# Malawi's Health System Resilience in Managing Climate-Induced Cholera Outbreaks

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**Abstract**

**Background:** Malawi's health system faces major challenges in managing cholera outbreaks, worsened by climate-induced extreme weather events (EWEs) like tropical cyclone-related floods (TCRFs). These disasters amplify existing vulnerabilities, including poor infrastructure and limited resources. The March 2022 outbreak, the most severe in two decades, impacted all 29 districts, with a case fatality rate three times the anticipated threshold of 1%. This paper examines Malawi's health system's resilience using a structured literature review approach guided by the WHO Operational Framework for Building Climate-Resilient Health Systems. Through secondary data analysis, case studies, and comparative assessments, it identifies key structural and operational weaknesses. It also explores the role of intersectoral collaboration and community engagement, highlighting initiatives like the Tipewe Cholera Campaign. Drawing on international best practices, the study presents evidence-based recommendations to strengthen governance, health infrastructure, workforce distribution, financing, early warning systems, and WASH (Water, Sanitation, and Hygiene) infrastructure. These measures aim to build a climate-resilient health system capable of effectively managing future outbreaks.

**Keywords:** Health System, climate-resilient, climate-induced, cholera outbreak, Malawi

## Introduction

Cholera remains a critical global health challenge, particularly in sub-Saharan Africa (SSA), where inadequate Water, Sanitation, and Hygiene (WASH) infrastructure and constrained healthcare systems exacerbate the disease's spread. Over the past two decades, SSA has accounted for more than 2.6 million cholera cases and 60,000 fatalities (Olu et al., 2023). Malawi stands out as one of the most cholera-affected nations, contributing 26% of global cholera deaths. It accounts for 29% of total cholera cases and 46% of all deaths reported in the World Health Organization Regional Office for Africa (WHO AFRO) (WHO, 2024a; WHO, 2024b). Climate-induced events like Tropical Cyclone-Related Floods (TCRFs) disrupt WASH infrastructure, displace populations, and create ideal conditions for disease outbreaks. The cholera outbreaks are fueled by constrained resources, insufficient medical supplies, inadequate sanitation, inconsistent water supplies, and increased cross-border movements (WHO, 2024a).

In March 2022, Malawi experienced its worst cholera outbreak in two decades, with all 29 districts affected (Miggo et al., 2023). The outbreak had a higher case fatality rate, 3%, compared to the 1% rate expected for cholera, making Malawi the most cholera-affected nation globally (Bagcchi, 2022; Miggo et al., 2023). This outbreak, exacerbated by Cyclones Ana and Gombe, caused severe flooding, displaced 221,000 people in southern Malawi, and pushed one million into poverty, leaving communities without clean water, adequate sanitation, or sufficient healthcare services—conditions that heightened susceptibility to cholera (Adriano et al., 2023; Pangapanga-Phiri et al., 2022). In March 2023, Tropical Cyclone Freddy worsened the situation, causing even greater devastation across 15 districts (Adriano et al., 2023). The cyclone displaced 659,278 people and resulted in 679 deaths, 537 missing persons, and 2,178 injuries, with children and individuals with disabilities among the most affected (Adriano et al., 2023; Government of Malawi [GOM], 2023a). Freddy's destruction submerged 918 boreholes, leaving over one million people without access to clean water and sanitation (United Nations Office for the Coordination of Humanitarian Affairs [OCHA], 2023). The damage to WASH infrastructure compounded the contamination of water sources, significantly escalating the risk of cholera outbreaks in already vulnerable communities (GOM, 2023a).

The health sector was particularly hard hit, with about 83 health facilities damaged (Adriano et al., 2023), including primary and secondary health centers as well as maternity wings, cholera treatment units (CTUs), and oral rehydration points (ORPs) (GOM, 2023a). Of these, 74 remained operational but were inaccessible due to the disaster, while the rest ceased operations due to supply and infrastructure disruptions. The destruction of health facilities resulted in the loss of essential medication and medical records, restricting access to health services. Additionally, opportunistic infections, malnutrition risks, and disease outbreaks escalated post-storm morbidity and mortality rates (OCHA, 2023a). The health system was overwhelmed, and Malawi faced substantial challenges in managing the 2022-2023 cholera outbreak (Miggo et al., 2023). These events highlighted Malawi's limited disaster preparedness, poor resource mobilization, ineffective governance, poor health system resilience, and the urgent need for effective interventions to mitigate future outbreaks.

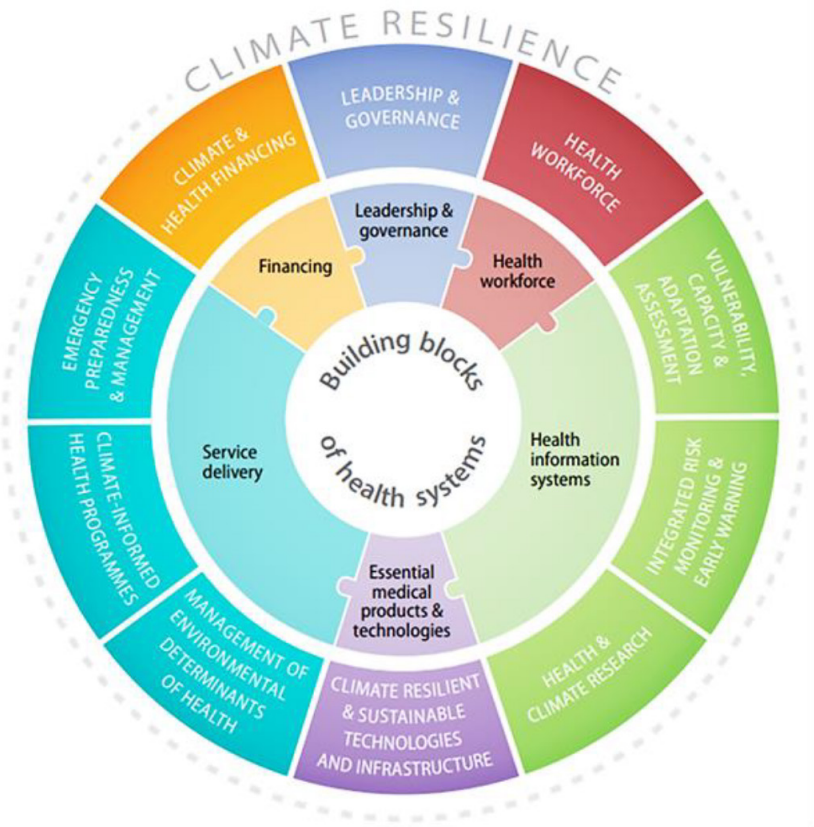
Despite ongoing efforts, including international support, gaps in Malawi's disaster response capacity remain a significant barrier to addressing climate-induced health challenges (Karamagi et al., 2022). Investigating these gaps is essential to improving disaster preparedness, health infrastructure, and WASH services, particularly in increasing climate variability (Miggo et al., 2023; Ministry of Health [MOH], 2023). Strengthening the resilience of Malawi's health system aligns with key Sustainable Development Goals (SDGs), including

SDG 3 (Good Health and Well-being), SDG 6 (Clean Water and Sanitation), and SDG 13 (Climate Action) (United Nations [UN], 2024). By addressing these gaps, Malawi can reduce the burden of cholera and enhance its ability to withstand climate-induced shocks.

This research assesses Malawi's health system performance during TCRF-driven cholera outbreaks, identifying barriers to resilience and proposing evidence-based interventions. Guided by the WHO operational framework for building climate-resilient health systems (Figure 1), the paper systematically assesses how governance, financing, workforce, medical products, information systems, and service delivery contribute to overall resilience.

**Figure 1**

*WHO Operational Framework for Building Climate-Resilient Health Systems (The World Bank, 2023)*



## Governance

The Malawian government, in collaboration with World Health Organization (WHO), United Nations Children's Fund (UNICEF), and Centers for Disease and Control (CDC), developed a National Cholera Response Plan to combat outbreaks through improved WASH services, oral cholera vaccination (OCV), surveillance, case management, and community engagement (Bagcchi, 2022). High-risk districts, including Lilongwe, Blantyre, Chikwawa, and Nsanje, implemented emergency preparedness plans with funding from WHO (WHO, 2023a; WHO, 2024c). Malawi also pioneered the Global Task Force on Cholera Control (GTFCC) hotspot identification tool, using 2018-2023 data to prioritize interventions in vulnerable areas like Mangochi, Nsanje, and parts of Zomba (WHO, 2023b). These areas were designated as Priority Areas for Multi-Sectoral Interventions (PAMIs) based on a comprehensive analysis that considered cholera persistence, WASH conditions, population density, cross-border risks, and vulnerability to natural disasters. A national stakeholder workshop validated and expanded the priority areas, ensuring local insights were incorporated (GOM, 2023c; WHO, 2023b). This strategic prioritization enabled the country to optimize resources by targeting areas where multi-sectoral interventions could significantly reduce cholera transmission and mortality, even if those areas were not the highest incidence districts by traditional definitions (GOM, 2023c).

Intersectoral collaboration was critical in managing the 2022-2024 cholera outbreak (WHO, 2023a). The government declared it a public health emergency and incorporated response efforts into the Presidential Taskforce on COVID-19, enabling a multi-crisis approach. Key initiatives included establishing Emergency Operations Centers (EOCs), multisectoral district coordination groups, and cross-border committees with Mozambique and Zambia (WHO, 2023a). Despite these efforts, Malawi's cholera response remains constrained by bureaucratic delays, centralized decision-making, resource constraints, and inefficiencies within its governance framework. Fragmented efforts, weak risk assessment, and ineffective cross-border coordination exacerbate outbreaks, especially during concurrent crises like COVID-19, tropical storms, and polio (Miggo et al., 2023).

These challenges highlight a gap between policy and implementation, underscoring the need for streamlined processes and stronger coordination mechanisms. Malawi could improve its cholera response by adopting Rwanda's decentralized health system, which empowers local authorities to make swift, context-specific decisions. This model improves resource allocation, ensuring funds and medical supplies meet regional needs rather than centralized mandates. Additionally, intersectoral collaboration-integrating education, sanitation, and local governance- supports a comprehensive public health strategy and strengthens disease prevention and mitigation efforts (Oliveira et al., 2023).

## Financing

Malawi's health system faced severe financial strain during the cholera outbreak, with only 8.5% of the 2022/2023 budget allocated to health, falling below the 14.5% Abuja declaration target (UNICEF Malawi, 2023a). Like Malawi, most African nations struggle to reach this benchmark, with domestic health spending ranging from 2.1% to 12% of total government expenditure (WHO, 2023d). The limited funding proved inadequate for managing the surge in cholera cases and was exacerbated by Cyclone Freddy's destruction of health infrastructure, resulting in $8.7 million in recovery costs (GOM, 2023b). The government redirected resources and sought external assistance, leading to a $45.3 million UN Flash Appeal, which mobilized $18 million to aid 4 million vulnerable individuals (UN, 2023).

To scale up response efforts, the United Nations Central Emergency Response Fund (CERF) allocated $5.3 million for WASH, healthcare, logistics, and community protection services. At the same time, WHO secured 4.9 million doses of Oral Cholera Vaccine (OCV) for high-risk districts. Additional support from ECHO, CDC, the World Bank, and other donors sustained containment efforts. However, by February 2023, a $14.8 million funding gap remained, 89% of the total funding requirement, severely limiting the response efforts (OCHA, 2023b; United Nations Central Emergency Response Fund (UNCERF, 2023; WHO, 2023c).

Challenges included misallocation of climate funds, reliance on post-disaster emergency financing, and lack of a dedicated Climate Fund. The District Development Fund failed to address climate-related cholera risks (The World Bank Group, 2022). These financial shortcomings highlight the need for sustainable health financing, improved disaster preparedness, and proactive resource allocation. The surge in cases and cyclone damage further exposed the system's vulnerability to climate disasters. The government's reactive approach, relying on fund reallocation and external aid, highlighted a lack of financial resilience, often diverting resources from other critical health sectors (UNICEF Malawi, 2023b; The World Bank Group, 2022).

Despite international support, the $14.8 million funding gap proved that government and donor contributions were insufficient. Misallocation of climate mitigation funds and reliance on post-disaster financing resulted in higher costs and less effective responses. Poor coordination of local projects further complicated efforts (The world Bank Group, 2022). Malawi can enhance cholera outbreak preparedness by adopting sustainable financing models like Zimbabwe's Climate Resilience Fund and South Africa's Green Fund, which pool resources from government budgets, international donors, and private sector contributions. These models also strengthen domestic resource mobilization by earmarking taxes for climate-related health initiatives (Muula, 2023; Qu et al.,

2023). A similar fund in Malawi would provide a dedicated, reliable financial stream to support outbreak response and long-term health system resilience. Improving financial planning would further enhance the country's ability to manage future cholera outbreaks and broader climate-related health challenges.

## Health Workforce

Malawi faced a critical health workforce shortage during the 2022-2023 cholera outbreak, with only 10.42 health workers per 10,000 people, far below WHO's 22 per 10,000 target (GOM, 2019). The shortage was worse in rural areas like Neno district, with just 1.3 health workers per 10,000 people. Only 55% of health worker posts were filled, with significant gaps in nursing (61%) and pharmacy staff (78%), further straining healthcare delivery (Berman et al., 2022). Community health workers (CHWs), making up 30% of the workforce, played a key role in the cholera response by promoting hygiene, distributing oral rehydration solution (ORS), administering vaccines, and tracking cases. However, they were overburdened, undertrained, and often worked beyond their scope. These pressures contributed to service gaps and high resignation rates, though no specific data on resignations was found in the literature (Niederberger et al., 2022).

The Ministry of Health (MOH), in collaboration with WHO, UK-EMT, and Save the Children, deployed emergency medical teams (EMTs) to mitigate the workforce shortage (WHO, 2023e). Over 2,000 health workers were trained in areas such as surveillance, case management, critical care skills, and laboratory sampling (UNCERF, 2023). UNICEF trained 12,000 health workers in case management, surveillance, and infection prevention control. WHO and UNICEF also strengthened data management, community engagement, and climate-health training, incorporating climate change and health education into national health curricula to improve long-term resilience against climate-sensitive diseases (UNCERF, 2023; UNICEF, 2024; UNICEF Malawi, 2022).

Despite progress in capacity building and training, sustained efforts are needed to improve rural healthcare access, support CHWs, and retain skilled workers. Investments in incentives for rural service, mentorship, mandatory rotations, decentralized recruitment, and enhanced CHW training are essential. Adopting the Tanzania Field Epidemiology and Laboratory Training Program (TFELTP), which effectively functions as a rapid response mechanism for health emergencies by providing comprehensive training in epidemiology and laboratory management (AFENET, 2024), could further enhance Malawi's capacity to detect, investigate, and respond to climate-induced emergencies.

## Medical Products, Technologies and Infrastructure

Cyclone Freddy severely disrupted supply chains, delaying cholera kit shipments and damaging infrastructure and roads, which hindered supply

distribution and case reporting (WHO, 2024e). District health facilities and Cholera Treatment Units (CTUs) were damaged, requiring patient relocation to Queen Elizabeth Central Hospital (QECH), where a camp was set up for continued patient treatment (Chavula, 2023a). Despite challenges, UN partners provided health services to over 433,900 people (87% of the affected population) during the crises (OCHA, 2023c). Organizations like UNICEF, UNFPA, WHO, and WFP played crucial roles in the response.

UNICEF supported the MOH with emergency medical supplies, treated 34,200 cases (92.5% of the reported cases), reached 74.4% of the targeted populations with OCV campaigns, and set up 90 CTUs and mobile clinics. UNICEF also supplied Acute Watery Diarrhea (AWD) kits, ORS, medicines, diagnostic test kits, and IPC supplies to Cholera Treatment Centers (CTCs). They provided three high-performance tents for CTUs in Zomba, Machinga, and Balaka and supported mobile clinics for cholera treatment and vaccination in Cyclone Freddy-affected districts (Chavula, 2023b; UNCERF, 2023a; UNICEF, 2024). UNFPA distributed dignity kits and minimum initial package services to nearly half their target population (UNCERF, 2023b).

WHO treated 5,300 patients, vaccinated 170,852 people (92% of their target population), and provided cholera kits, antibiotics, fuel, tents, ORS, and IPC supplies. They stockpiled supplies to prevent outbreak spread and established 106 ORPs (UNCERF, 2023a, 62). WFP facilitated logistics, transporting and storing supplies in six affected districts. These efforts significantly reduced cholera fatality rates from 3% to less than 1% (UNCERF, 2023a) (Table 1).

Despite international support in providing emergency supplies, CTCs, logistics, and innovative solutions like mobile clinics addressing infrastructure challenges, bureaucratic delays in shipment authorizations revealed the need for more efficient processes. WHO's stockpiling and WFP's logistical support highlighted the importance of efficient logistics, reinforcing the need for resilient health infrastructure, improved supply chains, and stronger international partnerships (Masefield et al., 2020; Miggo et al., 2023). As seen in Mozambique, decentralized inventory management could strengthen Malawi's supply chain by preventing stock loss and enabling faster emergency responses. Additionally, investing in off-road vehicles would improve healthcare access in disaster-prone regions (Rossi et al., 2024).

**Table 1**

*Summary of Assistance Provided by NGOs*

| Organization | Assistance Provided |
|---|---|
| **UNICEF** | ○ Supported OCV campaigns<br>○ Established 90 CTUs<br>○ Procured and distributed AWD kits, ORS, essential medicines, rapid diagnostic test kits, and IPC supplies in CTCs<br>○ Supported the set-up of mobile clinics in Cyclone Freddy-affected districts for cholera treatment and vaccination<br>○ Provided 3 high-performance tents to establish CTUs in Balaka, Machinga, and Zomba |
| **UNFPA** | ○ Distributed dignity kits to women and girls<br>○ Provided lifesaving Minimum Initial Service Packages |
| **WHO** | ○ Provided OCV to 92% of the target population<br>○ Donated cholera investigation, laboratory, and case management kits<br>○ Stockpiled cholera supplies in MOH central medical stores<br>○ Distributed Ringers Lactate, antibiotics, fuel, cholera tests, tents, Chlorine (HTH), and ORS<br>○ Established 106 ORPs for community-level treatment |
| **WFP** | ○ Provided logistical services, including transportation and handling of life-saving supplies<br>○ Deployed Mobile Storage Units<br>○ Provided cargo storage in the six most affected districts: Blantyre, Balaka, Mangochi, Salima, Lilongwe, and Machinga |

## Health Information Systems

### *Vulnerability, Capacity, and Adaptation Assessment*

Malawi assessed its vulnerability, capacity and adaptation needs during a cholera outbreak (Table 2). In Lilongwe, the epicenter of cases, the Centers for Disease and Control (CDC) collaborated with the Ministry of Water, Lilongwe Water Board, and the District Environmental Health Office to support water quality testing, which found that piped water which serves 70% of the population, was safe, but alternative water sources had significant fecal contamination (CDC, 2024a). Vulnerable groups faced heightened risks, particularly those lacking access to piped water. To improve future resilience, district monitors were trained in routine chlorine testing of piped water networks nationwide (CDC, 2024a).

Despite ongoing response efforts, cholera cases surged, overwhelming Malawi's health system. Limited resources, overcrowded facilities, cyclone-damaged infrastructure, and workforce shortages further strained response capacity, hindering effective care delivery. Some primary healthcare services were suspended as facilities converted to

cholera centers (UN Volunteers, 2023; International Federation of Red Cross and Red Crescent Societies [IFRC], 2023). Additionally, diagnostic challenges, particularly in newly affected regions, prompted CDC-supported upgrades in national laboratory testing to improve cholera detection and case management (CDC, 2024b). However, rural areas continued to face inconsistencies in case reporting due to limited financial and human resources, which in turn delayed pathogen confirmation and an effective outbreak response (IFRC, 2022; MOH, 2023).

Access to timely cholera treatment was further hindered by geographic, systemic, and social barriers, including long distances to health facilities, unreliable transportation, negative healthcare experiences, and cultural preferences for traditional medicine (IFRC, 2023; Niederberger et al, 2022). Stigma and misinformation, particularly in rural areas, further delay care. Misconceptions such as the belief that cholera was a fabricated disease for financial gain impeded public health efforts (Niederberger et al., 2022). In contrast, awareness was higher among urban and educated individuals, highlighting disparities in health communication and access to information (Niederberger et al., 2022).

Climate change has exacerbated these systemic vulnerabilities by intensifying cholera risks through rising temperatures and erratic rainfall, prolonging outbreaks and expanding their geographic scope (Miggo et al., 2023). The destruction of WASH infrastructure due to the tropical storms in 2022–2023 that led to the collapse of thousands of latrines and wells, intensified the risk of cholera transmission, particularly in Nsanje and Chikwawa. These districts experienced heightened cases due to inadequate sanitation, open defecation, and residents' reluctance to relocate from high-risk areas (Braka et al., 2024; Grist, 2023). Furthermore, climate-induced crop failures have intensified poverty and malnutrition, compounding vulnerability to cholera and limiting the capacity of individuals and communities to implement preventive measures (Joshua et al., 2021).

Ultimately, Malawi's susceptibility to cholera outbreaks stems from systemic deficiencies in WASH infrastructure, limited health system capacity, and inadequate climate resilience (IFRC, 2023). Poor waste management, open defecation, and deteriorating water systems drive transmission, with only 25% of the population accessing clean water-reliant sources are often non-functional due to neglect (Shariff et al., 2024). Heavy rainfall and cyclones exacerbate contamination, particularly affecting shallow wells (Shariff et al., 2024). Without significant investments in resilient WASH systems, sustainable climate adaptation strategies, and strengthened health system governance, cholera will remain a persistent public health challenge in Malawi.

**Table 2**

*Summary of Key Findings from Assessments*

| Aspect | Findings and Assessment |
|---|---|
| **Water Quality** | ○ Significant fecal contamination in non-piped water sources |
| **Health System Capacity** | ○ Overcrowded health facilities; inadequate infrastructure and resources |
| **Diagnostic Capabilities** | ○ Limited diagnostic facilities |
| **Human Resources** | ○ Uneven distribution; shortages in critical areas. |
| **Treatment Supplies** | ○ Shortages of Ringer's lactate, ORS, and diagnostic equipment. |
| **Community Awareness** | ○ Varied knowledge levels; misinformation and rumors widespread |
| **Climate and Environmental Impact** | ○ Cyclones and extreme weather events exacerbate vulnerability. |
| **Sanitation and Waste Management** | ○ Open defecation and inadequate waste management contribute to outbreaks. |

### *Integrated Risk Monitoring and Early Warning*

Malawi established a comprehensive cholera monitoring system, enabling real-time tracking of cases and deaths across all 29 districts. The monitoring system recorded the age and sex of cholera cases, enabling targeted interventions for the most affected groups. It mapped cases and deaths by district, visualizing the outbreak's spread, hotspots, and seasonal trends since its onset in March 2022 (WHO, 2023a). Climate data on rainfall patterns was used to explore links between weather and cholera transmission (Chinkaka et al., 2024). Cross-border risks, particularly with Mozambique, were monitored to detect potential international spread early. This continuous monitoring allowed swift identification of new hotspots, rapid deployment of resources, and strategy adjustments, such as scaling up chlorination efforts and implementing single-dose OCV campaigns in the most affected districts amid global vaccine shortages (CDC, 2024a).

Malawi's early warning system, including the 7-1-7 Approach and updated IDSR Guidelines, strengthened detection and response during the outbreak. The 7-1-7 Approach trained Health Surveillance Assistants (HSAs) and community volunteers to identify cases within seven days of infection, notify authorities within one day of detection, and respond within seven days of notification, while the IDSR Guidelines improve data usage for decision-making (WHO, 2024e). However, IDSR implementation is limited, with training in only 8 of 29 districts (MOH, 2023).

While Malawi's monitoring and early warning system has made progress, gaps remain in implementing IDSR

and integrating climate data into health operations. Limited IDSR training coverage and underuse of climate data highlight areas for improvement. Expanding IDSR coverage and providing comprehensive training to health workers could strengthen the system. Additionally, Malawi could benefit from adopting practices from Tanzania's urban resilience program, which integrates climate data to improve responses to urban climate emergencies (The World Bank, 2023).

## Service Delivery

To combat the cholera outbreak, Malawi implemented comprehensive Water, Sanitation, and Hygiene (WASH) interventions. Before receiving CERF funding, the government and partners provided water treatment supplies and sanitation infrastructure to 197 Cholera Treatment Units, reaching 472,000 people, and equipped over 100 schools with WASH supplies for 200,000 learners (OCHA, 2023b). UNICEF distributed hygiene kits and supported latrine construction, while the Malawi Red Cross Society rehabilitated boreholes (IFRC, 2022; UNCERF, 2023a). Through radio programs, mobile vans, and door-to-door campaigns, community education effectively disseminated prevention messages, with Risk Communication and Community Engagement (RCCE) activities reaching 93% of their target (UNCERF, 2023a). Additionally, nutrition services supported 266,000 children and caregivers, emphasizing nutrition's role in resilience against waterborne diseases (OCHA, 2023b) (Table 3).

**Table 3**

*Summary of Management Strategies*

| Environmental Determinant | Management Strategies |
|---|---|
| **Water Supply** | ○ Distribution of water treatment chemicals (chlorine, water guards)<br>○ Water quality monitoring in communal taps, household taps, and shallow wells<br>○ Rehabilitation of 25 boreholes<br>○ Construction of 3 new boreholes<br>○ Drilling of 500 boreholes in schools (out of 1,262 needed)<br>○ Water quality testing on 150 boreholes |
| **Sanitation** | ○ Construction of 30 latrines in CTUs<br>○ Rehabilitation of communal sanitation facilities<br>○ Installation of mobile and prefabricated latrines in CTUs and camps<br>○ Distribution of 112,000 hygiene kits |
| **Hygiene** | ○ Provision of handwashing soap to 472,000 people<br>○ Equipping over 100 schools with WASH supplies, benefiting 200,000 learners<br>○ Training of 960 people for door-to-door cholera prevention actions |
| **Community Engagement** | ○ Broadcasting of 12 radio programs on cholera prevention<br>○ Mobile van announcements and interactive audio-visual shows<br>○ Distribution of 140,000 Information, Education, and Communication (IEC) materials<br>○ Engagement with local leaders, religious leaders, and market committees |
| **Nutrition** | ○ Screening of 75,000 children for acute malnutrition<br>○ Nutrition services provided to 266,000 children and caregivers |

Despite these efforts, disparities in sectoral success rates were noted. While RCCE activities achieving high coverage WASH, Education, and Health sectors achieved only 26%, 5%, and 4% of their targets due to resource distribution and inter-sectoral coordination challenges, exacerbated by damaged infrastructure and inaccessible areas (OCHA, 2023b). The success of RCCE highlights the crucial role of community engagement in building climate resilience. However, gaps in other sectors call for a more integrated and coordinated approach (Aderinto, 2023). Malawi could enhance its coordination efforts by adopting Ghana's strategy of identifying and supporting champions to advocate for health interventions and influence key decision-makers (Bulthuis et al., 2023).

The Tipewe Cholera campaign (Table 4), launched on October 25, 2023, by President Lazarus Chakwera (WHO 2023f), effectively integrated climate considerations into public health responses. Recognizing the link between climate events and disease outbreaks, the campaign prioritized water safety to address contamination risks from flooding. Over two weeks, health workers nationwide were mobilized with information, vaccines, diagnostic tools, testing kits, and chlorine. Using a "case area targeted intervention" (CATI) approach, supported by UNICEF and partners, community-level follow-ups were conducted for each reported cholera case (Pensulo, 2024).

Activities included disinfecting homes, providing sanitary materials and safe water storage, establishing Oral Rehydration Points (ORPs) in high-risk areas, and testing water sources. The campaign reached 88% of targeted households with life-saving messages and 79% with chlorine solutions, cleaning 95% of targeted markets. By mid-November, 2,205 diarrheal patients were treated, and cholera cases reduced from 300-400 per week the previous year to 218 nationwide over three months (Pensulo, 2024). Ongoing Oral Cholera Vaccine (OCV) distribution in Mangochi and Blantyre achieved 96.8% coverage among high-risk communities (WHO, 2023a).

**Table 4**

*Summary of Key Aspects of the Tipewe Cholera Campaign*

| Aspect | Details |
|---|---|
| **Initiation** | Launched by President Lazarus Chakwera on October 30, 2023 |
| **Duration** | Over two weeks |
| **Approach** | Case Area Targeted Intervention (CATI) |
| **Key Activities** | ○ Mobilization of health workers nationwide<br>○ Distribution of information, diagnostic tools, chlorine, testing kits, and vaccines<br>○ Detailed community-level follow-ups for each reported case<br>○ Disinfection of homes<br>○ Provision of sanitary materials and safe water storage equipment<br>○ Water source testing<br>○ Establishment of Oral Rehydration Points (ORPs) in high-risk areas |
| **Results** | ○ 88% of targeted households received life-saving messages<br>○ 79% of the targeted population received chlorine solution for water safety<br>○ 95% of targeted markets were cleaned<br>○ 2,205 diarrheal patients treated by mid-November |
| **Impact** | ○ Cholera cases dropped from 300-400 weekly average to 218 cases nationwide (Nov 2023 - Feb 2024)<br>○ 96.8% coverage (2,825,229 doses) among high-risk communities |

The Tipewe campaign's success highlights the importance of integrating climate considerations into public health responses, emphasizing community involvement, and building long-term resilience. It serves as a model for adaptive health interventions in the face of climate-related challenges.

## Conclusion

This research has examined Malawi's health system performance during climate-induced cholera outbreaks, identifying several strengths as well as critical vulnerabilities that hinder its overall resilience. While the country has made significant strides in cholera response through effective intersectoral collaboration with organizations like WHO, UNICEF, and CDC, challenges persist that undermine the health system's capacity to withstand and respond to climate shocks.

Malawi's response to cholera has benefited from community engagement initiatives, such as the TIPEWE Cholera campaign, which successfully integrated climate considerations into public health interventions. However, critical challenges remain. Infrastructure vulnerability, where frequent natural disasters like tropical cyclones disrupt

supply chains and damage health facilities, underscores the urgent need for more resilient infrastructure. This damage compounds the already fragile state of the health system, with frequent destruction of health facilities making it difficult to provide timely and adequate care.

Workforce shortages, particularly in rural areas, significantly hamper effective response efforts. The limited number of health workers, combined with their overburdened roles, impedes the ability to provide essential services. Financial constraints also play a major role, as Malawi's heavy reliance on donor funding and inadequate national resources restricts its ability to respond sustainably. These funding shortfalls, coupled with governance challenges such as bureaucratic inefficiencies and poor coordination, further hinder the effective implementation of policies and allocation of resources. In addition, deficiencies in WASH infrastructure, including poor waste management and inadequate sanitation facilities increase the risk of cholera outbreaks, especially during climate-induced disasters.

Several key interventions are recommended to enhance Malawi's resilience to cholera outbreaks and climate-related health challenges. Strengthening cross-border collaboration between the Ministry of Health (MOH), neighboring countries, and international organizations is crucial for coordinated cholera prevention efforts, including synchronized vaccination campaigns, WASH interventions, and joint training of health workers. Additionally, multisectoral coordination should be improved through the establishment of a permanent Intersectoral Cholera Control Committee to enhance collaboration across health, WASH, education, agriculture, and disaster management sectors. To ensure financial sustainability, the government should establish a Cholera and Climate-Related Health Emergency Fund, financed through earmarked carbon taxes and fuel levies introduced in 2019. This fund would direct misallocated climate revenues to prioritize health funding in high-risk areas.

Strengthening the health workforce by recruiting and retaining skilled personnel, particularly in rural areas, through targeted incentives and training programs is essential. Furthermore, capacity building should be advanced through the establishment of the Malawi Field Epidemiology and Laboratory Training Program (MFELTP) to develop a workforce proficient in outbreak response and climate-related health challenges. Supply chain management should also be improved through strategic stockpiling of cholera treatment supplies, real-time inventory tracking, and alternative transportation methods such as drones and mobile health units to reach remote areas. In addition, enhancing WASH infrastructure through climate-resilient water and sanitation systems, improved waste management, and routine water quality monitoring is critical for disease prevention.

Developing an Integrated Climate-Health Early Warning System that incorporates climate and disease

surveillance data, risk mapping, and seasonal forecasting would further strengthen outbreak preparedness. Lastly, decentralizing health management by empowering local authorities to allocate resources and make decisions based on regional needs while maintaining central oversight would improve the efficiency and responsiveness of the health system. Collectively, these recommendations provide a comprehensive framework for strengthening Malawi's health system resilience to climate-related health emergencies.

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## Declaration of Interest

The author declares that there are no conflicts of interest.

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