected districts from 2015 to 2020^{[11](#)}.

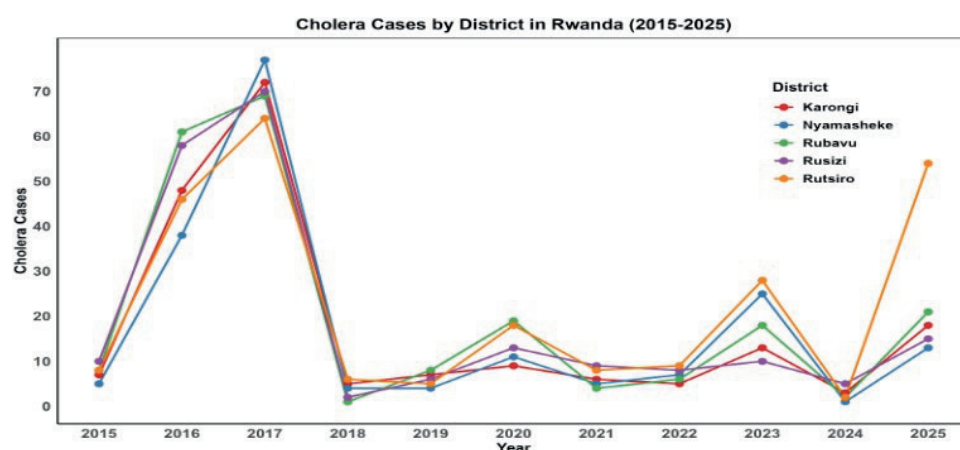


Figure 3: Cholera incidence in Rwanda during 2015-2025.

The graph reveals a significant cholera outbreak across five Rwandan districts that peaked dramatically in 2017, with Nyamasheke recording the highest cases at approximately 77. Following this major outbreak, case numbers dropped substantially and remained relatively low (generally under 20 cases) from 2018-2022, suggesting successful intervention measures. However, a concerning resurgence pattern has emerged since 2023, with cases spiking again in 2025, particularly in Rutsiro district (approximately 54 cases). Rutsiro consistently shows the highest vulnerability across multiple outbreak years (2017, 2023, and 2025), indicating it may require targeted public health interventions. The cyclical pattern suggests cholera remains endemic in these regions, necessitating continued surveillance and outbreak preparedness despite periods of effective control.

In Rwanda, diarrheal diseases rank among the top ten causes of morbidity and mortality and are the third leading cause of death among children under five years of age. Post-outbreak investigations have identified two main modes of cholera transmission in the country. The primary mode involves exposure to environmental reservoirs of *Vibrio cholerae* or consumption of contaminated food and water sources. The secondary mode involves transmission from individuals previously infected with cholera, who can trigger new outbreaks. Evidence suggests that the first mode of transmission is likely the predominant one in Rwanda, indicating that cholera may be endemic in the Lake Kivu basin. *V. cholerae* can persist in aquatic environments for extended periods—possibly indefinitely—and subsequently infect humans. In many cases, contamination occurs when cholera patients defecate in the open environment, allowing fecal matter to contaminate water sources used by communities.

Cross-border transmission is also another significant risk factor in Rwanda due to shared water bodies and high population mobility with neighbouring countries in the Great Lakes region. Border districts are particularly vulnerable to imported cases from endemic areas, necessitating regional collaboration, coordinated surveillance, and harmonized response strategies to interrupt transmission chains and prevent recurring outbreaks.

In Rwanda, between 2000 and 2017, the percentage of households using improved drinking water sources increased from 64.1 to 87.4% (Government of Rwanda & UNICEF 2014; NISR, 2018). Households with access to improved sanitation services increased from 51.5 to 86.2% (Government of Rwanda & UNICEF 2014; NISR, 2018). Those with improved sanitation used pit latrines with solid slabs (84.3%) and flush toilets (1.9%), whereas those with unimproved sanitation used pit latrines without slabs (9.8%), or other/no facilities (4.0%); NISR, 2018).

Cholera surveillance

In Rwanda, cholera is classified as a Category One notifiable disease under the International Health Regulations (IHR-2005). The National Health Act mandates that any suspected case be reported within 24 hours through the electronic surveillance system. This notification process is coordinated under the Integrated Disease Surveillance and Response (IDSR) system. All public and private health facilities, as well as public laboratories, are required to directly report *Vibrio cholerae*-positive specimens to the Rwanda Biomedical Centre (RBC).

Case detection

Cholera surveillance integrates health facility-based surveillance and community-based surveillance (CBS) to detect suspected cholera cases, as well as event-based surveillance (EBS) to detect cholera signals:

- **Health Facility Surveillance**

Trained health workers at designated health facilities identify suspected cholera cases using standardized case definitions. They assess clinical symptoms such as the onset of acute watery diarrhea and dehydration and initiate further laboratory investigation and management as required.

- **Community Event-Based Surveillance (eCEBS)**

Community Health Workers (CHWs) report alerts of suspected cholera cases through the electronic community-based reporting system (Impuruza). Upon receipt of an alert, the Community Environmental Health Officer (CEHO) verifies the alert. If the alert is confirmed, the CEHO facilitates referral of the individual to the nearest health facility for laboratory confirmation

Suspected case

- In areas where a cholera outbreak has *not been declared*, a suspected cholera case is a person aged two years or older with acute watery diarrhoea and severe dehydration, or who died from acute watery diarrhoea with no other known cause of death
- In the presence of a probable or confirmed cholera outbreak, a suspected cholera case is any person with acute watery diarrhea or who died from

Probable case

A suspected case without laboratory culture confirmation but has an epidemiologic link to a confirmed cholera case.

Confirmed case:

- In the absence of a probable or confirmed cholera outbreak:

A confirmed cholera case is any person: infected with *Vibrio cholerae* O1 or O139, as confirmed by culture (including Sero agglutination) or PCR.

*The bacterial strain should also be demonstrated as toxigenic (by PCR) if there is no confirmed cholera outbreak in other surveillance unit(s), and no established epidemiological link to a confirmed cholera case or source of exposure in another country.

- In the presence of a probable or confirmed cholera outbreak:

A confirmed cholera case is any person: infected with *Vibrio cholerae* O1 or O139, as confirmed by culture (including Sero agglutination) or PCR.

Case registration/ reporting

All suspected cases who presented to the health facility and on consultation, the IDSR immediate case-based reporting form is filled and data is recorded in the e-IDSR system by the health facility data manager.

Case confirmation

The fresh stool samples are collected from suspect cases, and primarily screened using Cholera Rapid Test kits, and subsequently confirmed through culture.

Data analysis and feedback

At the health Centre data is initially captured electronically, using eIDSR. The eIDSR access is compartmentalized for different administrative levels and the data managers at all levels can analyse the data and share the report on a daily basis. The RBC under the Public health disease surveillance and response division provides daily situational reports. Public-facing dashboards may be made available in the context of an outbreak through the Ministry of Health.

Response

Districts and the national level activate the incident management system upon the confirmation of an outbreak. The response is coordinated by the IMT with various pillars to ensure all aspects of the response are addressed. The rapid response team is responsible for field investigations and implementation of the response activities and provides feedback to the Incident Management Team (IMT) for decision-making.

Cholera Testing Algorithm

In Rwanda, the diagnosis of cholera relies on the rapid detection and laboratory confirmation of *Vibrio cholerae* using a combination of three key diagnostic approaches: Cholera Antigen Rapid Diagnostic Tests (RDTs), stool culture, and Whole Genome Sequencing of *Vibrio cholerae* done at Rwanda National Laboratory.

Stool samples collected from suspected cases are primarily screened using Cholera RDTs. The RDT-positive samples are then triaged for bacterial culture to confirm the presence or absence of *Vibrio cholerae*. Once confirmed, the sample(s) are also subjected to antimicrobial susceptibility testing to guide microbial treatment. Once a confirmatory test is confirmed by culture, the subsequent cases do not require culture for diagnosis. Periodic testing is carried out throughout the outbreak to monitor ongoing transmission, track trends, and guide case management. These follow-up tests provide critical information for assessing the effectiveness of interventions and determining when it is appropriate to declare the outbreak closed, ensuring that public health responses remain targeted and evidence-based. If a facility does not conduct bacterial culture, samples are referred to the nearest facility capable of performing culture, using Cary Blair Transport Media for safe and effective sample transportation.

Currently, the national reference laboratory has established designated health facilities in high-risk districts with laboratory capacity to perform culture for improved diagnostic efficiency, suspected cholera cases with established epidemiological links to index cases are systematically screened using Cholera RDTs. Rwanda plans to implement PCR testing for cholera surveillance due to its rapid and accurate detection capabilities. PCR also enables the identification of toxigenic *Vibrio cholerae* strains, and early detection of the bacteria in environmental samples. Once bacterial culture and Antimicrobial Susceptibility Testing (AST) are completed, the results are promptly uploaded into the Laboratory Information System (LIS), making them readily accessible to the requesting facilities for appropriate and timely clinical decision-making.

Finally, *Vibrio cholerae* isolates are preserved in skimmed milk medium and transported to the National Reference Laboratory (NRL) for further molecular testing and biobanking.

Rationale

Rwanda has demonstrated a strong commitment to eliminating cholera, aligning its national efforts with the World Health Organization (WHO) and the Global Task Force on Cholera Control (GTFCC) goal of “Ending Cholera – a Global Roadmap to 2030.” This initiative aims to combat and reduce cholera transmission worldwide, with specific targets to decrease cholera-related deaths by 90% and halt transmission in



20 countries by 2030. Rwanda aligns its national targets with these goals, providing a clear benchmark and supporting the identification of PAMIs to guide targeted interventions. By actively participating in this global effort, Rwanda seeks to reinforce its public health infrastructure and response capabilities.

Additionally, Rwanda shares borders with several neighbouring countries that report high incidences of cholera outbreaks, creating a heightened risk of cross-border transmission. The ongoing civil conflict in the Democratic Republic of the Congo (DRC) has led to significant refugee influxes into Rwanda, introducing additional vulnerabilities and increasing the potential for cholera outbreaks. This refugee movement exacerbates the public health challenge, necessitating urgent and strategic interventions to mitigate the risk of cholera spread. Moreover, the impact of climate change, particularly through flooding and other natural disasters, has been identified as a contributing factor to cholera outbreaks. Rwanda's tropical climate and hilly landscape, which stretches from east to west, disrupt sanitation and water supply systems, leading to increased transmission risks.

Hence, the need to conduct PAMIs is essential to gain visibility into the geographical areas most vulnerable to cholera outbreaks, enabling targeted and multi-sectoral interventions. The PAMIs will also facilitate a comprehensive assessment towards identifying gaps in infrastructure, enhancing surveillance systems, and promoting community engagement in cholera prevention efforts. By focusing on these areas, Rwanda can improve its preparedness and response to cholera, ultimately contributing to the global aim of cholera elimination by 2030.

CHAPTER TWO : METHODS

This chapter highlights detailed steps that were taken to identify Cholera priority areas for multi-sectoral interventions. Here, we detailed the steps, including preparation of datasets, assessment of vulnerability factors, calculation and scoring vulnerability indicators, calculation of vulnerability index, and stakeholder validation.

2.1. Supporting information

2.1.1 Administrative level of NCP operational geographic units

The administrative sector level 4 was selected as the operational geographic unit for implementing the National Cholera Plan (NCP) and identifying PAMIs for cholera elimination. This level falls directly under the district administration. Each sector has at least one health center capable of performing rapid diagnostic tests (RDTs) and conducting field investigations. Focusing on the sector level allows for identifying the lowest administrative unit for targeted interventions within specific districts.

List of NCP operational geographic units

The list of geographic units and the unique identifiers were obtained from the National Institute of Statistics Rwanda (NISR). A total of 416 NCP operational geographic units (Sector) from all 30 districts of the five provinces listed in the data obtained from NISR.

Population data by NCP operational geographic units

Yearly estimated population figures for NCP operational geographic units were sourced from the 2022 Rwanda Population and Housing Census reports published by the National Institute of Statistics, which recorded a total population of 13,246,394.

2.1.2 Duration of analysis period

The vulnerability index was calculated using retrospective data collected over the past 7 years, spanning January 2019 to December 2025. The GTFCC recommends that the analysis period should involve retrospective data of at least five years.

2.1.3 Description of vulnerability factors considered in the analysis

List of vulnerability factors

We used the following GTFCC indicative list of generic vulnerability factors (there were no additional country-specific vulnerability factors identified):

- Confirmed cholera imported case(s) in the NCP operational geographic unit
- Cross-border areas adjacent to frequently cholera-affected areas or identified PAMIs in neighboring countries

- Location along major travel routes with transportation hubs
- Major population gatherings
- High population density locations or overcrowded settings
- High-risk populations
- Hard-to-access populations
- The population that received the oral cholera vaccine (OCV) more than three years ago
- High risk of extreme climate and weather conditions
- Unimproved water
- Unimproved sanitation, and
- Limited access to hygiene.
- Complex Humanitarian Emergency (Refugee camps)

2.2 Vulnerability index

2.2.1 Data documentation table reporting the definition of each measurable indicator, with a concise description of the corresponding data sources.

Measurable Indicator	Definition of indicator	Data source
Cholera outbreak	The occurrence of at least one confirmed case of <i>Vibrio cholerae</i> (O1 or O139) with evidence of Local transmission. In endemic areas, it is defined as unexpected significant increase in suspected cases over two consecutive weeks, with some laboratory confirmation.	IDSR, NRL, District Health Unit data
Confirmed cholera imported case(s)	Laboratory-confirmed cholera cases that originated from transmission outside the country's borders, typically identified through epidemiological investigation linking the case to travel or contact with cases from cholera-affected neighboring countries.	NRL, District Health Unit data

Cross-border areas adjacent to frequently cholera-affected areas or identified PAMIs in neighboring countries	Geographic regions within national boundaries that share borders with areas in neighboring countries that experience regular cholera transmission or have been designated as Priority Areas for Multi-sectoral Interventions.	NISR
Location along major travel routes with transportation hubs	Areas situated on primary transportation corridors including international highways, railway stations, airports, bus terminals, and border crossings that facilitate high volumes of human movement and potential disease transmission.	RFTDA
Major population gatherings	Events or locations that bring together large numbers of people, including religious gatherings, markets, festivals, refugee camps, internally displaced person settlements, and other mass congregation sites.	Local authorities
High population density locations or overcrowded settings	Areas with concentrated populations exceeding normal capacity, including urban slums, informal settlements, overcrowded housing, and densely populated neighborhoods with limited infrastructure	NISR (Rwanda National Institute of Statistics)
High-risk populations	Groups with increased vulnerability to cholera infection including children under 5 years, pregnant women, elderly individuals, immunocompromised people, malnourished individuals, and populations with limited access to healthcare.	Local authorities

The population that received the oral cholera vaccine (OCV) more than three years ago	Communities previously vaccinated with oral cholera vaccine where immunity may have waned, as OCV protection typically lasts 2-3 years, requiring re-vaccination for continued protection	RBC/Immunization
High risk of extreme climate and weather conditions	Areas prone to natural disasters and extreme weather events including floods, droughts, cyclones, and seasonal variations that can compromise water and sanitation infrastructure and increase cholera transmission risk.	METEO Rwanda
Complex humanitarian emergency	Situations involving armed conflict, displacement, breakdown of governance, and disruption of basic services that create conditions conducive to disease outbreaks and limit effective public health response.	MINEMA, MoH, District Health data
Unimproved water	Water sources that do not protect against contamination, including unprotected wells, springs, surface water bodies, and water delivered by tanker trucks or carts without proper treatment and storage.	WASAC, DHS
Unimproved sanitation	Sanitation facilities that do not hygienically separate human excreta from human contact, including pit latrines without slabs, hanging latrines, bucket latrines, and open defecation areas	WASAC, DHS, District Health Unit data

Limited access to hygiene	Insufficient availability of handwashing facilities, soap, or water for personal hygiene practices, or lack of knowledge and resources to maintain proper hygiene behaviors essential for cholera prevention.	DHS, District Health Unit data
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Method for assessing vulnerability factors

Data for vulnerability assessment was collected before the validation workshop from all 416 sectors. During the validation workshop, participants reviewed, verified and validated the data collected to support the identification of Priority Areas for Multisectoral Interventions (PAMIs). Stakeholders from across the country were organized into three groups, each responsible for reviewing and verifying data collected from all the sectors within each of the 30 districts nationwide. Group composition was based on participants' familiarity, experience, and professional engagement in specific provinces, ensuring that members from the same province worked together.

Within each group, data on vulnerability factors collected from multiple sources, including the IDSR, NRL, DHS 2023, hygiene and sanitation reports from district health units, and additional references such as district reports and online platforms (e.g., Google Maps) to identify geographical features were reviewed and verified. Each group appointed a team leader and a secretary to guide the discussion and document findings.

The assessment process involved reviewing each NCP operational geographic unit sequentially within the assigned districts. A standardized list of vulnerability factors and clear definitions for each indicator were provided and discussed in plenary sessions to ensure consistent understanding across all groups. Teams then conducted the assessment by reviewing the presence or absence of each vulnerability factor, assigning a score of "Yes" or "No" accordingly. This structured, participatory approach ensured a comprehensive, province-informed, and standardized data collection process.

2.2.2 Assessment of quality of the data

All datasets were cleaned to ensure timeliness, completeness, consistency across formats, removal of duplicates, correction of anomalies, and alignment of indicators across sources. A multi-stakeholder validation process was conducted, where technical representatives from each concerned institution in the three small groups constituted above, with each group being assigned a task to check

and verify data consistency, by reviewing the datasets, resolving discrepancies, and reaching consensus on the final dataset for analysis. All decisions were transparently documented to uphold analytical integrity. This process ensured that the final dataset was accurate, harmonized, and fit for the construction of a robust Vulnerability Index.

2.2.3 Management of missing data

Initial validation checks help identify gaps and inconsistencies. There was no missing information from the data collected. We ensured accuracy and consistency through counter-checking with the district officers via phone and/or review of available documents. Sensitivity analyses were performed to evaluate the impact of imputation outcomes (final vulnerability scores). Collaboration with data custodians, including RBC, WASAC, District health units, and Rwanda METEO, helped validate assumptions and preserve the integrity of the analysis.

2.2.4 Scoring of measurable vulnerability indicators

Each vulnerability indicator was assessed for its presence or absence within a given geographic unit and assigned a binary score as follows:

- **1 = Yes** (indicator present, increased vulnerability)
- **0 = No** (indicator absent, no vulnerability)

No differential weighting was applied across indicators; all were treated equally in the analysis.

2.2.5 Calculation of the vulnerability index

For each geographic unit:

Scores for all indicators were summed to produce a total vulnerability score.

Prioritization for PAMIs

- Based on total vulnerability scores and cholera epidemiological data:
- **Initial PAMIs:** Sectors with reported cholera outbreaks in the period under review
- **Additional PAMIs:** Sectors with high vulnerability index value $\geq$ *vulnerability index threshold*
- **Moderate-Risk Areas:** Sectors with moderate vulnerability factors $<$ the vulnerability index threshold, but still has vulnerability factors that need attention
- **Minimal Risk areas:** Sectors with minimal vulnerabilities and no recent cholera cases.

Sources of data for the calculation of the vulnerability index

In September 2024, data spanning the past seven years (January 2019 to December 2025) were collected from multiple sources, including digital disease surveillance systems (IDSR), NRL for Cholera disease outbreak, Meteo Rwanda for climate and weather conditions, Demographic and Health Surveys (DHS), and hygiene and sanitation records from health units across all 30 districts of Rwanda. The core data team consisted of key actors from the Ministry of Health (MoH), specifically the Rwanda Biomedical Centre staff engaged in cholera response, surveillance teams at district hospitals, and district-level health promotion officers. This team was responsible for collecting and preparing the data used to calculate the vulnerability index.

2.3 Stakeholder validation

A four-day stakeholder validation workshop was held to review vulnerability factors and gather stakeholder feedback and input. The in-person workshop took place in Kigali, Rwanda, from July 21st to 24th, 2025. It was facilitated by staff from the Rwanda Biomedical Centre, with technical support from the World Health Organization (Rwanda country office and regional office),

Africa CDC, and ECSA-HC. The workshop began with facilitators presenting the results from the PAMIs identification exercise. This was followed by breakout sessions in which stakeholders were divided into three groups to review the Background, Methodology, and Results. Each group presented their findings and received feedback from other groups and facilitators. This process allowed consensus and unit of purpose in the PAMI identification process. Stakeholders expressed their expert opinion and country context which enriched the process extensively.

Where stakeholders expressed concerns, such as when a geographical unit believed to be a Cholera PAMI had a priority score below the threshold, they were allowed to propose a re-assessment of the vulnerability factors and potential inclusion of the area on the PAMIs list. Table 1 presents the list of stakeholders who participated in the validation process.

Table1. Stakeholders participated in the data validation workshop.

Stakeholders	Location
MoH	National
Rwanda Biomedical Centre	National
WHO- Regional office	Regional
WHO - Country office	Rwanda
Africa CDC	Rwanda

IDSR Focal Person (Mibilizi DH, Gihundwe DH, Kibogora DH, Kibuye RH, Mugonero DH, Gisenyi DH, Murunda DH)	Districts (Rusizi, Nyamasheke, Rutsiro, Karongi, Rubavu)
WASAC	National
ECSA-HC	Regional
Water for People	Rwanda
University of Rwanda	National
Referral Hospitals	National

CHAPTER THREE : RESULTS

The PAMIs identification exercises are presented according to the following sequence of sub-sections: Vulnerability index and Stakeholder validation.

Vulnerability index

Data overview

Table 2 shows an overview of data that was used for calculating the vulnerability index for the NCP geographical units for the identification of priority areas for multi-sectoral interventions (PAMIs). A total of 416 geographical units at the level of the sectors, representing 100% of all geographical units in Rwanda, were included in the analysis. The period of analysis covered seven years from January 2019 to December 2025.

Table 2: An overview of data used for calculating the priority index for PAMIs identification in Rwanda.

Vulnerability factors	Num. of observations				Relative percentage			
	Missing values	"No"	"Yes"	Total	Missing values	"No"	"Yes"	Total
Confirmed cholera outbreak(s) over the analysis period	0	402	14	416	0.0%	96.6%	3.4%	100.0%
Confirmed cholera imported case(s) in the NCP operational geographic unit considered	0	410	6	416	0.0%	98.6%	1.4%	100.0%
Cross-border areas adjacent to frequently cholera-affected areas or identified PAMIs in neighbouring country(ies)	0	372	44	416	0.0%	89.4%	10.6%	100.0%
Location along major travel routes with transportation hubs	0	359	57	416	0.0%	86.3%	13.7%	100.0%
Major population gatherings	0	370	46	416	0.0%	88.9%	11.1%	100.0%
High population density locations or overcrowded settings	0	367	49	416	0.0%	88.2%	11.8%	100.0%
High-risk populations	0	368	47	415	0.0%	88.7%	11.3%	100.0%
Hard-to-access populations	0	376	40	416	0.0%	90.4%	9.6%	100.0%
Population that received oral cholera vaccine (OCV) more than three years ago	0	416	0	416	0.0%	100.0%	0.0%	100.0%
High-risk for extreme climate and weather conditions	0	316	100	416	0.0%	76.0%	24.0%	100.0%
Complex humanitarian emergency	0	416	0	416	0.0%	100.0%	0.0%	100.0%
Unimproved water	0	380	36	416	0.0%	91.3%	8.7%	100.0%
Unimproved sanitation	0	404	12	416	0.0%	97.1%	2.9%	100.0%
Limited access to hygiene	0	380	36	416	0.0%	91.3%	8.7%	100.0%

Table 3 and Figure 4 show an overview of data that was used to support the

identification of areas where cholera outbreaks or confirmed cholera importation have occurred at the NCP geographical units for identification of priority areas for multi-sectoral interventions (PAMIs). Of the total geographical units, 14 (3.4%) units had recorded at least a cholera outbreak during the analysis period.

Table 3. Number of laboratory-confirmed cases by sector, District, and year, Rwanda, 2019 – 2025.

District	Sector	2019	2020	2021	2022	2023	2025
Rusizi	Nkanka	2	1				
	Gihundwe		1				
	Mururu				1		
	Bugarama	1	1		2		
	Nkombo	2	3		2	2	
Rubavu	Nyamyumba		3	3		5	
	Kanama					2	
	Gisenyi					4	
Nyamasheke	Kanjongo					3	
	Kirimbi					2	
	Mahembe					4	
	Gihombo					2	
Karongi	Bwishyura					1	
Rutsiro	Boneza						54
Total		5	9	3	5	25	54

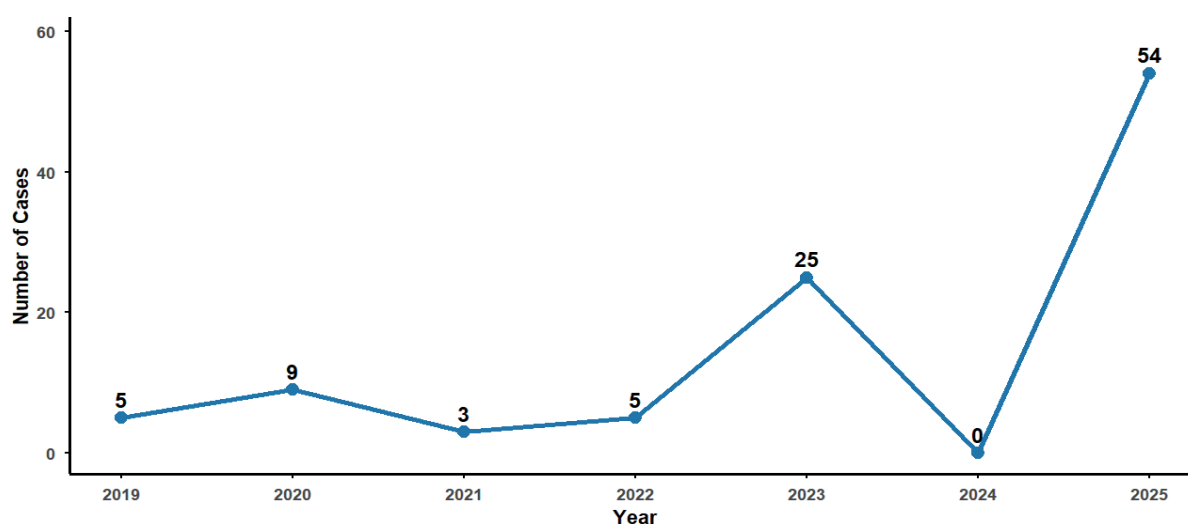


Figure 3: Annual trend of laboratory-confirmed cholera cases reported from January 2019 to December 2025

Vulnerability index threshold and justification for the threshold selected.

Rwanda considered the factors related to the feasibility of implementation of the interventions (human, technical, and financial resources) and the public health impact of those interventions

in selecting the vulnerability index threshold. After thorough discussions, reflections, and wide

engagements and consultations among all the stakeholders, the team agreed to set a realistic target. **A vulnerability index threshold of six (6)** was unanimously selected (Table 4).

Table 4: Vulnerability index threshold.

Vulnerability index values	Number of geographic units	Cum. number of geographic units	Rel. % of the num. of geographic units	Cum. % of the num. of geographic units	Total population	Rel. % of total population	Cum. % of total population
Initial PAMI	14	14	3.4%	3.4%	476,409	3.6%	3.6%
9	2	16	0.5%	3.8%	72,493	0.5%	4.1%
8	1	17	0.2%	4.1%	36,530	0.3%	4.4%
6	5	22	1.2%	5.3%	139,446	1.1%	5.5%
5	8	30	1.9%	7.2%	312,763	2.4%	7.8%
4	13	43	3.1%	10.3%	379,416	2.9%	10.7%
3	24	67	5.8%	16.1%	690,459	5.2%	15.9%
2	49	116	11.8%	27.9%	1,612,740	12.2%	28.1%
1	94	210	22.6%	50.5%	2,966,956	22.4%	50.5%
0	206	416	49.5%	100.0%	6,559,182	49.5%	100.0%
Grand Total	416		100.0%		13,246,394	100.00%	

Number and percentage of NCP operational geographic units selected as PAMIs

At the vulnerability index threshold of 6, a cumulative 22 sectors (NCP geographic units) were selected as the final list of PAMIs with 14 as initial PAMIs and 8 as additional PAMIs. The combined population across the 22 PAMI operational areas stands at 724,387, accounting for approximately 5.4% of Rwanda's total national population. (Table 4)

The OCV vulnerability factor, defined as the proportion of the population that received Oral Cholera Vaccine more than three years ago, was assessed across all 416 sectors in Rwanda. All sectors scored 0 for this factor, as Oral Cholera Vaccine has never been used or administered in Rwanda. Therefore, there is no population with prior OCV coverage, resulting in a uniform score of 0 across all sectors.

The complex humanitarian emergency vulnerability factor was assessed across all 416 sectors in Rwanda. All sectors scored 0 for this factor, reflecting the current stable humanitarian situation in the country. Rwanda is not experiencing any complex humanitarian emergency, including conflict, population displacement, or disruption

of essential services, that would elevate cholera transmission risk at the sector level. This factor was therefore found to be absent across all sectors, resulting in a uniform score of 0. This assessment is consistent with the prevailing peace and security conditions in Rwanda and the absence of any declared humanitarian crisis within the country at the time of the PAMI identification.

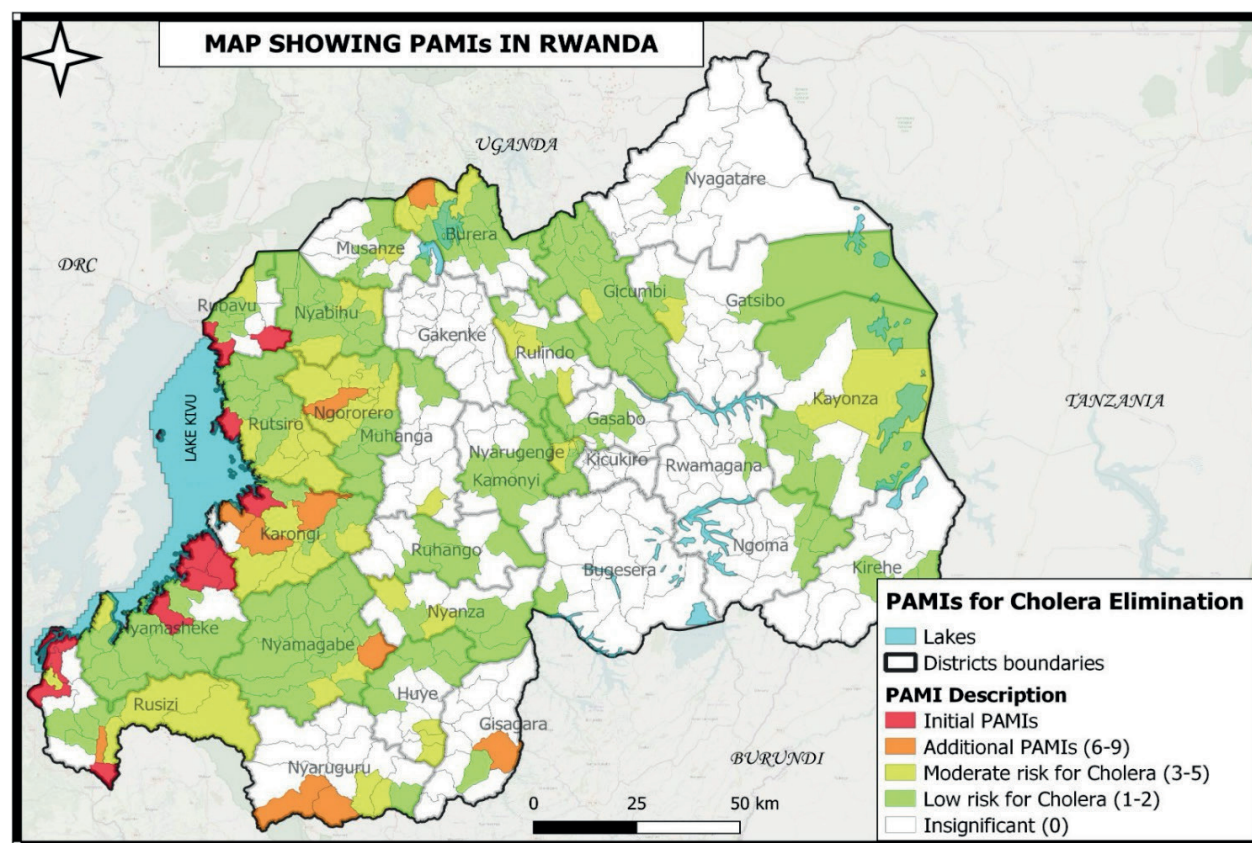


Figure 4: Map showing PAMIs in Rwanda

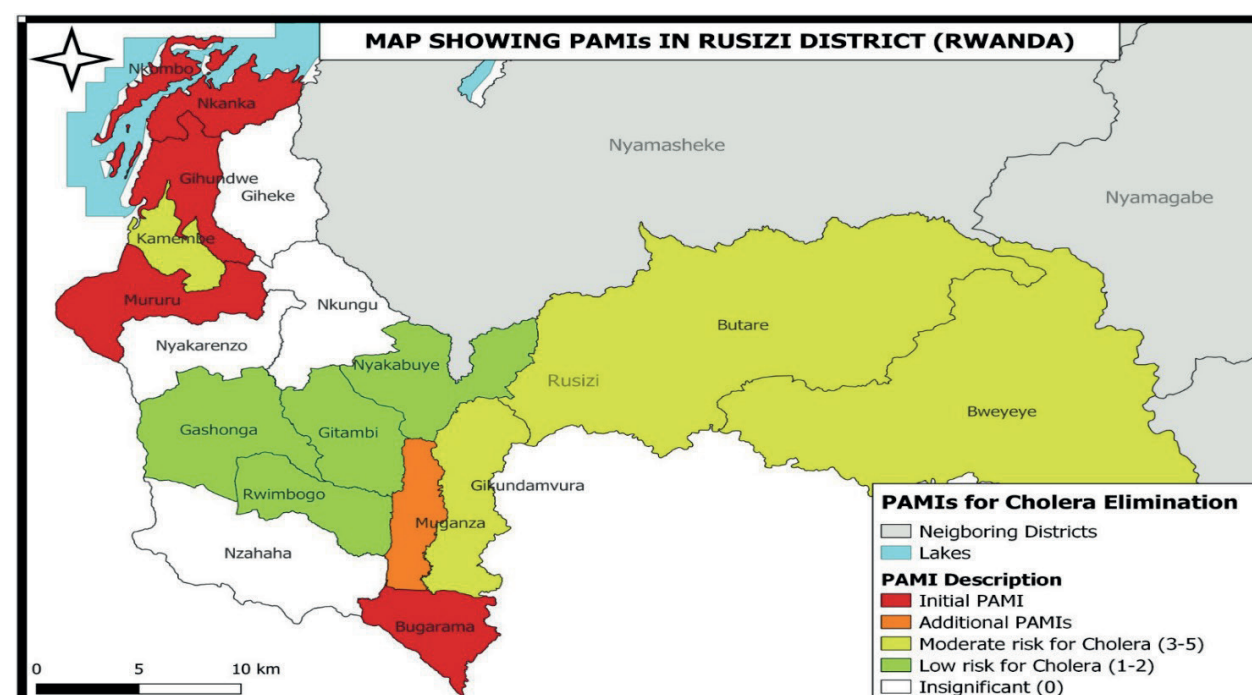


Figure 5: PAMIs in Rusizi district

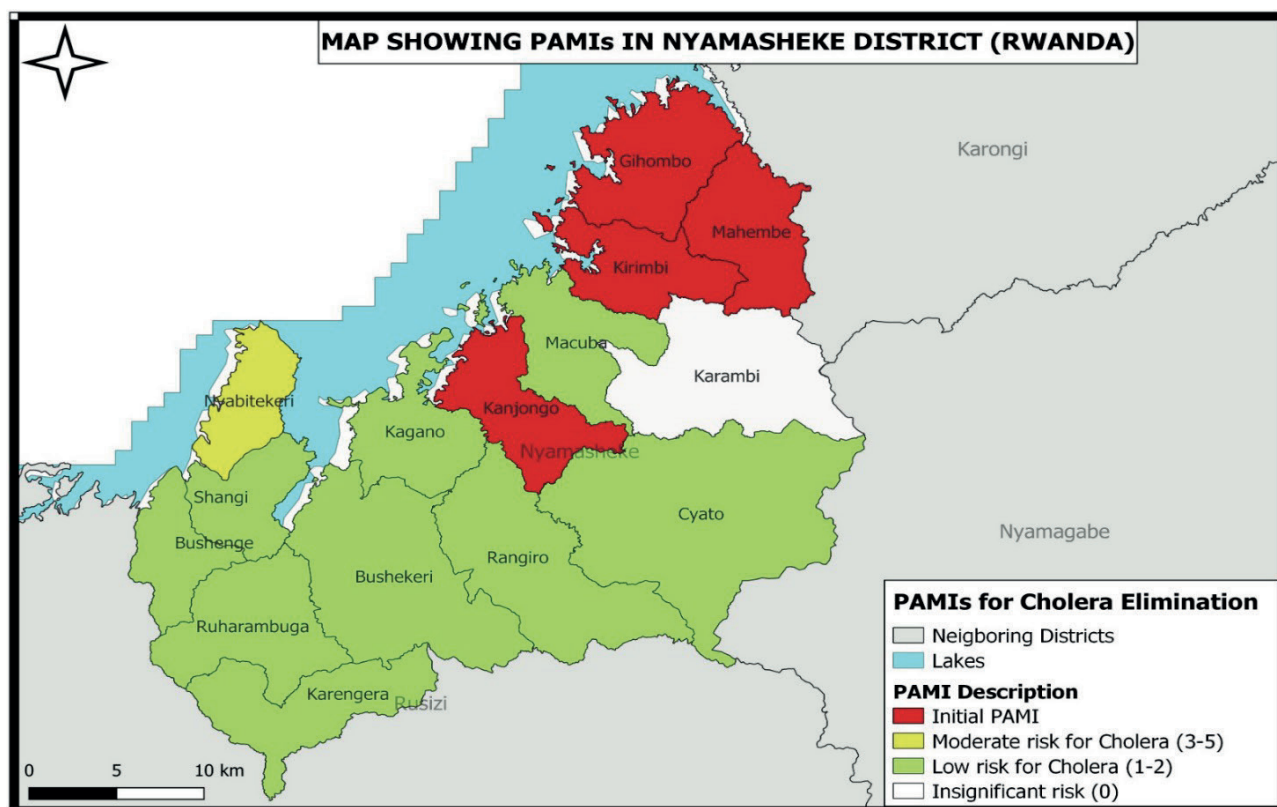


Figure 6: PAMIs in Nyamasheke district

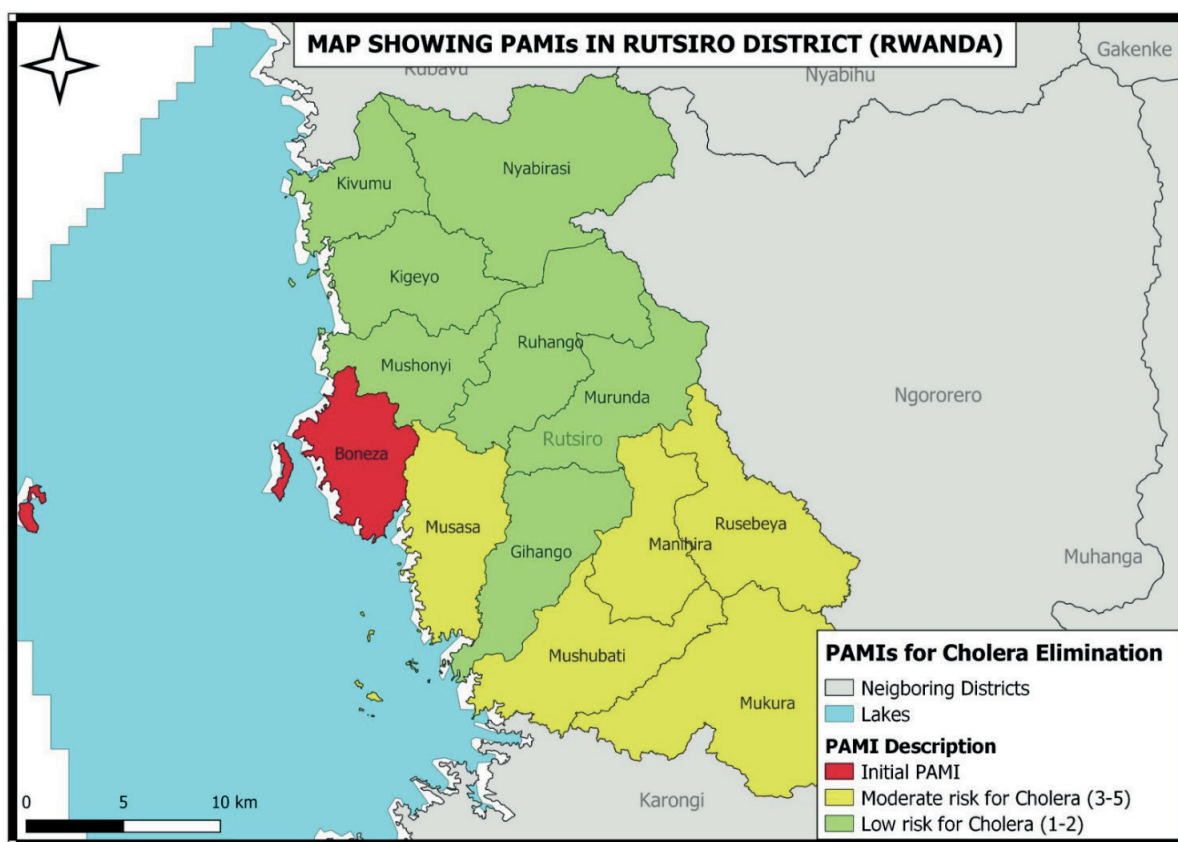


Figure 7: PAMIs in Rutsiro district

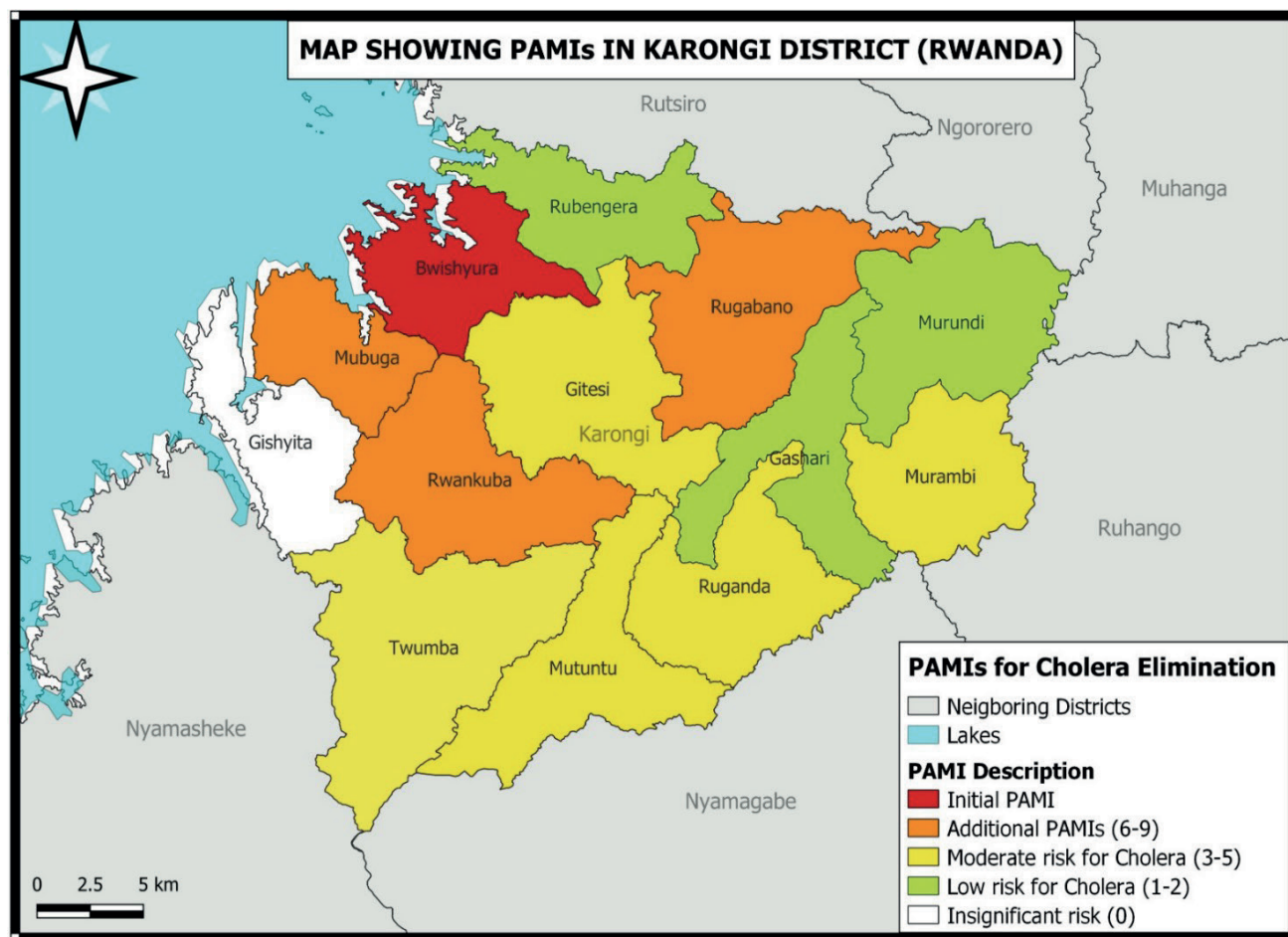


Figure 8: PAMIs in Karongi district

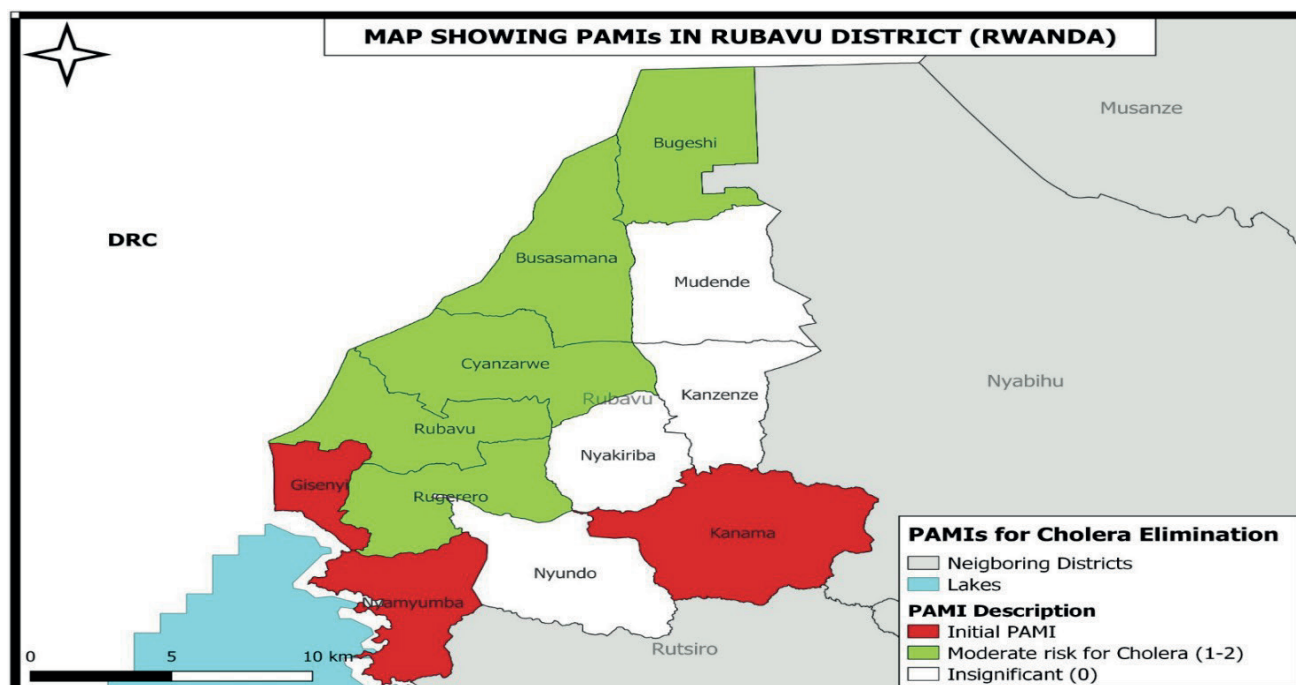


Figure 9: PAMIs in Rubavu district

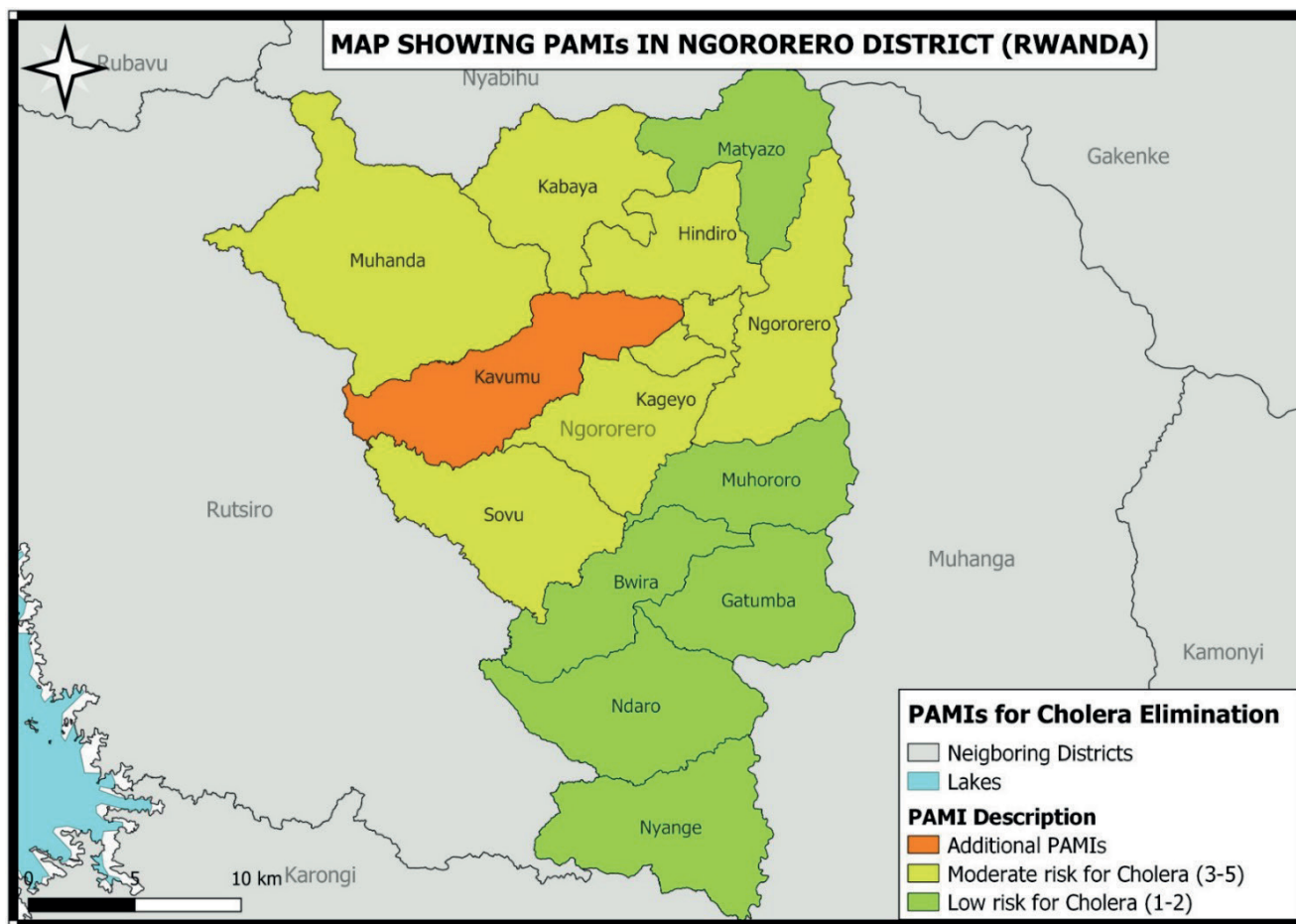


Figure 10: PAMIs in Ngororero district

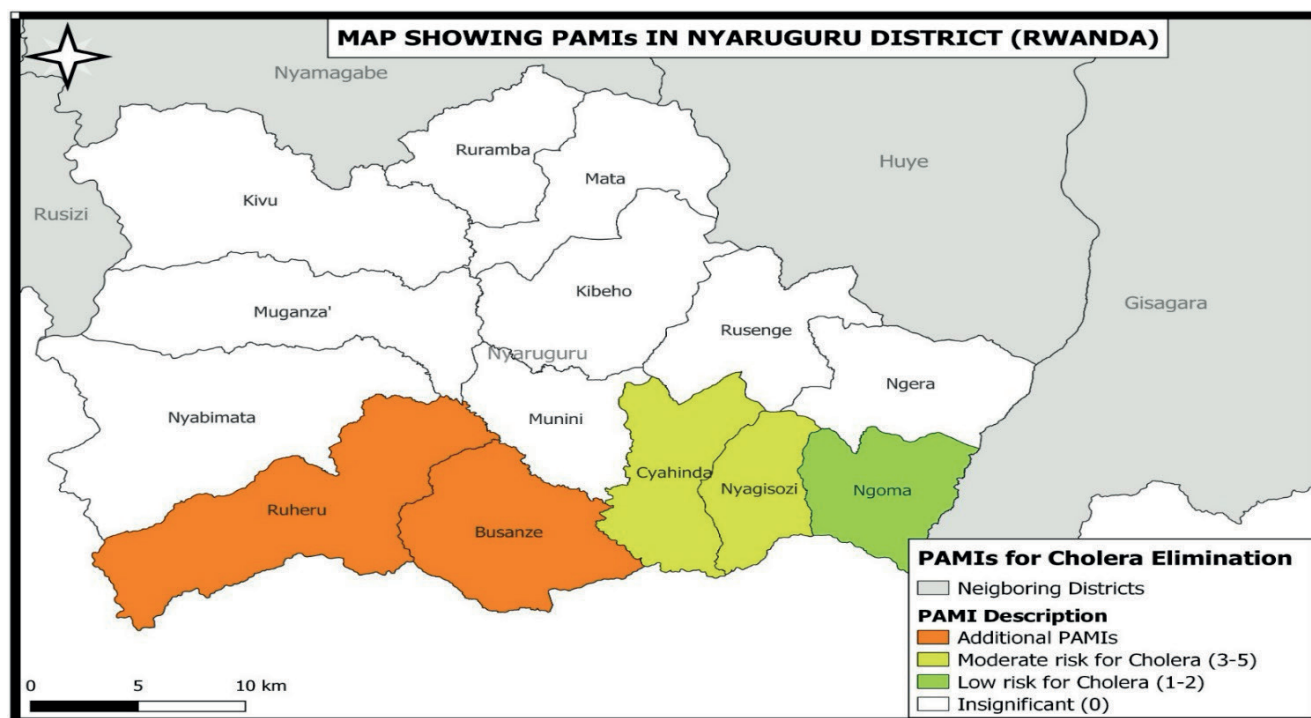


Figure 11: PAMIs in Nyaruguru district

District	Sector	Population	Priority index
KARONGI	BWISHYURA	40720	Initial PAMI
NYAMASHEKE	Gihombo	29843	Initial PAMI
NYAMASHEKE	Kanjongo	40341	Initial PAMI
NYAMASHEKE	Kirimbi	25647	Initial PAMI
NYAMASHEKE	Mahembe	20043	Initial PAMI
RUBAVU	GISENYI	51594	Initial PAMI
RUBAVU	KANAMA	37584	Initial PAMI
RUBAVU	NYAMYUMBA	48718	Initial PAMI
RUSIZI	BUGARAMA	42830	Initial PAMI
RUSIZI	GIHUNDWE	41615	Initial PAMI
RUSIZI	MURURU	29774	Initial PAMI
RUSIZI	NKANKA	19857	Initial PAMI
RUSIZI	NKOMBO	18637	Initial PAMI
RUTSIRO	BONEZA	29206	Initial PAMI
KARONGI	RUGABANO	34207	9
KARONGI	RWANKUBA	38286	9
RUSIZI	MUGANZA	36530	8
BURERA	CYANIKA	25693	6
KARONGI	MUBUGA	23455	6
NGORORERO	KAVUMU	32791	6
NYARUGURU	BUSANZE	29795	6
NYARUGURU	RUHERU	27712	6

The above (Table 6) shows all the 22 sectors cholera risk maps highlighting the location of PAMIs within various sectors.

WAY FORWARD

a. National Cholera Elimination Plan Development

The next steps will involve finalizing the development of the National cholera elimination plan with the current leadership and coordination mechanism to ensure that all key stakeholders are well-informed and aligned with the goal. This will be done in the form of a meeting involving senior management from the National and Provincial Departments of Health and other sector Departments and stakeholders and partners to provide feedback on the PAMIs identification. This meeting will be conducted in July 2025, and will be followed by the implementation of the following strategic actions:

- ♦ Developmental phase (May-July 2025) where each Pillar will be expected to:
 - Formulate & prioritize activities.
 - Develop operational plans & associated budget.
 - Develop a monitoring & evaluation framework including definition of indicators & milestones.
- ♦ Implementation phase (January 2026) where each Pillar will be expected to implemented according to:
 - Prioritized activities.
 - Established timelines.

- Available budget.
- ◊ Monitoring and reporting phase (September 2025) where each pillar will be expected to:
 - Conduct monitoring of indicators.
 - Provide an annual report of progress against targets and indicators.
 - Prioritize activities for next period.

b. PAMI Report review and dissemination

The other next key step is to submit the PAMI report to the GTFCC PAMI Review Committee for review and possible clearance. Once cleared by the Committee, the report will be disseminated to all key stakeholders, including relevant subnational levels

**IDENTIFICATION OF PRIORITY AREAS FOR MULTI-SECTORAL
INTERVENTIONS (PAMIs) FOR CHOLERA ELIMINATION FOR
RWANDA**
