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About the HEALTH PRESS

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FOREWORD

Dear Readers,

I am pleased to present the third issue of The Health Press Zambia for 2025.
This quarter, Zambia continues to confront persistent public health challenges, including cholera outbreaks. Cholera remains a significant threat, particularly in urban and peri-urban settings, where inadequate water, sanitation, and hygiene (WASH) infrastructure exacerbates transmission. In this issue, we feature an editorial on cholera outbreaks in Zambia that applies a Social Ecological Model framework to highlight the multiple, interconnected drivers of cholera transmission, from individual behaviors to community, institutional, and policy-level determinants. The article underscores the need for coordinated interventions, including strengthened WASH infrastructure, vaccination campaigns, and community engagement, to sustainably prevent outbreaks.

Complementing the editorial, we include an original research article on the recent cholera outbreak investigation in Kabwe. This study provides detailed epidemiological insights, highlighting factors associated with infection, gaps in surveillance, and the public health response required to control and prevent further cases. The findings emphasize the importance of early detection, rapid response, and investment in outbreak preparedness to mitigate cholera's impact.

Additionally, this issue presents research on Konzo disease in Mutondo Community, Luampa District. Through a household survey, the study identifies key demographic, nutritional, and behavioral risk factors driving Konzo, including high reliance on bitter cassava, low protein intake, and gaps in knowledge about safe processing practices. The article calls for community-based interventions, enhanced nutrition, and strengthened surveillance to prevent this debilitating neurological disorder.

Together, these articles illustrate the complex interplay of environmental, nutritional, and socio-economic factors in Zambia's public health landscape. We hope this issue provides valuable insights for researchers, health practitioners, and policymakers, and fosters informed action to reduce the burden of cholera and Konzo in affected communities.

Finally, this issue presents summary statistics on key notifiable diseases tracked by ZNPHI, including acute flaccid paralysis, Mpox, measles, anthrax, bilharzia, typhoid fever, and others.

I hope the evidence and insights presented in this issue will guide effective public health action and enhance our collective capacity to protect and strengthen national health security.

Prof. Roma Chilengi

Director General - Zambia National Public Health Institute

Editorial

Addressing Cholera Outbreaks in Zambia: A Call for a Social Ecological Approach

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Introduction

Cholera continues to pose a significant public health threat across Africa, driving outbreaks that result in avoidable illness and death. Globally, an estimated 2.8 million cases and 95,000 deaths occur annually [1], with Africa carrying the greatest burden: 82% of cases and 94% of deaths [2]. Between January and August 2025 alone, 213,586 cases and 4,507 deaths were recorded across 23 African Union (AU) Member States [3]. Projections for the upcoming rainy season (September 2025–February 2026) predict more than 200,000 additional cases and 6,020 deaths, representing a 42% increase in cases and nearly double the number of deaths compared to 2024, if current efforts remain unchanged [2].

In response to this growing crisis, the Africa Centre for Disease Control and Prevention (Africa CDC) and the World Health Organization (WHO) launched a six-month continental cholera response plan on August 26, 2025, in Lusaka, Zambia. This initiative, endorsed by African Union (AU) Cholera Champion President Hakainde Hichilema, aims to accelerate progress toward eliminating cholera by 2030. The plan prioritizes seven key areas: coordination, surveillance, laboratory capacity, case management, WASH (water, sanitation, and hygiene) interventions, vaccination, and community engagement [2,3]. President Hichilema's leadership reflects the strong political commitment essential for achieving a cholera-free Africa.

Zambia's experience with cholera

Zambia exemplifies the persistent challenge of cholera control. Almost every rainy season triggers new outbreaks, driven by inadequate WASH infrastructure, particularly in urban and peri-urban settlements [4]. The country has faced 29 outbreaks between 1977 and 2018, with case fatality rates ranging from 0.5% to 9.3% [4–6]. The 2023/24 outbreak alone recorded 23,381 cases and 740 deaths across nine provinces, with Lusaka, Central, and Eastern provinces most affected [5,6]. These outbreaks strain health services, disrupt livelihoods, and highlight deep-rooted structural and environmental drivers of cholera transmission.

To strengthen understanding and guide action, it is useful to interpret these outbreaks through the Social Ecological Model (SEM), which highlights how individual, community, institutional, and policy-level factors interact to perpetuate cholera transmission.

The Social Ecological Model: A framework for public health action

The Social Ecological Model (SEM), developed by psychologist Uriel Bronfenbrenner in the late 1970s, is a key framework in public health for understanding the multiple and interconnected influences on health outcomes. It recognises that health behaviours and outcomes are not shaped by a single factor, but emerge from interactions across different levels of society [7].

At the individual level, health outcomes are influenced by knowledge, attitudes, behaviours, and biological factors. In contrast, the interpersonal level reflects the impact of family, peers, and social networks on health practices. The community level encompasses cultural norms, neighbourhood conditions, and access to local resources that support or hinder healthy behaviours [7,8]. At the institutional level, the effectiveness of service delivery systems, schools, workplaces, and health facilities plays a vital role, and at the policy or structural level, governance, legislation, public health regulations, and resource allocation determine the broader systems and infrastructure that sustain population health [7,8].

Applying the SEM to diseases such as cholera can help identify both immediate and structural drivers of transmission, enabling policymakers and practitioners to design more comprehensive and sustainable interventions beyond individual behaviour change.

Applying the SEM to cholera outbreaks in Zambia
Cholera transmission in Zambia is shaped by multiple, interconnected factors across different levels of the SEM. At the individual level, misconceptions about transmission and prevention persist despite general awareness, contributing to poor uptake of WASH practices and delayed treatment [6,9]. Interpersonal influences, particularly within overcrowded households in Lusaka, which account for nearly 75% of cases, compound risks through inadequate sanitation, contaminated water, and stigma that discourages early care-seeking [6].

At the community level, cultural practices, misinformation, reliance on unsafe water sources, and limited access to sanitation exacerbate outbreaks [6,10]. Only 68% of households in Zambia have access to improved water sources, and just 40% have access to improved sanitation, while rapid urbanisation, reliance on shallow wells in peri-urban areas, and seasonal flooding continue to heighten the risk of water contamination [5,10].

Organisational and institutional weaknesses, including inadequate surveillance, limited laboratory capacity, low emergency preparedness, and a critical shortage of health workers (11.2 per 10,000 in rural areas and 18.7 per 10,000 in urban areas, against the WHO standard of 40) [6], continue to undermine effective outbreak response. At the policy level, fiscal constraints, reduced WASH investment, weak enforcement of public health regulations, and weak inter-ministerial coordination undermine sustainable prevention efforts [6,10]. Collectively, these factors demonstrate that cholera in Zambia is not simply a matter of individual behaviour but a multi-level challenge rooted in social, environmental, institutional, and structural determinants.

A call to action

The recurrence of cholera outbreaks in Zambia highlights persistent weaknesses in current response strategies. Guided by the SEM, elimination efforts must address determinants at multiple levels: from individual to policy. This will require (1) urgent, sustained, and multisectoral action focused on expanding oral cholera vaccination, (2) investing in long-term WASH solutions, (3) strengthening community health education, (4) building resilient health systems for rapid detection and response, (5) enforcing sanitation and housing regulations, and (6) fostering cross-sectoral partnerships to tackle the structural drivers of outbreaks.

Conclusion

The launch of the continental cholera response plan in Lusaka reflects strong political leadership and renewed momentum toward cholera elimination. For Zambia, this presents both an opportunity and a responsibility to act across all levels of the SEM: empowering individuals and communities, strengthening institutions, and reinforcing policy and structural systems for sustainable WASH improvements. Cholera elimination is achievable if coordinated action, political will, and community ownership align to end recurring outbreaks.

References

1. Ngingo BL, Mchome ZS, Bwana VM, Chengula A, Mwanyika G, Mremi I, et al. Socioecological systems analysis of potential factors for cholera outbreaks and assessment of health system's readiness to detect and respond in Ilemela and Nkasi districts, Tanzania. BMC Health Services Research. 2023;23(1):1261.

2. Africa CDC. President Hakainde Hichilema, AU Cholera Champion, Joins Partners to Unveil Africa's New Continental Cholera Plan. Africa CDC. https://africacdc.org/news-item/president-hakainde-hichilema-au-cholera-champion-joins-partners-to-unveil-africas-new-continental-cholera-plan/. Accessed 29 September 2025.

3. Kunda J. Africa unveils continental cholera emergency preparedness, response plan. https://www.aa.com.tr/en/africa/africa-unveils-continental-cholera-emergency-preparedness-response-plan/3669892. Accessed 29 September 2025.

4. Mwaba J, Debes AK, Shea P, Mukonka V, Chewe O, Chisenga C, et al. Identification of cholera hotspots in Zambia: A spatiotemporal analysis of cholera data from 2008 to 2017. PLoS Negl Trop Dis. 2020;14(4):e0008227.

5. Mbewe N, Tembo J, Kasonde M, Mwangilwa K, Zulu PM, Sereki JA, et al. Navigating the cholera elimination roadmap in Zambia – A scoping review (2013–2024). PLoS Negl Trop Dis. 2025;19(6):e0012422.

6. Hakayuwa CM, Sibomana O, Kalasa CS. Cholera

resurges in Zambia: Challenges and future directions. IJID Regions. 2025;15:100640.

7. Yolene G, Ravenell J, Steptoe R, Douglas D, Camille J, Castor C. Socio Ecological Model (SEM) and Diffusion of Innovation (DOI) Integrated Framework: A Proposal for Integration to Improve Intervention in the Digital Age of Medicine. Innov Pharm. 2024;15(4):10.24926/iip.v15i4.6271.

8. Rural Health Information Hub. Ecological Models - Rural Health Promotion and Disease Prevention Toolkit. https://www.ruralhealthinfo.org/toolkits/health-promotion/2/theories-and-models/ecological. Accessed 30 September 2025.

9. Chisanga A, Daka S, Masebe E, Mulenga R, Dorothy B, Saul Simbeye T, et al. An Assessment of the Knowledge, Practices and Attitudes towards Cholera Preventive Measures among Students at Lusaka Apex Medical University in Lusaka, Zambia. International Journal of Innovative Science and Research Technology (IJISRT). 2024;492–505.

10. International Growth Centre. Cholera in Zambia: Treating the causes, not the symptoms. International Growth Centre. 2018. https://www.theigc.org/blogs/cholera-zambia-treating-causes-not-symptoms. Accessed 4 October 2025.

Article One

Cholera Outbreak Investigation at a Secondary School in Kabwe, Zambia, April 2025: A Case-Control Study

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Abstract

Introduction: Cholera remains a significant public health threat in Zambia, with outbreaks commonly linked to inadequate water, sanitation, and hygiene (WASH) systems. In March 2025, a cholera outbreak was reported in Kabwe District, primarily affecting David Ramusho Secondary School and the surrounding Mine Compound. This investigation aimed to determine the source of infection, identify associated risk factors, and assess transmission dynamics to inform future interventions.

Methods: A case-control study was conducted involving 70 confirmed cholera cases and 70 matched community controls. Data were collected through structured interviews, environmental and sanitary assessments, and review of health facility records. Analysis was performed using R software, applying descriptive statistics to summarize participant characteristics and conditional logistic regression to identify factors independently associated with cholera infection.

Results: The median age of cases was 21 years (IQR: 6 - 20 years), and 50% were female. Most cases (35.7%) were aged 11 - 20 years, reflecting the school-based nature of the outbreak. The epidemic curve indicated a common point-source exposure followed by limited secondary transmission. Cases were significantly more likely than controls to rely on unsafe boreholes (57.1% vs. 28.6%, $p<0.01$), use pit latrines (50.0% vs. 21.4%, $p<0.01$), and consume untreated water (42.9% vs. 14.3%, $p<0.01$). Multivariate analysis showed that drinking untreated water (aOR = 4.00; 95% CI: 1.70–9.40), reliance on unsafe water sources (aOR = 3.20; 95% CI: 1.50–6.80), and poor sanitation (aOR = 2.80; 95% CI: 1.30–6.00) were the strongest predictors of infection.

Conclusion: The outbreak underscores the vulnerability of peri-urban populations due to unsafe water and poor sanitation. While the initial response was timely, challenges persisted in sustained control. Recommendations include strengthening household water treatment, improving sanitation infrastructure, enhancing health education, and instituting routine water quality monitoring. These measures are crucial for integrated WASH interventions and sustained preparedness to prevent future outbreaks in similar settings.

Keywords: Cholera, Outbreak investigation, Kabwe, Zambia, WASH, Case–control study, public health response

Introduction

Cholera is caused by toxigenic Vibrio cholerae serogroup O1 or O139 and is transmitted through the fecal-oral route. As such, infection is usually associated with drinking contaminated water, poor hygiene, and sanitation [1]. In endemic countries, cholera causes an estimated 2.86 million annual cases (uncertainty range: 1.3-4.0 million), resulting in approximately 95,000 deaths per year (uncertainty range: 21,000–143,000) (World Health Organization, 2022) [2]. Zambia's experience with cholera has been marked by fluctuating cases and an increase in numbers since 1977. The most recent cholera outbreak in Zambia occurred in 2023, and by 21st February 2024, the country had reported over 19,719 confirmed cases with 682 deaths, the majority of which were recorded in Lusaka, the capital city [2].

The implementation of Zambia's Multi-Sectoral Cholera Elimination Plan after the 2017 outbreak led to a temporary pause in outbreaks until the year 2022[3]. A vaccination campaign spearheaded by WHO was carried out following the 2024 outbreak, targeting 1.5 million people, with priority given to children, health workers, and people at most risk of infection in the worst-affected areas [4].

One of the most recent cholera outbreaks in Zambia was recorded at David Ramusho Secondary in Kabwe District. The outbreak began on 27th March 2025, when a female teacher from David Ramusho Secondary School presented with diarrhoea at Kasanda Health Centre. The following day, a 13-year-old female pupil from the same school presented with diarrhoea and vomiting and was seen at Kabwe Women and Newborn Children's Hospital. The pupil, a resident of Makululu Compound, was referred from Makululu Mini Hospital and immediately isolated. Cholera rapid diagnostic test (RDT) confirmed infection, and samples were collected for culture and sensitivity testing.

On 28th March 2025, a 15-year-old male pupil from the same school presented with similar symptoms and was admitted to Kabwe General Hospital. On the same day, 14 additional cases were reported across various health facilities: Kasanda Health Centre (10 cases), Makululu Mini Hospital (2 cases), Makululu Health Centre (3 cases), and Magandanyama Health Post (1 case). In response, Ngungu Health Centre was opened to accommodate rising cases. By 29th March 2025, a total of 37 new cases were recorded, bringing the cumulative total to 51 cases. Among these, 44 were pupils from David Ramusho School, with 27 females and 24 males affected. As of 29th March 2025, 13 patients had been discharged, while 37 remained admitted.

The outbreak spread rapidly, with 111 cases reported between 27th March and 8th April 2025, most linked to David Ramusho Secondary School and affecting residents across six wards that included David Ramusho, Moomba, Zambezi, Makululu, Chililalila, and Justine Kabwe. This paper presents findings from the cholera outbreak investigation conducted at the school and surrounding communities in Kabwe District, aimed at identifying the source of infection and assessing associated risk factors.

Methods

Design

A one-to-one case control study design was used. The study focused on case identification, environmental assessments to determine the source of infection and associated risk factors.

Study Setting

The study was conducted at David Ramusho Secondary School, with 1,200 pupils, and the surrounding high-density Mine Compound, home to over 35,000 residents in Kabwe. The area's WASH situation was poor, characterized by limited piped water and a reliance on unprotected boreholes and pit latrines. The school itself depended on a single, unprotected borehole and had insufficient sanitation facilities. These conditions made the location a high-risk environment and the epicenter of the cholera outbreak.

Sampling and Sample Size

The sample size of 70 cases and 70 controls was determined by including all confirmed cases identified in the outbreak up to the point of the investigation, constituting a census of known cases. An equal number of controls were then recruited to maximize the study's power to detect significant associations within the logistical constraints of the response.

Investigation team

The investigation team comprised of epidemiologists, environmental health officers, clinicians, and laboratory scientists. Clinicians and nurses from Kabwe District Health Office coordinated case management and patient follow-up, while two environmental health specialists conducted water and sanitation assessments in the school and the surrounding community.

Data Collection

Multiple data sources and collection methods were utilized to investigate the outbreak:

1. Record Review and Surveillance Data Analysis

A retrospective review of patient files and medical records from all affected health facilities was conducted to characterize the extent of the outbreak. This was complemented by an analysis of existing surveillance data to determine the magnitude, describe case trends, and calculate epidemiological characteristics such as age, gender, and geographic distribution.

2. Case-Control Study and Structured Interviews

A 1:1 matched case–control study was implemented. Cases (individuals meeting the case definition for cholera) were compared with controls (healthy individuals of the same age group, sex, and residence from the same community or school) to minimize confounding. Data on potential exposures, including water sources, sanitation practices, and hygiene behaviors, were collected from both groups using structured interviews administered via KoboToolbox.

3. Environmental Assessment and Sanitary Inspection

Environmental health specialists conducted inspections of water and sanitation infrastructure at the school and in the surrounding community. This involved tracing water sources, assessing the safety and maintenance of boreholes and latrines, and identifying potential points of faecal contamination.

4. Contact Tracing and Response Evaluation

Contact tracing was performed by interviewing confirmed cases to identify their close contacts, particularly within households and the school. These contacts were then monitored for the development of symptoms.

Data Analysis

The datasets were exported from KoboToolbox and analyzed using R software [9]. Descriptive statistics for categorical variables were summarized as frequencies and proportions. The distribution of cholera cases was visualized through tables and graphs based on demographic and clinical characteristics. To identify risk factors associated with cholera infection, conditional logistic regression was employed to calculate unadjusted and adjusted odds ratios with 95% confidence intervals.

Case definition used

Cases and controls were those epidemiologically linked to David Ramusho Secondary School and the surrounding Mine Compound in Kabwe district. The case definition described a suspected cholera case as any person presenting with acute watery diarrhea (≥ 3 loose stools in 24 hours) with/without vomiting, and who is a resident of Mine Compound, Kabwe District, on or after 26th March 2025. A Probable cholera case was any suspected case with an epidemiological link to a confirmed case or an area with ongoing cholera transmission within Mine Compound, Kabwe District, on or after 26th March 2025. A confirmed cholera case was a suspected case with Vibrio cholerae, confirmed by culture and/or PCR, from Mine Compound, Kabwe District, on or after 26th March 2025.

Ethical Considerations

This analysis was based on routine programmatic data collected during a public health emergency. It was covered by the umbrella protocol for the Field Epidemiology Training Program that was approved by the Zambian National Health Research Authority (NHRA) in 2023.

Results

Table 1 shows that cholera cases were predominantly aged 11–20 years, with no significant sex difference between groups. Cases were significantly more likely to rely on unsafe boreholes, use pit latrines, and drink untreated water compared to controls ($p<0.01$). Education level was also associated with infection, with fewer cases having a tertiary education ($p=0.04$). No difference was observed in oral cholera vaccine coverage between the two groups.

Table 1: Demographic Characteristics of Cholera Cases and Controls in Kabwe District, March 2025 (N=140)

Variable	Category/Value	Cases (N=70)	Controls (N=70)	Total (N=140)	p-value
Age Group	1–5 years	12 (17.1%)	8 (11.4%)	20 (14.3%)	**0.34**
	6–10 years	15 (21.4%)	10 (14.3%)	25 (17.9%)	
	11–20 years	25 (35.7%)	20 (28.6%)	45 (32.1%)	
	21–45 years	15 (21.4%)	25 (35.7%)	40 (28.6%)	
	46+ years	3 (4.3%)	7 (10.0%)	10 (7.1%)	
Sex	Male	35 (50.0%)	30 (42.9%)	65 (46.4%)	**0.41**
	Female	35 (50.0%)	40 (57.1%)	75 (53.6%)	
Education	No formal	10 (14.3%)	5 (7.1%)	15 (10.7%)	**0.04**
	Primary	15 (21.4%)	15 (21.4%)	30 (21.4%)	
	Secondary	30 (42.9%)	25 (35.7%)	55 (39.3%)	
	Tertiary	15 (21.4%)	25 (35.7%)	40 (28.6%)	
Water Source	Piped (Safe)	30 (42.9%)	50 (71.4%)	80 (57.1%)	**<0.01**
	Borehole/Unsafe	40 (57.1%)	20 (28.6%)	60 (42.9%)	
Toilet Type	Flush toilet	30 (42.9%)	50 (71.4%)	80 (57.1%)	**<0.01**
	Pit latrine	35 (50.0%)	15 (21.4%)	50 (35.7%)	
	No latrine	5 (7.1%)	5 (7.1%)	10 (7.1%)	
Water Treatment	Boiling/Chlorine	40 (57.1%)	60 (85.7%)	100 (71.4%)	**<0.01**
	Untreated	30 (42.9%)	10 (14.3%)	40 (28.6%)	
Received OCV*	Yes	50 (71.4%)	50 (71.4%)	100 (71.4%)	**1.00**
	No	20 (28.6%)	20 (28.6%)	40 (28.6%)	

*OCV - Oral Cholera Vaccine

Factors associated with cholera

The adjusted odds ratios (aOR) from the conditional logistic regression in figure 1 revealed that reliance on unsafe water was associated with more than a threefold increase in cholera risk (aOR = 3.20; 95% CI: 1.50–6.80), while poor sanitation, such as use of pit or no latrines, also increased the risk nearly three times (aOR = 2.80; 95% CI: 1.30–6.00). Failure to treat drinking water was the strongest predictor, with affected individuals being four times more likely to develop cholera (aOR = 4.00; 95% CI: 1.70–9.40). In contrast, being aged 21–45 years (aOR = 0.50; 95% CI: 0.20–1.20) and having tertiary education (aOR = 0.60; 95% CI: 0.25–1.40) showed a trend toward being protective, though these were not statistically significant.

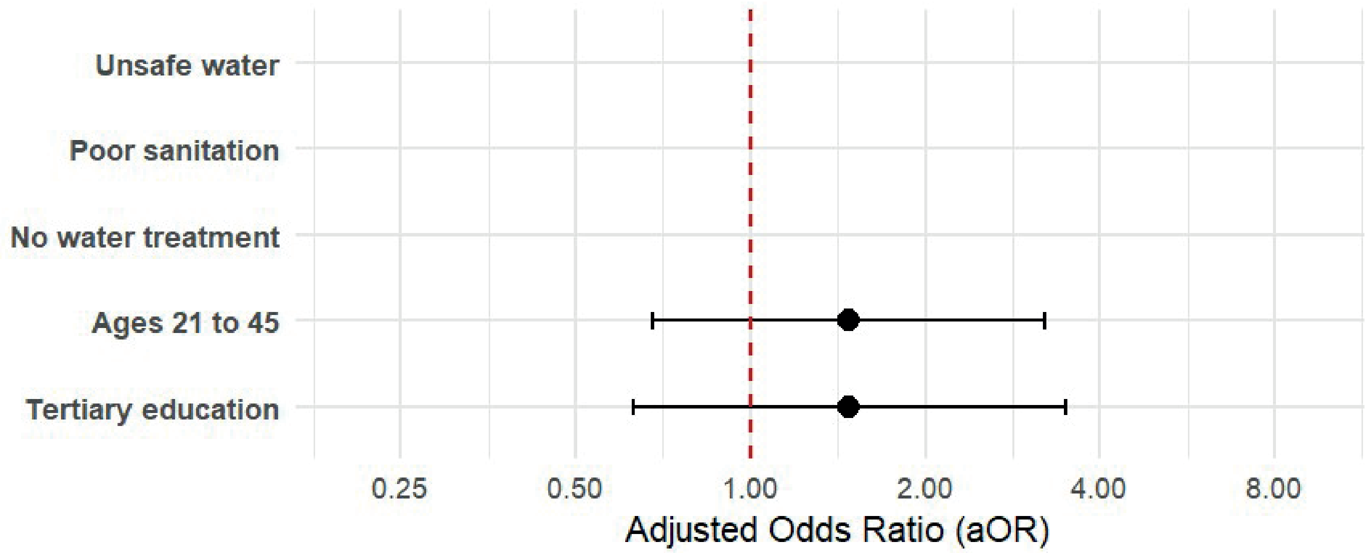

Fig 1: Factors Associated with Cholera at David Ramusho School in Kabwe District, 19th February to 13th May 2025 (N=140)

**aOR –Adjusted Odd Ratio*

Epidemic curve for cholera cases recorded in Kabwe district from 19th February to 13th May 2025

The epidemic curve in Fig. 2 shows a sharp primary peak following the index case, indicative of a common point-source exposure. A subsequent plateau and smaller peaks suggest ongoing person-to-person transmission within the community. The curve illustrates the outbreak's rapid onset and prolonged tail, highlighting the challenge of containing secondary spread despite initial control measures.

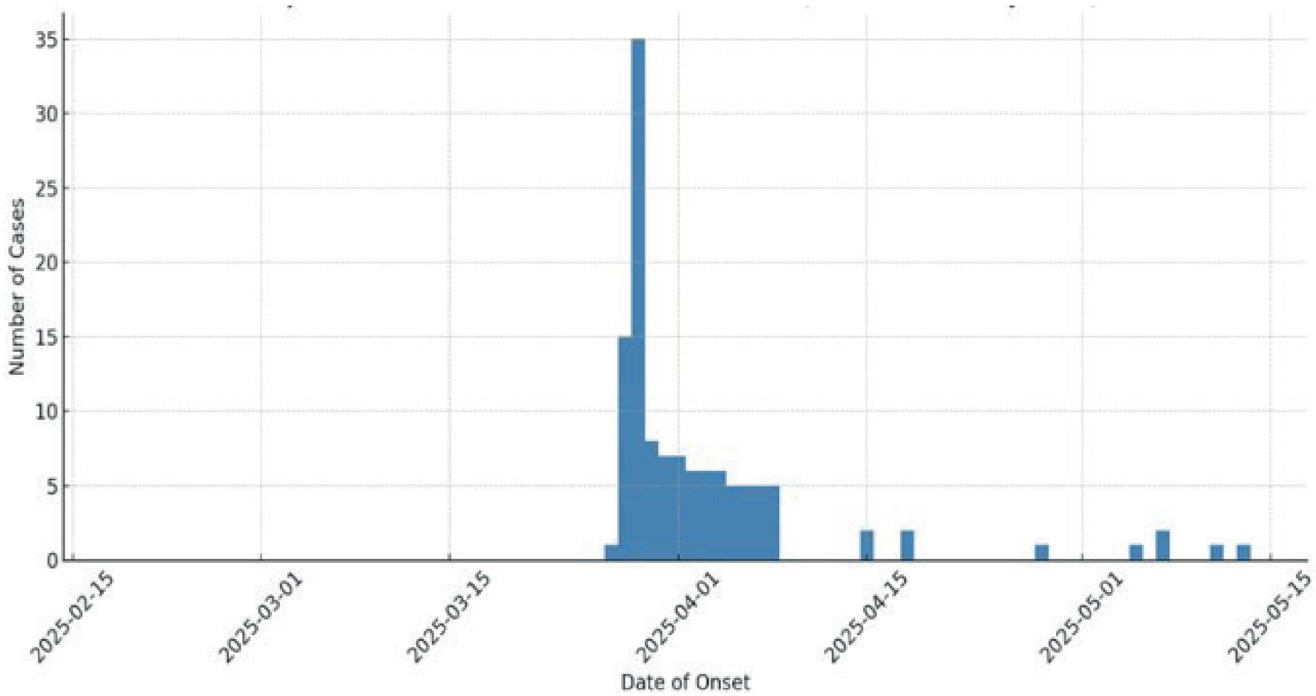

Fig 2: Epidemic curve for cholera cases recorded in Kabwe district from 19th February to 13th May 2025 (N=140)

Discussion

This study set out to investigate the cholera outbreak at David Ramusho Secondary School and the surrounding communities in Kabwe District in order to identify the source of infection, assess risk factors, and guide effective public health interventions. The investigation revealed that the primary risk factors were related to water safety and sanitation. Individuals relying on untreated and unsafe water sources were over three times more likely to develop cholera, a finding consistent with other studies in similar settings [5]. Similarly, poor sanitation, particularly the use of pit latrines or lack of latrines, was a significant contributor, underscoring the role of inadequate sanitation infrastructure in transmission [6]. These findings align with the known fecal-oral transmission pathways of Vibrio cholerae through contaminated water. Water treatment emerged as the most significant protective behavior, underscoring the importance of public health messaging on water boiling or chlorination [7]. Although OCV coverage was high, it did not show a protective effect, potentially due to reasons like strain mismatch, which has been noted in other outbreaks [8]. Demographic characteristics such as age and education initially appeared protective but lost significance in the multivariate model, indicating they may act as proxies for underlying behavioral or environmental exposures.

These findings are similar to a study conducted in Lusaka during the 2017 cholera outbreak, where reliance on untreated water and poor sanitation facilities were also identified as major risk factors [5]. Comparable results were reported in Kenya, where the use of unsafe water sources increased cholera risk more than threefold [6]. A study in Bangladesh equally demonstrated that untreated drinking water and inadequate sanitation infrastructure were the strongest drivers of cholera epidemics [7]. These consistencies across multiple contexts highlight that the Kabwe outbreak fits within a broader global pattern, reinforcing the need for sustainable WASH interventions as a cornerstone of cholera prevention and control.

Limitations

This investigation had several limitations that included recall bias, which could have affected the accuracy of data collected from case interviews, particularly concerning histories of food and water consumption. Second, contact tracing was incomplete, potentially leading to an undercount of secondary cases due to reluctance to report symptoms and losses to follow-up. Finally, the extensive environmental contamination, characterized by poor sanitation and multiple contaminated water sources, complicated efforts to pinpoint a single definitive source of infection.

Public health response and implications

The Kabwe cholera outbreak highlights critical implications for public health preparedness and response. Shortages of IV fluids and oral rehydration salts underscored the importance of pre-positioned medical supplies and resilient supply chains. Incomplete contact tracing and delayed water testing emphasized weaknesses in surveillance and laboratory systems, limiting timely corrective measures. The identification of schools as high-risk transmission sites points to the need for targeted WASH interventions, including borehole audits and provision of safe water points. Sustained investment in WASH infrastructure, coupled with intensified community engagement, is essential to break recurrent transmission cycles and strengthen future outbreak prevention and control.

Conclusion and Recommendations

The Kabwe cholera outbreak underscores the critical role of unsafe water, poor sanitation, and inadequate preparedness in sustaining transmission. To prevent future outbreaks, it is recommended that households adopt water treatment methods such as chlorine and boiling, while schools and communities establish adequate handwashing facilities with soap.

District health authorities should intensify health education campaigns to raise awareness about waterborne diseases and promote preventive behaviours. The Local Council should strengthen waste management systems, including safe sewage disposal in high-risk areas, and institutionalise routine water quality testing for early detection of contamination. Sustained investment in WASH infrastructure, community engagement, surge staffing, and pre-positioning of cholera supplies is essential to enhance outbreak preparedness and response.

References

1. World Health Organization. Cholera. Available from: https://www.who.int/news-room/fact-sheets/detail/cholera

2. World Health Organization. (2022). Cholera Annual Report 2021. Weekly Epidemiological Record, 97(40), 485–500

3. Zulu M, Banda T, Sitali L. Cholera outbreak in Zambia: Lessons from 2017. Zambian J Public Health. 2018;6(2):45-52.

4. Ministry of Health, Zambia. Annual report on cholera response in Zambia. Lusaka: Ministry of Health; 2017.

5. Ochieng J, Ngugi H, Kamau R. Environmental factors influencing cholera spread in urban areas. J Environ Health. 2020;82(4):234-240.

6. Nanzaluka FH, et al. Risk factors for epidemic cholera in Lusaka, Zambia—2017. Am J Trop Med Hyg. 2020.

7. Ochieng J, Ngugi H, Kamau R. Environmental factors influencing cholera spread in urban areas. J Environ Health. 2020.

8. World Health Organization. Water, sanitation, and hygiene (WASH) for cholera prevention and control. WHO guidelines. 2021.

9. Gulumbe BH, et al. Zambia's battle against cholera outbreaks and the path to public health resilience: a narrative review. J Water Health. 2024.

10. Kobo Toolbox. (2021). KoBoToolbox: Data collection tools for challenging environments. Harvard Humanitarian Initiative. Available at: https://www.kobotoolbox.org

Article Two

Konzo Disease: A household survey conducted in Mutondo community, Luampa district, Zambia

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Abstract

Introduction:

Konzo is a neglected neurological disease characterized by sudden, non-progressive paralysis of the lower limbs, commonly linked to chronic consumption of cyanogenic cassava combined with protein deficiency. Since 2007, sporadic cases have been reported in Western Zambia, with recent clustering in Mutondo zone of Nakayembe catchment in Luampa District. This study aimed to describe household-level risk factors and provide a crude prevalence estimate for Konzo in Mutondo community.

Methods:

We conducted a descriptive cross-sectional household survey in Mutondo Zone, a rural community under Nakayembe Rural Health Centre in Luampa District. Data were collected using a structured questionnaire administered electronically via KoboToolbox to 50 household heads or their next of kin aged 18 years and above. Information was obtained on demographic and socio-economic characteristics, cassava dependency, processing and consumption practices, protein intake, and knowledge of Konzo. A suspected Konzo case was defined as any individual presenting with symmetric, non-progressive paraparesis consistent with the WHO case definition. Data were analyzed using R software, with categorical variables summarized as frequencies and proportions, and continuous variables as medians.

Results:

Of the 50 households surveyed, 32 (64%) were headed by males. Thirty-six percent (36%) of household heads had no formal education, and all respondents (100%) were engaged in informal employment. Nearly all (94%) depended on cassava as their main staple, and a quarter (26%) reported inadequate processing practices. Protein intake was low, with over 90% consuming protein-rich foods less than twice per week. While most respondents (94%) had heard of Konzo, only 38% recognized its link to cassava or recognised preventive measures. Thirty-seven suspected cases of Konzo were identified, yielding a crude prevalence of about 12% in the surveyed population.

Conclusion:

Konzo remains a significant public health concern in Mutondo Community, driven by heavy cassava reliance, poor processing practices, and low dietary protein intake. Targeted interventions to improve cassava processing, diversify food sources, and enhance community awareness are urgently needed to prevent further cases.

Keywords: Konzo, spastic paraparesis, cyanide toxicity, malnutrition, household survey, Zambia

Introduction

Konzo is a severe paralytic disease that predominantly affects poor rural populations in Africa (1). The World Health Organization defines it as a distinct upper motor neuron disorder characterized by the sudden onset of a symmetric, non-progressive, but permanent paralysis of the legs (2). It is caused by chronic exposure to cyanide from inadequately processed bitter cassava and worsened by protein deficiency. The disease presents with spastic paraparesis, often affecting the legs more severely than the arms, and in severe cases may also involve blurred vision, speech difficulties, and weakness. Though it resembles other neurological disorders, Konzo is distinct in its rapid onset and lack of progression (3,4). Since it was first identified in 1938, Konzo has been reported in several African countries, including the Democratic Republic of Congo, Mozambique, Tanzania, Cameroon, Angola, and the Central African Republic (5-9).

The prevalence of Konzo is influenced not only by dietary practices but also by socio-economic hardships such as war, drought, and poverty, which drive cassava dependence and unsafe processing practices (1). Globally, Konzo and other forms of spastic paraparesis occur endemically in the Tropics, largely driven by chronic malnutrition and dietary reliance on cyanide-producing staple crops such as bitter cassava, yams, and millet, which predispose affected populations to neurotoxicity and upper motor neuron damage (10). In Southern Africa, it is more prevalent in the Congo, with an estimated prevalence of between 0.1% and 17% (11). The earliest cases of Konzo in Zambia, were reported in Western Province (12), where it is commonly known to the locals as "liweyenga", a Lozi term that means loss of voluntary muscle control. To the best of our knowledge, the prevalence of konzo disease in this province has not yet been estimated.

Luampa District, situated in Western Zambia, has been recording cases of suspected Konzo disease. According to disease surveillance reports from the District Health Office (DHO), an increase was observed in the number of reported cases of suspected Konzo, particularly over the past year 2024 (n =37), making it a significant public health concern in the district. This rise was notable in the Nakayembe health center catchment area, where most cases (n = 26) were reported during that period. Mutondo health zone, situated within Nakayembe, accounted for 54% (n=14) in that year alone. Between January and July of 2025, 15 cases were reported in the District. Although no reliable prevalence estimates exist for Luampa, documented risk factors, including high cassava dependency, poor processing methods, low protein intake, and poverty (12-14), are well established in this community. Building on earlier observations, this study was undertaken to estimate the prevalence and explore the demographic, nutritional, and behavioral characteristics that drive Konzo in a localized setting of Luampa District.

Methods

Study Design

We conducted a descriptive cross-sectional study to assess household characteristics and knowledge of Konzo disease, as well as to identify suspected Konzo cases in Mutondo Zone, Luampa District, Western Zambia. Data were collected through household surveys using a structured questionnaire.

Study Setting

The study was conducted in Mutondo Zone, a remote community served by Nakayembe Rural Health Centre in Luampa District, Western Province of Zambia. The zone comprises eight villages, where subsistence farming is the main source of livelihood. Households rely heavily on cassava as a staple food and on unsafe surface water sources, and generally experience poor sanitation conditions. Mutondo Zone was purposively selected due to the high burden of Konzo cases reported by the District Health Office (DHO) between 2024 and 2025.

Study Population and Sampling

The study population comprised household heads residing in Mutondo Zone. From the eight villages in the zone, four villages were randomly selected for inclusion. A total of 50 household heads were targeted for interviews. Eligible respondents were household heads or, in their absence, their next of kin, aged 18 years or older, who had resided in the zone and provided informed consent. Households without an available respondent or those unwilling to participate were excluded from the survey.

Data Collection

Data were collected using a structured questionnaire administered electronically via KoboToolbox through face-to-face interviews with respondents. Information gathered included the age, sex, education level, religion, and employment status of household heads. In addition, data were collected on cassava dependency, cassava processing and consumption practices, protein intake, and knowledge of Konzo disease. Demographic and clinical data were also obtained for all suspected Konzo cases reported within each household.

Case Definition

A suspected case of Konzo was defined as an individual residing in a surveyed household who presented with symmetric, non-progressive paraparesis, consistent with the World Health Organization (WHO) case definition of Konzo (2).

Data Analysis

Data were exported from KoboToolbox and analyzed using R statistical software. Descriptive statistics were applied to summarize the data. Categorical variables were presented as frequencies and proportions, while continuous variables were summarized as medians.

To estimate the crude prevalence of Konzo in Mutondo Zone, the total number of suspected cases identified during the survey was divided by the estimated total number of individuals represented in the surveyed households. Assuming an average household size of six and a population of approximately 800–1,000 people, the 50 surveyed households (about 300 individuals) represented roughly one-third of the community. This descriptive estimate provided a preliminary understanding of Konzo occurrence in the study area.

Ethical considerations

This analysis was based on routine programmatic data collected during a public health emergency. It was covered by the umbrella protocol for the Field Epidemiology Training Program that was approved by the Zambian National Health Research Authority (NHRA) in 2023.

Results

1. Household-level Demographic characteristics at the household level

The median household size was six members per household, with a median of three children under age 10 and one woman aged 15–44 per household. Male household heads (HH) made up 64% of the surveyed households, and the median age of household heads was 36 years. The majority (74%) had lived in the area for over 10 years, 60% had attained primary education, and all were engaged in informal employment. Christianity was the only reported religion (Table 1).

Table 1: Demographic characteristics of households and household heads in Mutondo community, Luampa, Zambia, August 2025 (N=50)

Characteristics	**Median (IQR*)**
Household characteristics	
Household members	6 (5, 8)
Children <10 years	3 (2, 3)
Women aged 15 - 44	1 (1, 2)
Median age (H-Heads)	36 (27, 51)
Characteristics of H-Heads	**Number (%)**
Gender of H-Head	
Female	18 (36)
Male	32 (64)
Years lived	
1–4 years	5 (10)
5–9 years	8 (16)
10+ years	37 (74)
Level of Education	
No formal education	18 (36)
Primary	30 (60)
Secondary	2 (4.0)
Tertiary	0(0)
Type of employment	
Informal employment	50 (100)
formal employment	0 (0)
Religion	
Christian	50 (100)
Other	0(0)

*IQR – Interquartile Range

Dietary and nutritional characteristics at the household level

A cassava-based diet was predominant in 94% of households, with soaking being the main processing method (98%). Most households (86%) lacked access to clean water for processing. Protein intake was low, with 92% consuming protein-rich foods only once or twice per week, mainly beans (Table 2).

Table 2: Dietary and Nutritional Practices at the Household-Level in Mutondo Community, 2025 (N=50)

Characteristic	Number (%)
Cassava-dominated diet	
No	3 (6.0)
Yes	47 (94)
Weekly cassava intake	
Few (1–2 meals)	1 (2)
Moderate (3–5 meals)	2 (4)
Most (6+ meals)	47 (94)
Preferred method of processing	
Other	1 (2.0)
Soaking	49 (98)
Soaking period	
1–2 days	13 (26)
3–4 days	17 (34)
5+ days	20 (40)
Access to clean water (Cooking/Drinking)	
No	43 (86)
Yes	7 (14)
Weekly protein intake	
Few (1–2 meals)	46 (92)
Moderate (3–5 meals)	4 (8.0)
Type of protein	
Beans only	14 (28)
Beans & Fish	3 (6.0)
Beans, Fish, & Meat	1 (2.0)
Eggs only	1 (2.0)
Fish & Other	1 (2.0)
Other	30 (60)

*Categorical variable = n(Percentage)

Knowledge of Konzo disease at the household level

Most (94%) household heads had heard about Konzo, which they commonly referred to as “liweyenga”. The majority (56%) reported that they did not know the cause of Konzo disease, while the rest reported cassava poisoning (38%) and spiritual causes such as witchcraft (6%). Only 38% of the respondents indicated proper cassava processing as a way of preventing Konzo (Table 3).

Table 3: Head of Household Knowledge Assessment on Konzo Disease in Mutondo Community,2025 (N = 50)

Knowledge area	Number (%)
Heard about Konzo	
No	3 (6.0)
Yes	47 (94)
Cause of Konzo	
Cyanide from cassava	19 (38)
Spiritual/witchcraft	3 (6.0)
Don't know	28 (56)
How to prevent Konzo	
Proper processing	19 (38)
Stop eating cassava	4 (8.0)
Other	1 (2.0)
Don't know	26 (52)

2. Case-level Demographic and clinical characteristics of suspected Konzo cases

A total of 37 suspected Konzo cases were identified across 17 households, with a slight female predominance (54%) and a median age of 8 years. Nearly half (49%) developed symptoms in 2025, and most (59%) remained symptomatic at the time of the survey, while 35% had recovered and 5% had died (Table 4).

Table 4: Demographic and clinical characteristics of 37 suspected Konzo cases in Mutondo zone, Luampa District, Zambia, 2025 (N = 37)

Characteristic	Number (%)
Median age [media (IQR*)]	8 (6, 17)
Gender	
Female	20 (54)
Male	17 (46)
Year of Onset	
2023 or before	14 (38)
2024	5 (14)
2025	18 (49)
Outcome	
Alive - Recovered	13 (35)
Alive - Sick	22 (59)
Deceased	2 (5.4)

*IQR – Interquartile Range

Clinical profile for suspected Konzo cases

Ankle clonus and generalized weakness were two of the most frequently reported clinical symptoms, with each occurring in 46% of cases (Fig. 1). Other self-reported symptoms included impaired gait and disability to walk (Not shown).

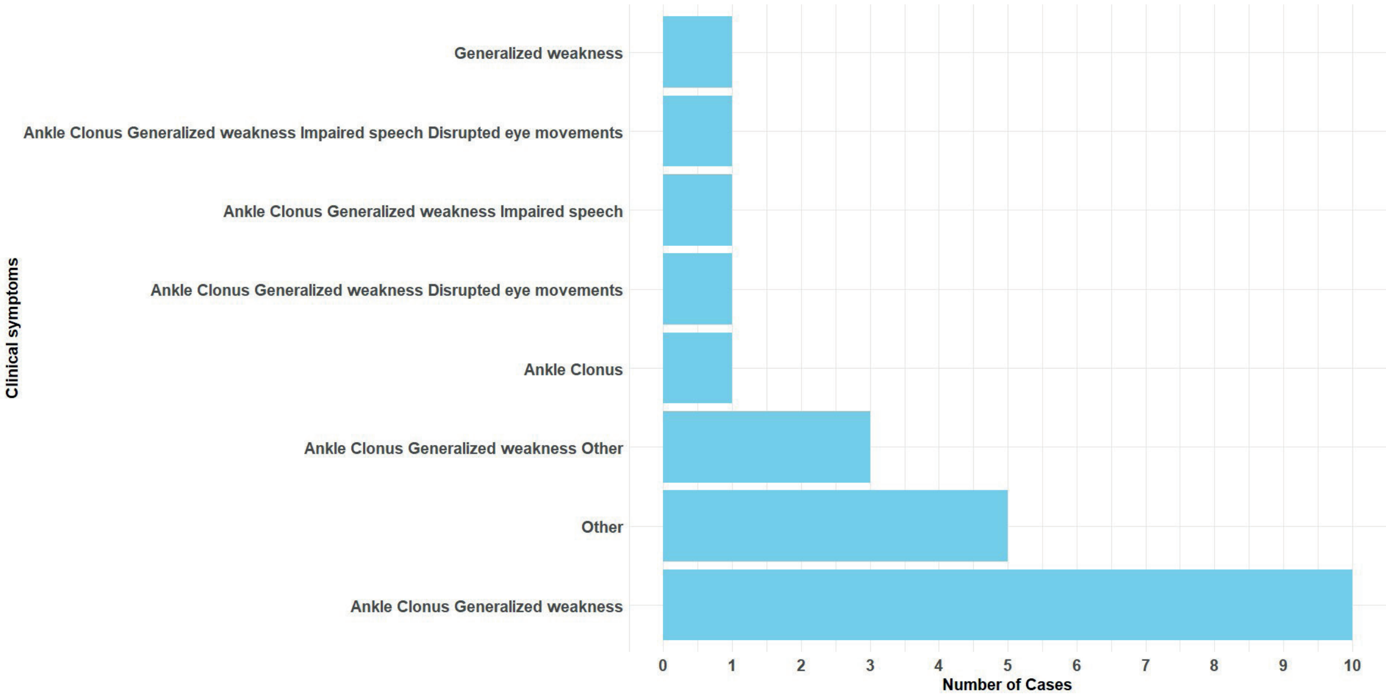

Figure 1: Reported symptoms from 37 Konzo cases in Mutondo Community, 2025 (N = 37)

Estimation of the prevalence of suspected Konzo cases in Mutondo Community

From the 50 surveyed households, a total of 37 individuals met the symptom-based criteria for suspected Konzo. Given an estimated population of 800–1,000 people in Mutondo zone and an average household size of six, the surveyed households represented roughly one-third of the community. This corresponds to a crude prevalence of approximately 12% among the surveyed population.

Discussion

This survey, conducted in the Mutondo zone, describes household and community vulnerabilities that predispose to Konzo in Luampa District. It demonstrates that the persistence of Konzo reflects overlapping vulnerabilities driven by food insecurity, inadequate cassava processing, and poor nutritional conditions, which could also be attributed to poor socio-economic conditions, though not assessed in this study (6,15,16). Our study found that households were largely dependent on poorly processed cassava as their staple food, with limited access to protein-rich alternatives. The interplay of these conditions, coupled with the reported low education levels, could provide circumstances that facilitate the prevalence of Konzo, aligning with patterns observed in previous outbreaks in Central and Southern Africa (5,7,8).

Most households were male-headed with low levels of formal education and employment. These factors likely reduce opportunities for dietary diversity and resilience against food insecurity, making communities more dependent on cassava as the primary staple. The persistence of such structural vulnerabilities explains the clustering of Konzo cases in Mutondo and mirrors observations from other affected countries, where poverty and low literacy are correlated with Konzo outbreaks (5,6,17).

Nearly all surveyed households relied on cassava as their primary food source, consuming it daily. Importantly, a significant proportion of households reported shortened soaking times, which compromises detoxification and leaves residual cyanide in the food chain. This pattern of reliance on cassava combined with inadequate processing practices aligns with prior outbreak investigations in the Democratic Republic of Congo and Mozambique, where food insecurity and resource constraints compelled households to cut corners in cassava preparation.

Protein intake was observed to be low, with most households consuming protein-rich foods only once or twice weekly. Since sulfur-containing amino acids are required to detoxify cyanide, this deficiency heightens susceptibility to Konzo (18). Our study findings align with prior nutritional studies that describe Konzo as both a toxicological and nutritional disease (5,18). Addressing protein access challenges through the promotion of livestock, fish farming, or legumes remains critical for ensuring an optimal mix of nutrients, there-by reducing the risk that comes with relying on cassava consumption.

Although nearly all respondents were aware of Konzo, only a minority linked it to cassava consumption or recognized safe processing practices as preventive measures. This gap between general awareness and specific knowledge reflects a critical barrier to behavioral change and underscores the need for community education that translates awareness into safe food practices (17).

According to our results, most cases occurred in children and women, consistent with the literature, which highlights these groups as being disproportionately affected. Previous studies show that children are more vulnerable due to dietary exposure relative to body weight (9), while women often bear the responsibility for cassava processing and food preparation (13). The long-term disability observed among young victims also has serious socio-economic consequences for affected households.

However, the study also raises important diagnostic considerations. Konzo is defined as a permanent, non-progressive neurological condition, yet some reported cases in Mutondo were described as having "recovered." This discrepancy suggests possible misclassification, likely due to reliance on self-reported histories from household heads without clinical verification. In a community with poor access to healthcare, it is possible that other neurological conditions, such as acute flaccid paralysis, nutritional neuropathy, post-infectious paralysis, or Guillain–Barré syndrome, were mistakenly reported as Konzo (3,4,19). While the risk environment aligns strongly with classical Konzo determinants, the absence of confirmatory neurological examinations or laboratory tests (e.g., blood cyanide or thiocyanate levels) limits diagnostic certainty.

The observed crude prevalence of approximately 12% among surveyed households indicates a substantial burden of suspected Konzo in Mutondo. This estimate aligns with prevalence ranges reported in other endemic regions such as the Democratic Republic of Congo (11), underscoring the persistent vulnerability of affected communities. Epidemiologically, this suggests that Konzo remains an endemic nutritional neurotoxic disorder in Luampa District, reflecting chronic dietary exposure and socioeconomic deprivation. From a public health perspective, such a high prevalence calls for urgent nutritional surveillance, community sensitization on cassava processing, and strengthened district-level monitoring systems. While this figure provides a preliminary indication of the disease burden in the area, it should be interpreted with caution, given the small sample size and the absence of clinical or laboratory confirmation.

Overall, the study highlights Mutondo as a high-risk setting for Konzo, shaped by cassava dependence, inadequate processing, protein deficiency, and limited actionable knowledge. At the same time, it underscores the need for more rigorous epidemiological investigations with clinical and laboratory confirmation to strengthen the evidence base for surveillance and intervention strategies.

Strengths and Limitations

Our study provides rare, community-based evidence on Konzo disease from a rural, underrepresented setting in Zambia, contributing novel insights into its nutritional and socio-economic determinants. Conducted in a hard-to-reach area, the study captures real-world conditions that shape disease vulnerability. However, several limitations should be noted including the lack of a comprehensive socio-economic assessment that incorporates poverty and income levels of the households The expanded case definition, which included individuals with sudden lower-limb paralysis or neuropathic symptoms beyond classical Konzo, may have introduced misclassification bias. The absence of laboratory confirmation, such as blood cyanide testing, limited diagnostic precision, while reliance on household head reports could have led to recall or reporting bias. Furthermore, the small sample size of 50 households from a single zone constrains the generalizability of findings and limits the statistical strength of conclusions, making these results primarily exploratory rather than inferential.

Conclusion and Recommendations

The findings of this study indicate that Konzo remains a public health concern in Mutondo, primarily driven by cassava dependence, inadequate processing practices, limited access to clean water, and low protein intake. Despite high awareness, few households understood the connection between the disease and cassava, or its prevention.

Addressing Konzo in Luampa requires a coordinated, community-based approach. The District Health Office should strengthen diagnostic capacity, establish local surveillance systems, and promote safe cassava processing through partnerships with stakeholders such as the United Nations Children's Emergency Fund

(UNICEF) and the Churches Health Association of Zambia (CHAZ). Improving food security and access to protein through small livestock, fish farming, and legumes is also essential.

Health education using local languages and community structures, such as Neighbourhood Health Committees, schools, and churches, should reinforce practical prevention messages. Together, these measures can reduce Konzo risk and enhance community resilience.

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References

1. Okitundu D, et al. The phenomenology and epistemology of konzo: Readings from the Kahemba Outbreak, Democratic Republic of Congo. Part I: Socioeconomic aspects. Vol. 333, Journal of the Neurological Sciences. 2013.

2. World Health Organization:WHO's first ever global estimates of foodborne diseases find children under 5 account for almost one third of deaths [Internet]. [cited 2025 Sep 30]. Available from: https://www.who.int/news/item/03-12-2015-who-s-first-ever-global-estimates-of-foodborne-diseases-find-children-under-5-account-for-almost-one-third-of-deaths

3. Owolabi JO. Neuroepidemiology: Perspectives from Africa. Vol. 55, Neuroepidemiology. 2021.

4. Mtonga A, Mwaba P, Mazaba M, Chizema E, Kapina M, Mwangala S, et al. Increased Sensitization of Health Workers Leading to Detection of Unintended Cases of Acute Flaccid Paralysis: A Case of a "Konzo" Outbreak in Western Zambia. Med J Zambia. 2016;43(2):57–60.

5. Tshala-Katumbay D, Mumba N, Okitundu L, Kazadi K, Banea M, Tylleskär T, et al. Cassava food toxins, Konzo disease, and neurodegeneration in sub-Sahara Africans. Vol. 80, Neurology. 2013.

6. Howlett WP, Brubaker GR, Mlingi N, Rosling H. Konzo, an epidemic upper motor neuron disease studied in tanzania. Brain. 1990;113(1).

7. Boivin MJ; Caregiver Training to Prevent Konzo Disease in Children in Democratic Republic of Congo. Case Med Res. 2019

8. Kombi JM, Kahemba DLM, Mayambu JPB, Boivin M, Tamfum JM, Ngoy DM, et al. Clinical and biological characterization of konzo forms in children in Kahemba/Democratic Republic of Congo. J Neurol Sci. 2019;405.

9. E-Andjafono DOL, Ayanne MTSS, Makila-Mabe GB, Mayambu JPB, Ngoyi DM, Boivin M, et al. Socioemotional disorders in children living in Konzo-affected areas, an epidemic paralytic disease associated with cyanide poisoning from food in sub-Saharan Africa. Pan Afr Med J. 2018;31.

10. Román GC. Tropical spastic paraparesis. Handb Clin Neurol [Internet]. 2023 Jan 1 [cited 2025 Oct 5];196:149–56. Available from: https://www.sciencedirect.com/science/article/abs/pii/B9780323988179000260

11. Banea J, Bradbury J, Nahimana D, Denton I, N., Mashukano, et al. Survey of the konzo prevalence of village people and their nutrition in Kwilu District, Bandundu Province, DRC. Aust J Fr Stud. 2015 Feb 28;9(2):43–50.

12. Siddiqi OK, Kapina M, Kumar R, Ngomah Moraes A, Kabwe P, Mazaba ML, et al. Konzo outbreak in the Western Province of Zambia. Neurology. 2020 Apr 7;94(14):E1495–501.

13. Baguma M, Nzabara F, Maheshe Balemba G, Malembaka EB, Migabo C, Mudumbi G, et al. Konzo risk factors, determinants and etiopathogenesis: What is new? A systematic review. Vol. 85, NeuroToxicology. Elsevier B.V.; 2021. p. 54–67.

14. Baguma M, Malembaka EB, Bahizire E, Mudumbi GZ, Shamamba DB, Matabaro AN, et al. Revisiting konzo risk factors in three areas differently affected by spastic paraparesis in eastern democratic republic of the congo discloses a prominent role of the nutritional status—a comparative cross-sectional study. Nutrients. 2021 Aug 1;13(8).

15. Adamolekun B. Etiology of Konzo, epidemic spastic paraparesis associated with cyanogenic glycosides in cassava: Role of thiamine deficiency? J Neurol Sci. 2010;296(1-2).

16. Tylleskär T, Howlett WP, Rwiza HT, Aquilonius SM, Stâlberg E, Linden B, et al. Konzo: A distinct disease entity with selective upper motor neuron damage. J Neurol Neurosurg Psychiatry. 1993;56(6).

17. Bokundabi G, Haskins L, Horwood C, Kuwa C, Mutombo PB, John VM, et al. When knowledge is not enough: barriers to recommended cassava processing in resource-constrained Kwango, Democratic Republic of Congo. J Public Health Africa. 2023;14(5).

18. Ngudi DD, Kuo YH, Lambein F. Cassava cyanogens and free amino acids in raw and cooked leaves. Food Chem Toxicol. 2003;41(8).

19. Rwatambuga FA, Ali ER, Bramble MS, Gosschalk JE, Kim M, Yandju DL, et al. Motor control and cognition deficits associated with protein carbamoylation in food (cassava) cyanogenic poisoning: Neurodegeneration and genomic perspectives. Food Chem Toxicol. 2021;148.

Article Three

Integrated public health response to the 2025 cholera outbreak in Northern Province, Zambia: implementation, early outcomes, and lessons.

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Abstract

Background: Cholera remains a recurring public health emergency in Zambia, particularly in lakeshore and border districts, where inadequate water, sanitation, and hygiene (WASH) infrastructure increases the risk of transmission. In August 2025, an outbreak that started in Mpulungu District spread to Nsama and Mbala, triggering the activation of Zambia's integrated outbreak response frameworks. This paper outlines the outbreak's epidemiological progression and evaluates implementation, challenges, and lessons learned from the integrated multi-pillar response in these high-risk, hard-to-reach settings.

Methods: We conducted a descriptive analysis of the response from August 5 to September 24, 2025, using surveillance line lists, laboratory registers, situation reports, and partner activity records. The analysis focused on how the 7-1-7 framework, Incident Management System (IMS), Case Area Targeted Interventions (CATI), risk communication and community engagement (RCCE), WASH/IPC measures, and Oral Cholera Vaccination (OCV) preparedness were operationalized within a multi-pillar coordination structure.

Results: By September 24, 2025, there were 239 cholera cases and two deaths (case fatality rate of 0.8%) reported across the three districts. Early detection and quick IMS activation met the 7-1-7 timeliness targets. CATI allowed rapid containment of emerging clusters through household disinfection and contact tracing, while WASH and RCCE efforts reached over 58,000 people. Preparatory OCV micro-planning was completed in Mpulungu and Nsama

However, implementation faced several challenges, including transport and fuel shortages, limited trained personnel, weak real-time data systems, and a shortage of multilingual RCCE materials in remote areas.

Conclusions: The 2025 outbreak demonstrated the effectiveness of Zambia's integrated, multi-pillar cholera response. Enhancing decentralized rapid-response capabilities, investing in digital surveillance and multilingual communication, and improving cross-border coordination for CATI and OCV campaigns will be essential to maintain progress toward cholera elimination.

Keywords: Cholera, Zambia, Outbreak response, WASH, 7-1-7 Framework, Case Area Targeted Interventions, Oral Cholera Vaccination.

Introduction

Cholera remains a major global public health threat, with an estimated 1.3–4.0 million cases and 21,000–143,000 deaths each year (1). Although largely preventable through proper water, sanitation, and hygiene

(WASH), ongoing transmission reflects underlying social inequalities. Systematic reviews indicate that WASH factors have a strong influence on cholera risk and that properly implemented WASH measures effectively reduce transmission (2,3). In sub-Saharan Africa, recurrent outbreaks are persistent and predictable, with high-risk areas marked by weak WASH infrastructure and rapid, often unplanned urban growth. (4,5). Furthermore, hydro-climatic factors, including floods and droughts, influence seasonal patterns and increase risk (6,7). Additionally, cross-border movement of populations further spreads the disease and complicates control efforts along international routes (8). These combined factors strain health systems and delay effective responses, even when technical guidance exists (5,6).

In August 2025, the Africa CDC and WHO launched the Continental Cholera Response Plan (9) during an event in Lusaka, Zambia. Driven by the African Union (AU) and championed by President Hakainde Hichilema, this initiative seeks to eradicate cholera across Africa by 2030. It focuses on coordinated surveillance, swift response, broader vaccination efforts, and improved WASH systems. The plan will be implemented by a joint Incident Management Support Team (IMST) and signifies a renewed continental commitment to unified, cross-border strategies aimed at eliminating cholera.

Zambia has experienced cholera outbreaks since the late 1970s, with the first documented epidemic recorded in 1977 (10). Large-scale epidemics have recurred periodically, often affecting densely populated peri-urban settlements in Lusaka and the Copperbelt (Hosea et al., 2008; Zambia's Battle Against Cholera, 2023).

In recent decades, more than 30 outbreaks have been documented nationwide (11). Particularly, lakeshore and border districts such as Mpulungu, Nsama, and Mbala are increasingly recognized as high-risk zones due to long-standing deficits in safe water supply, reliance on unprotected water sources, and cross-border population movement associated with fishing, trade, and seasonal migration (12,13). These ecological, infrastructural, and mobility-related risk factors create favourable conditions for both the introduction of Vibrio cholerae and sustained local transmission.

To respond to cholera outbreaks in Zambia's most vulnerable districts, the Zambia National Public Health Institute, whose mandate is to safeguard public health security, adopts globally endorsed response frameworks that Rapid Response Teams (RRT) utilize, namely: the 7-1-7 target for outbreak response timeliness (disease detection within seven days of occurrence, notification or reporting within a day, and response with seven days of notification) (14); Incident Management Systems (IMS) to organize coordination; Case Area Targeted Interventions (CATI) for targeted cluster containment (15); and Oral Cholera Vaccination (OCV) to reduce community susceptibility. These strategies are complemented by surveillance, WASH as part of Infection Prevention and Control (IPC), case management, and risk communication and community engagement (RCCE). However, there is a scarcity of detailed descriptions of how these frameworks work together in remote lakeshore and border areas. The 2025 cholera outbreak in Zambia presents a critical opportunity to document early lessons from Zambia's response in hard-to-reach settings.

On August 5, 2025, a Tanzanian national presented at Chipwa Rural Health Centre in Mpulungu with severe watery diarrhea. Rapid diagnostic testing confirmed the presence of cholera, and epidemiological tracing linked the index case to a cross-border movement along Lake Tanganyika. By late September, the transmission had spread to Nsama, Mbala, and Senga Hill districts, necessitating a multi-level deployment of interventions. This study, therefore, aims to: (1) outline the outbreak's epidemiological progression and (2) evaluate implementation, challenges, and lessons learned from the integrated multi-pillar response in these high-risk, hard-to-reach settings.

Methods

Study design and setting

This descriptive programmatic analysis examined Zambia's integrated cholera response to the 2025 outbreak in Mpulungu, Nsama, and Mbala districts of the Northern Province. These districts, situated along the southern shores of Lake Tanganyika, represent a high-risk cholera corridor characterized by fishing activities, unprotected water sources, limited sanitation infrastructure, and frequent cross-border population movement with Tanzania. The analysis covered August 5–September 24, 2025, from the index cholera case detection to the latest consolidated situation report (latest consolidated situation report).

Data sources and integration

The study utilized routine programmatic data collected during the 2025 cholera outbreak response in Zambia's Northern Province. We extracted key epidemiological information from daily case line lists and laboratory registers. Additionally, reports from essential pillars such as surveillance, RCCE, WASH, case management, and OCV provided operational insights into interventions that contributed to this paper. Moreover, situation reports delivered consolidated analyses and updates on the response. These quantitative data and debriefs with district health teams, rapid response teams (RRTs), and community-based volunteers (CBVs) were supplemented with qualitative insights from after-action reviews, enriching the evaluation with field experiences and lessons learned.

Conceptual and analytical frameworks

The overall response was broadly structured under two governance frameworks: the 7-1-7 epidemic timeliness target (14,16) and the IMS, an operational delivery model driven by the CATI framework (15). Below, we highlight the response models and structures that characterised ZNPHI and MoH's response to the 2025 cholera outbreak in Northern province.

Governance and coordination frameworks

The 7-1-7 target set a performance benchmark for timeliness, aiming to identify the outbreak within seven days of emergence, notify and investigate within one day, and execute an effective multisectoral response within the following seven days. The IMS maintained structured coordination among district, provincial, and national levels, guiding resource mobilization, partner collaboration, and the flow of reporting. Daily IMS meetings at the district level synchronized technical activities and informed provincial and national decision-making.

CATI as the operational delivery model

The CATI approach served as the core framework guiding the integrated outbreak response. Once a suspected or confirmed cholera case was identified, response teams rapidly deployed a coordinated package within a defined radius of about 20–30 households (100–150 people). This included active case finding and contact tracing, rapid WASH and IPC measures such as household and water source disinfection, immediate case management through referrals and oral rehydration points, and targeted RCCE activities on hygiene and care-seeking. Delivering these interventions within 24–48 hours ensured that surveillance, case management, WASH/IPC, and RCCE were implemented synergistically to contain transmission quickly and effectively.

Technical pillars implemented through CATI

Within the CATI framework, we deployed all technical pillars in a coordinated and targeted manner to strengthen outbreak control. We enhanced surveillance and laboratory diagnostics by line-listing every suspected case, conducting rapid diagnostic tests and confirmatory cultures, and transmitting daily updates through the electronic IDSR platform. We strengthened case management by establishing cholera treatment centres in Mpulungu Urban and Chipwa, setting up oral rehydration points in high-incidence areas, training clinicians on WHO treatment protocols, and pre-positioning essential supplies such as IV fluids, antibiotics, and oral rehydration salts.

We implemented WASH and IPC interventions that included household chlorination, water-source disinfection, installation of latrines and handwashing stations, and safe burial practices to reduce environmental transmission risks. We intensified RCCE efforts through door-to-door sensitization, radio and public announcements of key messages, and engagement with traditional and faith leaders to improve community awareness and promote early care-seeking behavior. Finally, we advanced OCV preparedness by completing detailed microplanning and cold-chain assessments, in close collaboration with WHO and UNICEF, to ensure readiness for vaccine deployment once doses became available. Through these combined efforts, we ensured that each technical pillar directly contributed to rapid containment and the integrated delivery of interventions at the community level.

Data management and analysis

We established a structured, multi-tiered data management system to provide timely, accurate, and actionable information during the outbreak response. Quantitative data were mainly gathered through the electronic Integrated Disease Surveillance and Response (eIDSR) platform, which served as the primary reporting system for daily case notifications from health facilities. District IMS teams compiled and verified this data before submitting it to the provincial IMS for consolidation. The eIDSR dashboard was then used to produce real-time epidemiological outputs, including epidemic curves, trend tables, and geographic distribution summaries, supporting rapid decision-making and resource allocation.

To enhance routine surveillance, field teams used Kobo Collect to map transmission clusters and visualize spatial trends through epidemiological maps (epi-maps), improving the geographic accuracy of interventions. Additionally, community-based volunteers (CBVs) gathered qualitative data through debriefs and field reports, offering valuable insights into community behaviors, perceptions, and barriers to intervention uptake. These qualitative findings were combined with quantitative surveillance data to improve interpretation and support adaptive response strategies. This integrated data system, integrating real-time reporting, geospatial mapping, and field-level intelligence, provided a comprehensive understanding of outbreak dynamics and supported evidence-based decision-making at all levels of the response.

Ethical considerations

This analysis was based on routine programmatic data collected during a public health emergency. It was covered by the umbrella protocol of the Field Epidemiology Training Program that was approved by the Zambian National Health Research Authority (NHRA) in 2023.

Results

Epidemiological overview

From August 5 to September 23, 2025, a total of 239 cholera cases and two deaths (case fatality rate = 0.8%) were reported across Mpulungu, Nsama, and Mbala Districts. Figure 1 shows an early peak in mid-August, corresponding to increased community transmission in lakeshore fishing camps and peri-urban Mpulungu.

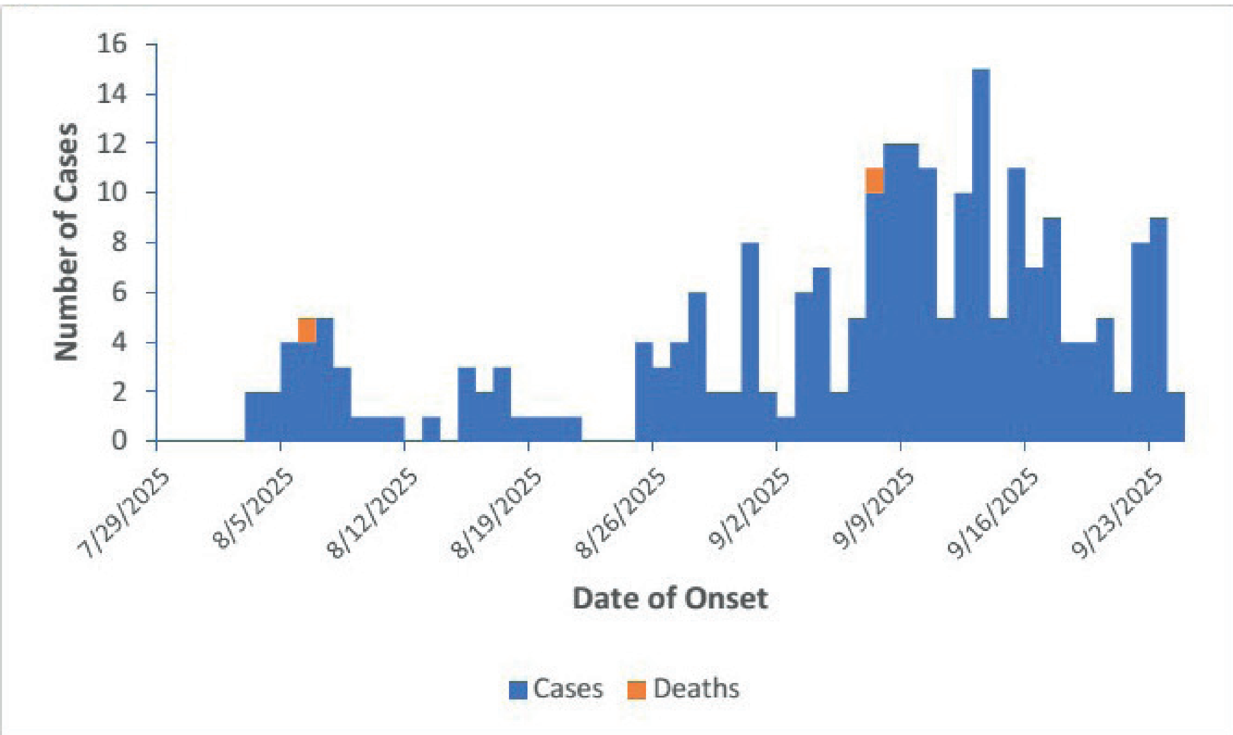


Figure 1: Epidemiological characteristics of the 2025 cholera outbreak in Northern Province, Zambia (5 August–23 September 2025). Note: the date format is m/d/y.

Furthermore, the spatial distribution in Mpulungu District indicated strong clustering along the Lake Tanganyika corridor, suggestive of an association of cross-border and fish trade movements with cholera spread, particularly in Mpulungu. Figure 2 illustrates a map of the cholera case distribution in Mpulungu along the Tanganyika lakeshore.

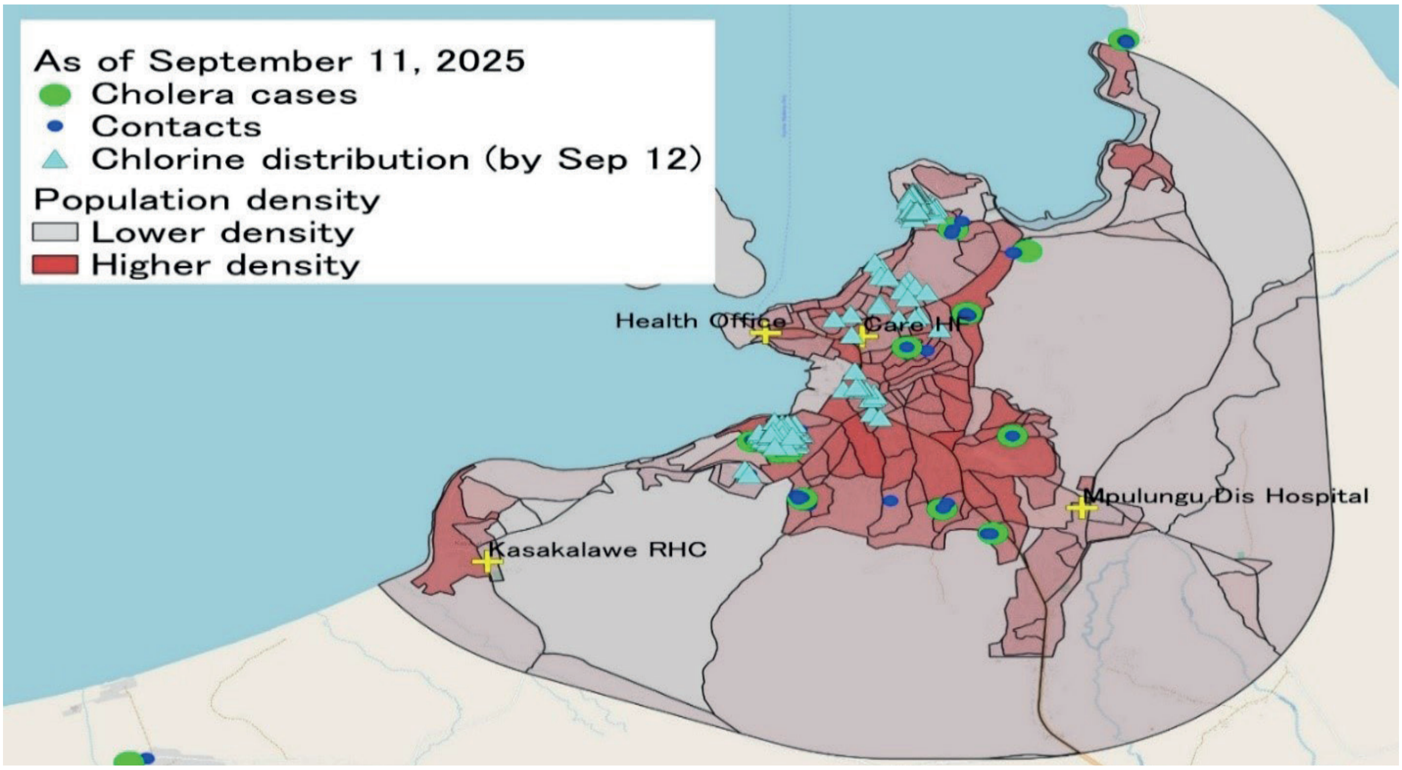


Figure 2: Map of the cholera case distribution in Mpulungu along the Tanganyika lakeshore

Timeliness of detection and response (7-1-7 Framework)

Detection and notification occurred within 48 hours of the index case, and an integrated response was operational within five days, meeting the 7-1-7 benchmark. Overall, Figure 3 shows the evaluation of the 7-1-7 response framework's successful implementation and some of the bottlenecks experienced during ZNPHI and MoH's rapid response in Mpulungu. Prompt initiation of surveillance, case management, and WASH interventions helped control early transmission of the disease. However, expanding efforts to remote fishing camps revealed logistical challenges, including delays in RRT deployment due to poor road access and fuel shortages, as well as communication gaps that affected data flow from peripheral facilities.

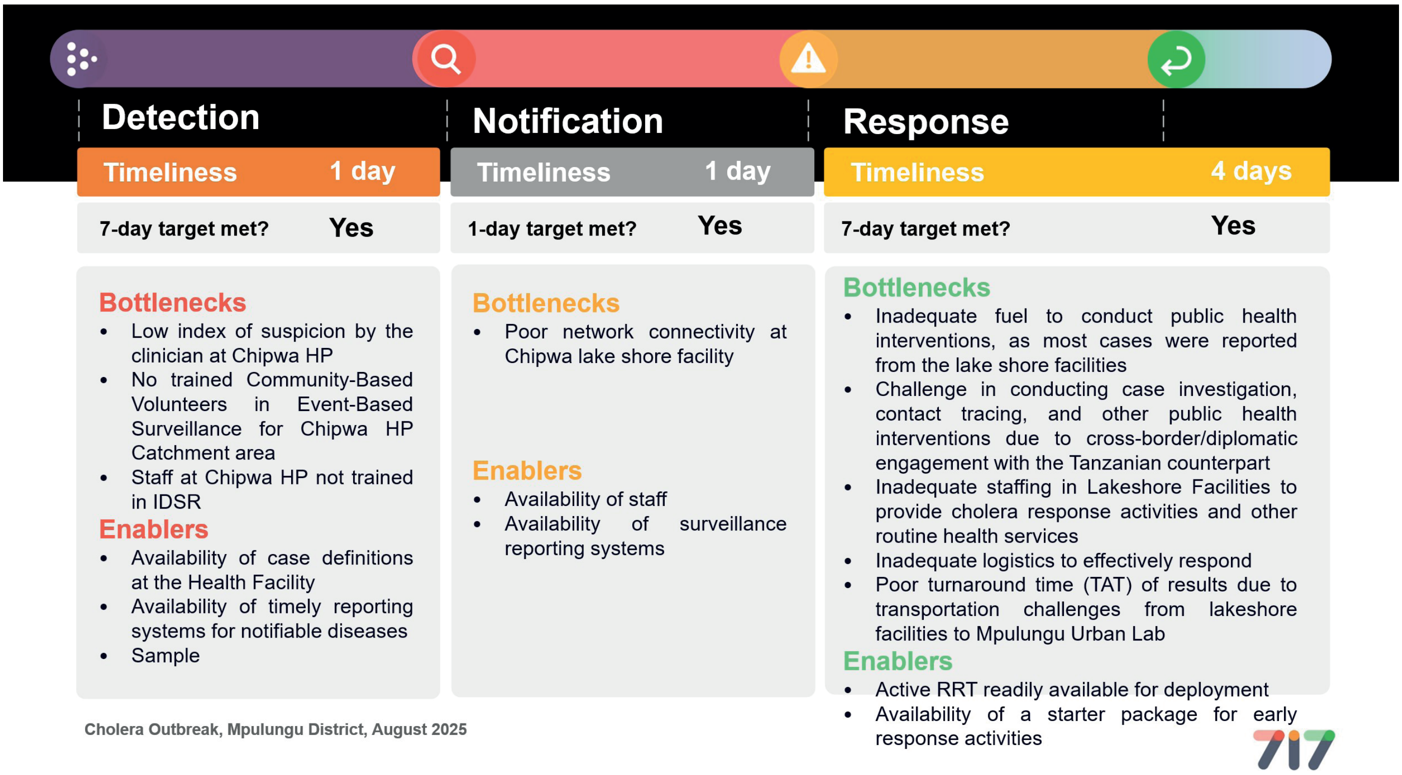


Figure 3: The 7-1-7 Framework implementation during the rapid response to the cholera outbreak in Mpulungu, Northern Province, in August 2025.

Coordination and multi-level governance through the IMS

The IMS facilitated coordination across district, provincial, and national levels. Daily district IMS meetings synchronized activities among technical pillars, while the provincial IMS provided surge staffing and laboratory oversight. The national IMS supported partner alignment and resource mobilization. However, staff turnover, delayed financial disbursements, and limited transport capacity hindered the simultaneous deployment of CATI across multiple hotspots. Figure 4 illustrates the organization of technical response pillars using the CATI operational framework, which is coordinated through district, provincial, and national IMS to ensure multi-sectoral integration and a timely response.

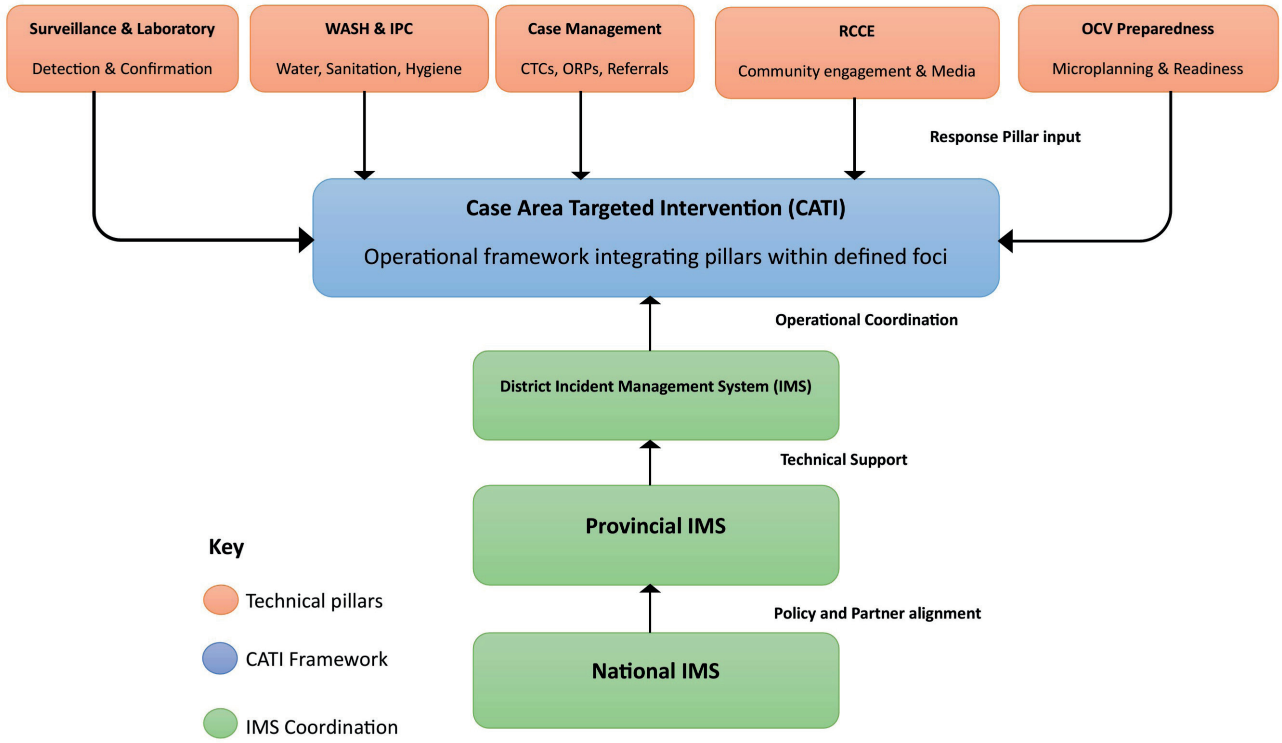


Figure 4: Integrated coordination and delivery structure for cholera outbreak response in Northern Province, Zambia, 2025

Implementation of CATI as the operational framework

CATI functioned as the central operational delivery model, integrating surveillance, WASH/IPC, case management, RCCE, and OCV readiness within specified outbreak zones. Response teams reached affected households within 24-48 hours of case confirmation, performing contact tracing, household disinfection, and point-of-use chlorination. Table 1 highlights key CATI performance indicators. CATI quickly contained clusters in Mpulungu Urban but was less consistent in some lakeshore areas within Mpulungu, Nsama, and Mbala, where terrain and transportation issues slowed down geographic coverage.

Table 1: Implementation performance of Case Area Targeted Interventions (CATI) for cholera in Northern Province from August to September 2025

District	Clusters investigated	Median time to response (hrs)	Households disinfected	Clusters contained within 14 days (%)
Mpulungu	17	8	231	88.2
Nsama	9	10	146	77.8
Mbala	6	12	88	66.7

Surveillance and laboratory findings

Enhanced surveillance improved case detection and timeliness of reporting. Health facilities conducted RDT screening and stool culture confirmation at the provincial level, while community-based volunteers facilitated active case finding and contact follow-up. As summarized in Table 1, daily reporting through the eIDSR platform enhanced data completeness, although weak internet connectivity in lakeshore health posts led to under-reporting and occasional backlogs.

Case management outcomes

Some CTCs and multiple ORPs were strategically set up across the affected districts. Clinical management was conducted in accordance with WHO guidelines, supported by refresher training and partner-provided emergency kits. The overall CFR stayed below 1%, indicating effective early treatment. However, limited inpatient capacity in rural facilities and delayed referrals during heavy rains hindered the speed of care escalation.

WASH and IPC interventions

District WASH teams carried out household chlorination, disinfected latrines, and installed temporary handwashing stations at schools and markets, as shown in Table 2. Burial teams were trained and deployed to conduct safe and respectful burials. Although there was extensive coverage in Mpulungu, shortages of chlorine supply and difficult terrain limited the consistency of interventions in lakeshore communities.

Table 2: Summary of Water, Sanitation and Hygiene (WASH) and Infection Prevention and Control (IPC) interventions implemented during the 2025 cholera outbreak, Northern Province, Zambia

Intervention	Indicator	Total achieved	Remarks
Water safety	Public water points chlorinated	85	≥0.5 mg/L* residual chlorine maintained
Sanitation	Temporary latrines installed	42	Focused on fishing camps
Hygiene promotion	Handwashing stations established	57	Schools and markets targeted

*mg/l - Milligrams per litre

RCCE activities

RCCE interventions reached a wide community audience by utilizing schools, churches, and markets as channels for messaging, particularly through door-to-door campaigns and mass media spots, which reached only 6,297 people as per Table 3. Ongoing Information, Education, and Communication (IEC) material shortages, limited translation into local languages, and inadequate CBV coverage in remote areas reduced the message's reach in some communities.

Table 3: Reach and coverage of risk communication and community engagement (RCCE) interventions during the 2025 cholera outbreak, Northern Province, Zambia

District	Target population	Population reached	Proportion reached (%)	Key notes
Mpulungu	73,838	4,686	6.3	High engagement in Chipwa; urban areas lagged
Nsama	66,404	1,006	1.5	Focus on schools and markets
Mbala	44,119	605	1.4	Limited reach due to staffing constraints-few CBVs*

Note: The target population is based on district health promotion estimates.

**CBVs – Community-based Volunteers*

OCV preparedness

By late September, OCV microplanning and cold-chain readiness assessments were completed in all the focus districts. Table 4 shows the OCV preparedness status of each district as of 24th September 2025. Engagement with traditional leaders fostered strong community receptivity to vaccination. However, deployment was delayed due to global vaccine shortages and logistical challenges in reaching mobile populations on the lakeshore.

Table 4: Oral cholera vaccination (OCV) campaign preparedness status as of 24 September 2025, Northern Province, Zambia

District	Target population	Microplanning status	Vaccine deployment status
Mpulungu	73,838	Completed	Completed
Nsama	66,404	In progress	Not initiated
Mbala	44,119	In progress	Not initiated

Discussion

This study provides a systematic assessment of Zambia's early response to the 2025 cholera outbreak in Mpulungu, Nsama, and Mbala Districts, focusing on both implementation fidelity and contextual challenges. By examining the response through the combined perspectives of 7-1-7, IMS coordination, and CATI delivery, we demonstrate how global frameworks were adapted to a difficult lakeshore environment, and we identify key bottlenecks that limit their effectiveness.

Detection of the index case within 48 hours and initiation of an integrated response within a week show that the 7-1-7 timeliness benchmark is achievable, even in resource-limited districts. Similar quick responses in outbreak settings have been associated with lower transmission and mortality rates (17). However, maintaining that early response in remote lakeshore areas was inconsistent, as logistical issues delayed team deployment to new clusters. This pattern reflects the challenges faced in low-resource settings that hinder cross-cluster mobilization (15).

IMS coordination served as the backbone of the multi-pillar response. Daily district-level meetings facilitated rapid decision-making, while provincial and national tiers provided technical surge support and resource coordination. This structure aligns with emergency management best practices, wherein public health IMS platforms or emergency operations centers (EOCs) are established to centralize command and coordination (18,19). However, persistent challenges, including high staff turnover, delays in funding disbursement, and weak transportation logistics, constrained the IMS's ability to scale CATI across multiple hotspots, particularly in remote areas. These limitations were also observed in broader health system coordination studies (20,21).

Implementing CATI as our operational delivery strategy enabled the integrated deployment of surveillance, WASH/IPC, case management, and RCCE in defined outbreak zones. In Mpulungu's early clusters, CATI appears to have rapidly curtailed transmission, consistent with evidence showing that prompt, repeated CATIs can shorten outbreak duration and reduce clustering (22,23). However, in Nsama and Mbala, terrain constraints, fuel shortages, and transport deficits limited reach, a pattern mirrored in other settings where CATI effectiveness was conditional on sufficient logistical and surge capacity (23,24).

Surveillance and laboratory diagnostics were fundamental to the response, enabling case confirmation and hotspot mapping. However, delays in real-time data entry and weak connectivity at lakeshore health posts hindered prompt situational awareness. Outbreak response literature increasingly highlights the importance of digital surveillance systems, offline-capable tools, and integrated feedback loops (25). Investing in resilient digital platforms would improve operational agility in geographically limited settings.

The observed case fatality rate (CFR) below 1% aligns with benchmarks for quality cholera case management and demonstrates the impact of early treatment, rapid setup of cholera treatment centres (CTCs), and supply pre-positioning (26). Nevertheless, in remote settings such as the Northern province of Zambia, limited inpatient capacity and delays in referrals due to poor road conditions or inaccessibility due to large water bodies reveal persistent inequities in access to lifesaving care.

WASH and IPC interventions, including chlorination, latrine installation, and water-source disinfection, are well-supported by the literature as essential components for outbreak containment (27,28). However, as observed in our response, interruptions caused by IPC commodity stockouts and the difficulty of reaching dispersed fishing communities curtailed consistent coverage.

Furthermore, RCCE played a pivotal role in improving public awareness and encouraging protective behaviors during the outbreak. Institutional outreach through schools, churches, markets, and other social platforms proved highly effective in amplifying prevention messages and fostering trust between communities and responders, a factor consistently linked to higher compliance with health measures during epidemics (29,30).

Coordination through the IMS ensured message consistency, minimizing misinformation and reinforcing public confidence. However, limited translation of IEC materials, inadequate supply chains, and understaffed networks of community-based volunteers constrained message penetration in remote, multilingual settings. Evidence from previous cholera and Ebola responses shows that pre-positioned multilingual RCCE kits, coupled with expanded, locally trained volunteer networks, substantially improve message reach and equity in hard-to-access populations (15,29).

OCV microplanning and cold-chain readiness were successfully implemented in Mpulungu before rollout, reflecting strong local preparation capacity. However, the actual deployment faced delays due to supply constraints and logistical challenges, a pattern documented in several post-licensure OCV analyses (31). Moreover, modeling studies in Africa show that geographic targeting of OCV campaigns can enhance cost-effectiveness and impact (32). In settings with cross-border, mobile populations, coordinated, synchronized campaigns across borders may help reduce reintroduction risk and bolster immunization efficiency, aligning with lessons from urban, targeted OCV efforts (33).

Across all pillars, persistent shortages of human resources, transport, fuel, and RCCE materials consistently hindered full implementation. These operational barriers are not unique to Zambia; evidence from other cholera responses shows that logistics, coordination, and supply chain reliability often determine the ultimate effectiveness of outbreak control efforts, rather than the technical soundness of interventions themselves (17,25,34).

Strengths and Limitations

This study's main strength is its integration of programmatic data from multiple response pillars, offering a comprehensive and practical view of how Zambia's 7-1-7, IMS, and CATI frameworks operated during a real-world outbreak. Unlike evaluations that focus on a single pillar, it examines coordination, implementation fidelity, and early outcomes within a unified analytical perspective. Using routinely collected surveillance and operational data increases the study's relevance for health system planning and policy adaptation, as it bases its conclusions on actual field observations rather than theoretical assumptions.

However, the analysis is limited by reliance on secondary programmatic data, which may underestimate unreported cases or activities in remote areas. Data completeness varied across districts due to connectivity issues and differing reporting capacities. Additionally, the short observation window, which covers only the initial outbreak phase, restricts the ability to assess long-term outcomes, such as sustained transmission interruption or post-OCV impact.

Despite these limitations, the findings provide credible early evidence on the feasibility and effectiveness of integrated outbreak response frameworks in resource-limited, cross-border settings, offering actionable insights for future epidemic preparedness in Zambia and similar contexts.

Conclusion and Recommendations

The early stages of the 2025 cholera outbreak in Mpulungu, Nsama, and Mbala districts of the Northern province in Zambia demonstrated both the strengths and the limitations of Zambia's epidemic response system. Furthermore, the coordinated use of the 7-1-7 framework, the IMS, and the CATI model allowed for rapid detection of cases, timely deployment of interventions, and effective case management. These efforts contributed to a low case fatality rate of 0.8 percent, showing that existing response mechanisms can significantly reduce transmission and mortality even in hard-to-reach areas.

However, key operational challenges limited the scale and effectiveness of the response. Transport and fuel shortages, insufficient human resources, and weak data systems reduced the ability to deploy interventions simultaneously in multiple locations. Limited translation and distribution of communication materials further constrained community engagement. Based on our findings, we recommend that the Ministry of Health and its partners strengthen response capacity at the district level through pre-positioned supplies, trained mobile teams, and reliable surge funding to improve future operations. Additionally, ZNPHI should support the upgrade of digital surveillance tools, including offline-capable systems, to allow faster data reporting and analysis through the eIDSR. Furthermore, we recommend expanding CBV networks, training on multi-hazards, and ensuring multilingual communication materials are prepared in advance to improve the reach and quality of engagement.

Lastly, our results showed that cross-border coordination is essential to prevent future cholera outbreaks. Therefore, we recommend that the Ministry of Health and ZNPHI, in collaboration with partners such as UNICEF, the International Federation of Red Cross, the WHO, and the Africa CDC, should align surveillance, targeted interventions, and oral cholera vaccination campaigns with neighboring countries along the Lake Tanganyika corridor to enhance control efforts in line with the International Health Regulations (IHR). We are convinced that implementing these recommendations, drawn from the lessons of the 2025 outbreak, will strengthen Zambia's preparedness and accelerate progress toward national and continental cholera elimination targets.

References

1. Ali M, Nelson AR, Lopez AL, Sack DA. Updated Global Burden of Cholera in Endemic Countries. Remais JV, editor. PLoS Negl Trop Dis. 2015 June 4;9(6):e0003832.

2. Taylor DL, Kahawita TM, Cairncross S, Ensink JHJ. The Impact of Water, Sanitation and Hygiene Interventions to Control Cholera: A Systematic Review. Bhutta ZA, editor. PLoS ONE. 2015 Aug 18;10(8):e0135676.

3. Wolfe M, Kaur M, Yates T, Woodin M, Lantagne D. A Systematic Review and Meta-Analysis of the Association between Water, Sanitation, and Hygiene Exposures and Cholera in Case–Control Studies. The American Journal of Tropical Medicine and Hygiene. 2018 Aug 2;99(2):534–45.

4. Sikder M, Deshpande A, Hegde ST, Malembaka EB, Gallandat K, Reiner RC, et al. Water, Sanitation, and Cholera in Sub-Saharan Africa. Environ Sci Technol. 2023 July 18;57(28):10185–92.

5. Lessler J, Moore SM, Luquero FJ, McKay HS, Grais R, Henkens M, et al. Mapping the burden of cholera in sub-Saharan Africa and implications for control: an analysis of data across geographical scales. The Lancet. 2018 May;391(10133):1908–15.

6. Charnley GEC, Kelman I, Murray KA. Drought-related cholera outbreaks in Africa and the implications for climate change: a narrative review. Pathogens and Global Health. 2022 Jan 2;116(1):3–12.

7. Perez-Saez J, Lessler J, Lee EC, Luquero FJ, Malembaka EB, Finger F, et al. The seasonality of cholera in sub-Saharan Africa: a statistical modelling study. The Lancet Global Health. 2022 June;10(6):e831–9.

8. Bwire G, Mwesawina M, Baluku Y, Kanyanda SSE, Orach CG. Cross-Border Cholera Outbreaks in Sub-Saharan Africa, the Mystery behind the Silent Illness: What Needs to Be Done? Carpenter DO, editor. PLoS ONE. 2016 June 3;11(6):e0156674.

9. Africa CDC, 2025. Continental Cholera Response Plan Unveiled in Lusaka; Weekly-Bulletin-31-Aug-2025-ENG.

10. Zambia Multisectoral Cholera Elimination Plan 2019, Global Task Force on Cholera Control.

11. Ngosa W, Imamura T, Mbewe N, Seriki J, Nzila O, Mfune F, et al. Geospatial analysis of cholera outbreak in Lusaka, Zambia, between 2023 and 2024. Trop Med Health. 2025 Mar 28;53(1):42.

12. Bwire G, Mwesawina M, Baluku Y, Kanyanda SSE, Orach CG. Cross-Border Cholera Outbreaks in Sub-Saharan Africa, the Mystery behind the Silent Illness: What Needs to Be Done? Carpenter DO, editor. PLoS ONE. 2016 June 3;11(6):e0156674.

13. Gulumbe BH, Chishimba K, Shehu A, Chibwe M. Zambia's battle against cholera outbreaks and the path to public health resilience: a narrative review. Journal of Water and Health. 2024 Dec 1;22(12):2257–75.

14. Bochner AF, Makumbi I, Aderinola O, Abayneh A, Jetoh R, Yemanaberhan RL, et al. Implementation of the 7-1-7 target for detection, notification, and response to public health threats in five countries: a retrospective, observational study. The Lancet Global Health. 2023 June;11(6):e871–9.

15. Ratnayake R, Peyraud N, Ciglenecki I, Gignoux E, Lightowler M, Azman AS, et al. Effectiveness of case-area targeted interventions including vaccination on the control of epidemic cholera: protocol for a prospective observational study. BMJ Open. 2022 July;12(7):e061206.

16. Frieden TR, Lee CT, Bochner AF, Buissonnière M, McClelland A. 7-1-7: an organising principle, target, and accountability metric to make the world safer from pandemics. The Lancet. 2021 Aug;398(10300):638–40.

17. Camacho A, Bouhenia M, Alyusfi R, Alkohlani A, Naji MAM, De Radiguès X, et al. Cholera epidemic in Yemen, 2016–18: an analysis of surveillance data. The Lancet Global Health. 2018 June;6(6):e680–90.

18. Malik MW, Ikram A, Safdar RM, Ansari JA, Khan MA, Rathore TR, et al. Use of public health emergency operations center (PH-EOC) and adaptation of incident management system (IMS) for efficient inter-sectoral coordination and collaboration for effective control of Dengue fever outbreak in Pakistan - 2019. Acta Tropica. 2021 July;219:105910.

19. Sharma R, Chauhan H, Parkash S, Verma P, Sunthlia A, Verma N, et al. Organisational models for managing Public Health Emergencies of International Concern (PHEICs) in the South-East Asia Region (SEAR) nations: protocol for a systematic review. BMJ Open. 2024 Sept;14(9):e084673.

20. Gooding K, Bertone MP, Loffreda G, Witter S. How can we strengthen partnership and coordination for health system emergency preparedness and response? Findings from a synthesis of experience across countries facing shocks. BMC Health Serv Res. 2022 Nov 29;22(1):1441.

21. Rico A, Sanders CA, Broughton AS, Andrews M, Bader FA, Maples DL. CDC's Emergency Management Program Activities — Worldwide, 2013–2018. MMWR Morb Mortal Wkly Rep. 2021 Jan 15;70(2):36–9.

22. Michel E, Gaudart J, Beaulieu S, Bulit G, Piarroux M, Boncy J, et al. Estimating effectiveness of case-area targeted response interventions against cholera in Haiti. eLife. 2019 Dec 30;8:e50243.

23. OKeeffe J, Salem-Bango L, Desjardins MR, Lantagne D, Altare C, Kaur G, et al. Case-area targeted interventions during a large-scale cholera epidemic: A prospective cohort study in Northeast Nigeria. PLoS Med. 2024 May 10;21(5):e1004404.

24. Dunoyer J, Ratnayake R, Moore S, Bulit G, Beaulieu S, Valingot C, et al. Optimizing the implementation of case-area targeted interventions during cholera outbreaks with context-specific delivery mechanisms. Vinetz JM, editor. PLoS Negl Trop Dis. 2025 Sept 23;19(9):e0013534.

25. Spiegel P, Ratnayake R, Hellman N, Ververs M, Ngwa M, Wise PH, et al. Responding to epidemics in large-scale humanitarian crises: a case study of the cholera response in Yemen, 2016–2018. BMJ Glob Health. 2019 July;4(4):e001709.

26. Worku Demlie Y, Gedefaw A, Jeon Y, Hailu D, Getahun T, Mogeni OD, et al. Retrospective Analysis of Cholera/Acute Watery Diarrhea Outbreaks in Ethiopia From 2001 To 2023: Incidence, Case Fatality Rate, and Seasonal and Multiyear Epidemic Patterns. Clinical Infectious Diseases. 2024 July 12;79(Supplement_1):S8–19.

27. Taylor DL, Kahawita TM, Cairncross S, Ensink JHJ. The Impact of Water, Sanitation and Hygiene Interventions to Control Cholera: A Systematic Review. Bhutta ZA, editor. PLoS ONE. 2015 Aug 18;10(8):e0135676.

28. Buliva E, Elnossery S, Okwarah P, Tayyab M, Brennan R, Abubakar A. Cholera prevention, control strategies, challenges and World Health Organization initiatives in the Eastern Mediterranean Region: A narrative review. Heliyon. 2023 May;9(5):e15598.

29. Bedson J, Jalloh MF, Pedi D, Bah S, Owen K, Oniba A, et al. Community engagement in outbreak response: lessons from the 2014–2016 Ebola outbreak in Sierra Leone. BMJ Glob Health. 2020 Aug;5(8):e002145.

30. Gilmore B, Ndejjo R, Tchetchia A, De Claro V, Mago E, Diallo AA, et al. Community engagement for COVID-19 prevention and control: a rapid evidence synthesis. BMJ Glob

Health. 2020 Oct;5(10):e003188.

31. Martin S, Lopez AL, Bellos A, Deen J, Ali M, Alberti K, et al. Post-licensure deployment of oral cholera vaccines: a systematic review. Bull World Health Organ. 2014 Dec 1;92(12):881–93.

32. Lee EC, Azman AS, Kaminsky J, Moore SM, McKay HS, Lessler J. The projected impact of geographic targeting of oral cholera vaccination in sub-Saharan Africa: A modeling study. Kretzschmar MEE, editor. PLoS Med. 2019 Dec 11;16(12):e1003003.

33. Massing LA, Aboubakar S, Blake A, Page AL, Cohuet S, Ngandwe A, et al. Highly targeted cholera vaccination campaigns in urban setting are feasible: The experience in Kalemie, Democratic Republic of Congo. Marks F, editor. PLoS Negl Trop Dis. 2018 May 7;12(5):e0006369.

34. Lagatie O, Njumbe Ediage E, Van Roosbroeck D, Van Asten S, Verheyen A, Batsa Debrah L, et al. Multimodal biomarker discovery for active Onchocerca volvulus infection. Cwiklinski K, editor. PLoS Negl Trop Dis. 2021 Nov 29;15(11):e0009999.

Summary of Priority Diseases and Events in Zambia

Trends for Priority Diseases and Events in Zambia (January - September 2025)

Between January and September 2025, malaria remained the leading cause of reported illness among the priority diseases and events tracked by ZNPHI, accounting for over 11 million suspected cases, followed by tuberculosis and diarrhoea with blood. Other frequently reported conditions included dog bites and bilharzia. Vaccine-preventable and zoonotic diseases such as measles, anthrax, Mpox, and cholera occurred sporadically. Overall, disease trends showed seasonal peaks, particularly for malaria in mid-year, while most other conditions/events remained stable or fluctuated slightly across quarters, with no sustained upward trend (Table one).

Table 1: Trends for Priority Diseases and Events in Zambia (January - September 2025)

	Months (2025)										
Disease/Event	January	February	March	April	May	June	July	August	September	Total	Trend
Malaria suspected	1,143,002	1,316,943	1,210,194	1,037,529	1,033,767	1,370,063	1,328,821	1,250,644	1,363,852	11,054,815	
Tuberculosis suspected	39,159	43,169	44,933	48,601	41,037	38,567	43,013	40,557	43,041	382,077	
Diarrhoea with blood suspected	6,873	5,483	6,351	7,025	6,457	5,737	5,311	6,379	5,981	55,597	
Dog Bite	2,597	2,420	2,398	2,309	2,295	2,391	2,555	2,264	2,456	21,685	
Bilharzia suspected	1,869	2,069	2,506	1,817	2,127	2,358	2,067	1,854	2,057	18,724	
COVID-19 suspected	402	602	929	276	636	744	1,309	640	592	6,130	
Typhoid fever suspected	913	707	729	717	534	573	454	687	609	5,923	
Measles	241	225	343	276	390	174	83	139	242	2113	
Mpox suspected	186	184	251	215	186	216	131	61	92	1,522	
Cholera suspected	22	87	235	103	247	45	288	12	22	1,061	
Bacterial meningitis suspected	57	74	113	83	74	39	139	30	114	723	
Anthrax suspected	45	8	25	11	22	55	10	39	31	246	
AFP (Poliomyelitis) suspected	30	22	21	27	30	31	18	27	24	230	

Trends for Priority Diseases and Events in Zambia by Province (January - September 2025)

Acute Flaccid Paralysis

Suspected Acute Flaccid Paralysis (AFP) cases have varied across provinces and quarters. Eastern, Copperbelt, and Western provinces recorded the highest numbers, with peaks in Quarter 2. Compared to the first two quarters, Quarter 3 showed a general decline in suspected cases in most provinces, though Southern and North-Western maintained steady reporting (Figure 1).

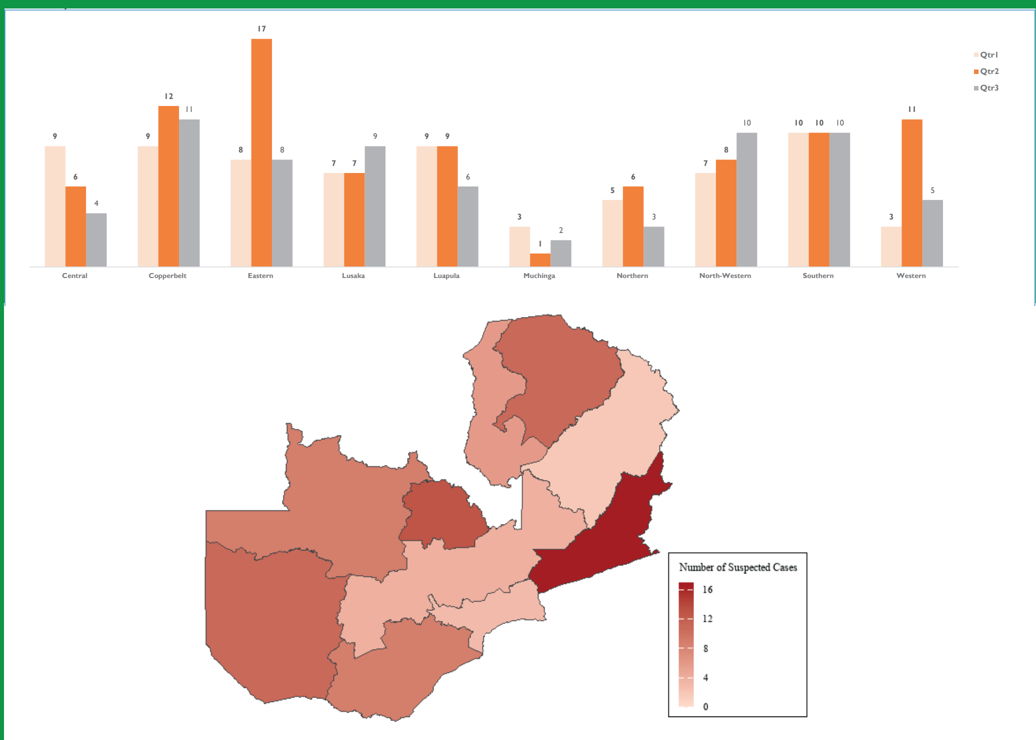


Figure 1: Suspected Acute Flaccid Paralysis (Poliomyelitis) Cases in Zambia by Province (January - September 2025)

Anthrax

Suspected anthrax cases in 2025 have been largely confined to Southern and Western provinces, with Southern recording the highest numbers, peaking at 62 cases in Quarter 2. Cases declined slightly in Quarter 3 across most affected provinces compared to the earlier quarters. Few cases were reported in Eastern, Lusaka, Northern, and Copperbelt, while the remaining provinces reported none, indicating localized transmission mainly in the southern regions (Figure 2).

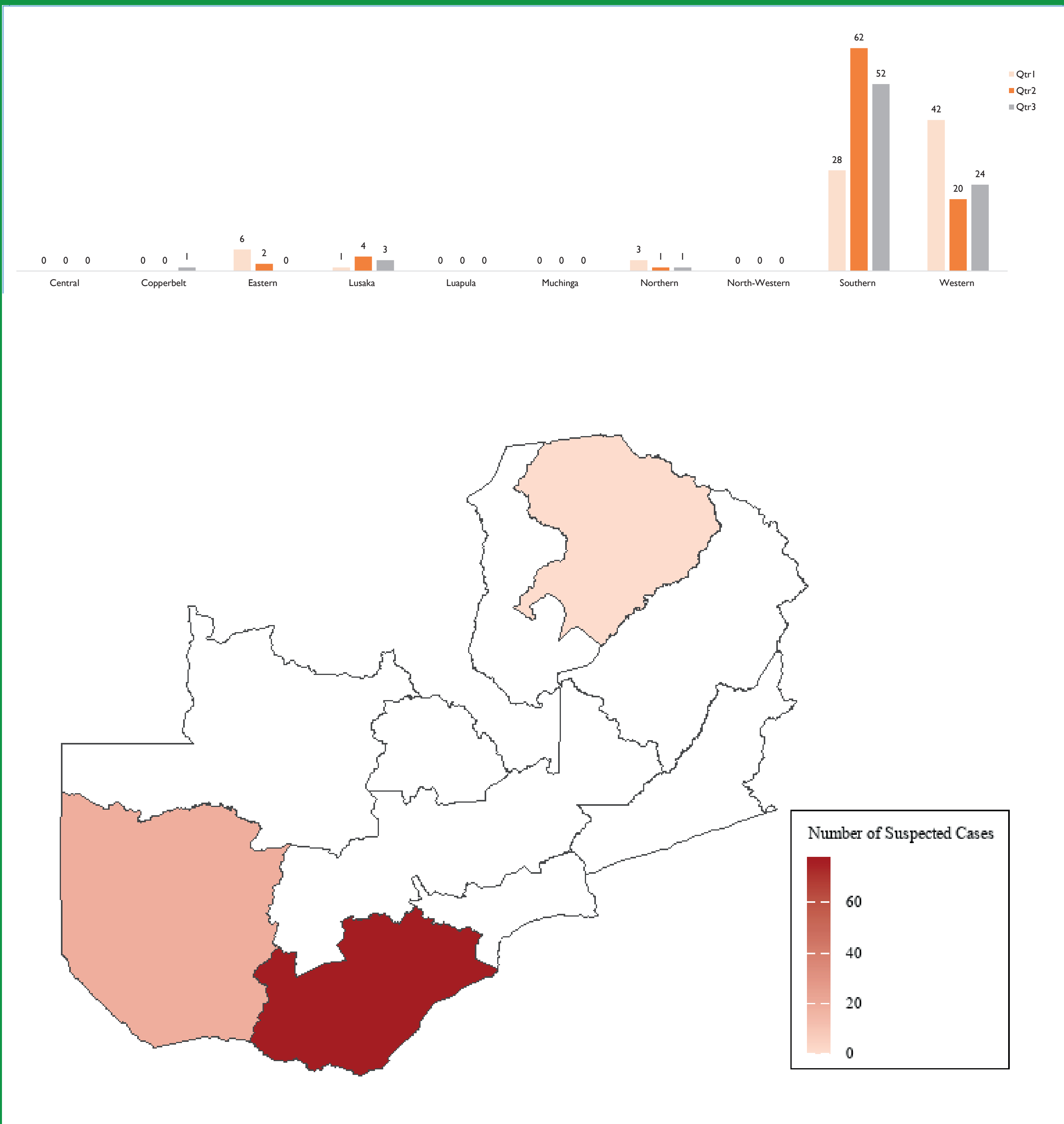
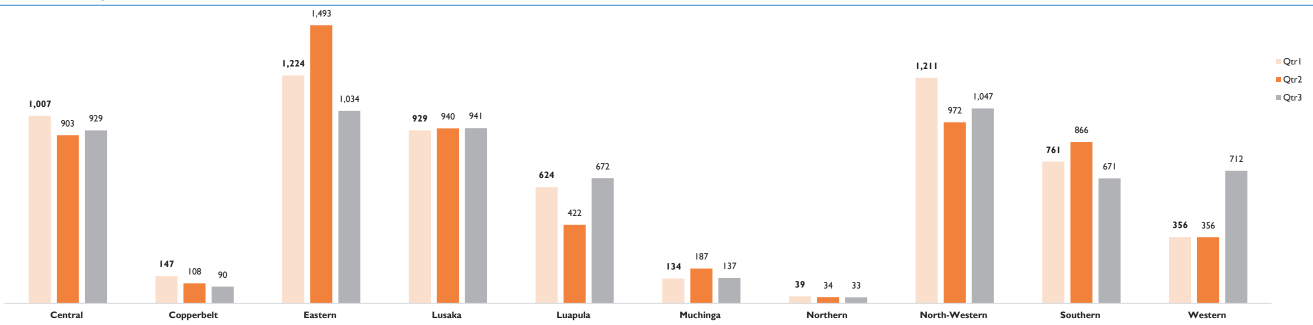


Figure 2: Suspected Anthrax Cases in Zambia by Province (January - September 2025)

Bilharzia

Figure 3 shows the quarterly trends in suspected Bilharzia cases across Zambia's provinces in 2025. Overall, cases declined in Quarter 3 compared to earlier quarters. Eastern Province, which peaked in Quarter 2, saw a notable drop in Quarter 3. Most other provinces, including Central and Southern, also declined, while Western and Luapula recorded slight increases.



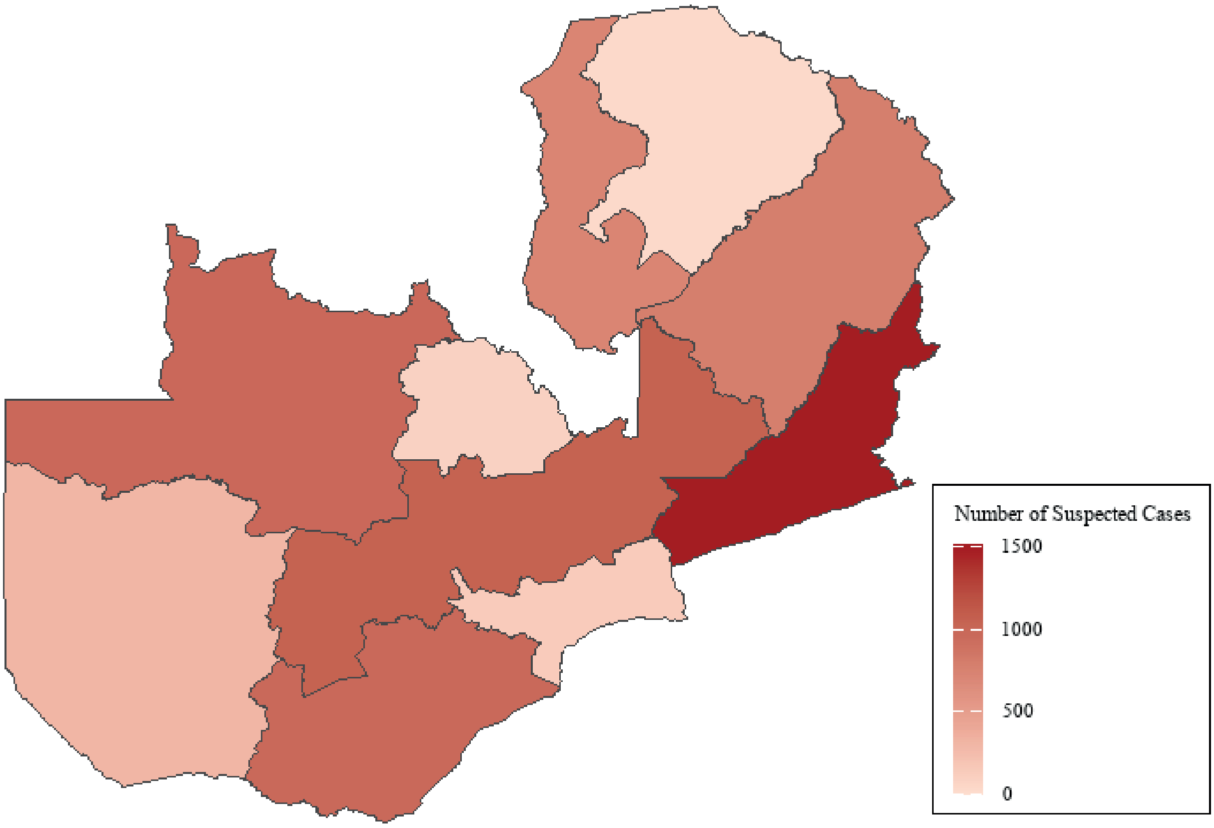


Figure 3: Suspected Bilharzia Cases in Zambia (January - September 2025)

Mpox

Figure 4 shows a sharp decline in suspected Mpox cases across most provinces in Quarter 3 of 2025. Muchinga, Northern, and Western provinces recorded the largest drops after earlier peaks. Lusaka and Copperbelt also declined moderately, while Central and Eastern showed slight increases. Overall, Mpox cases decreased nationwide in Quarter 3.

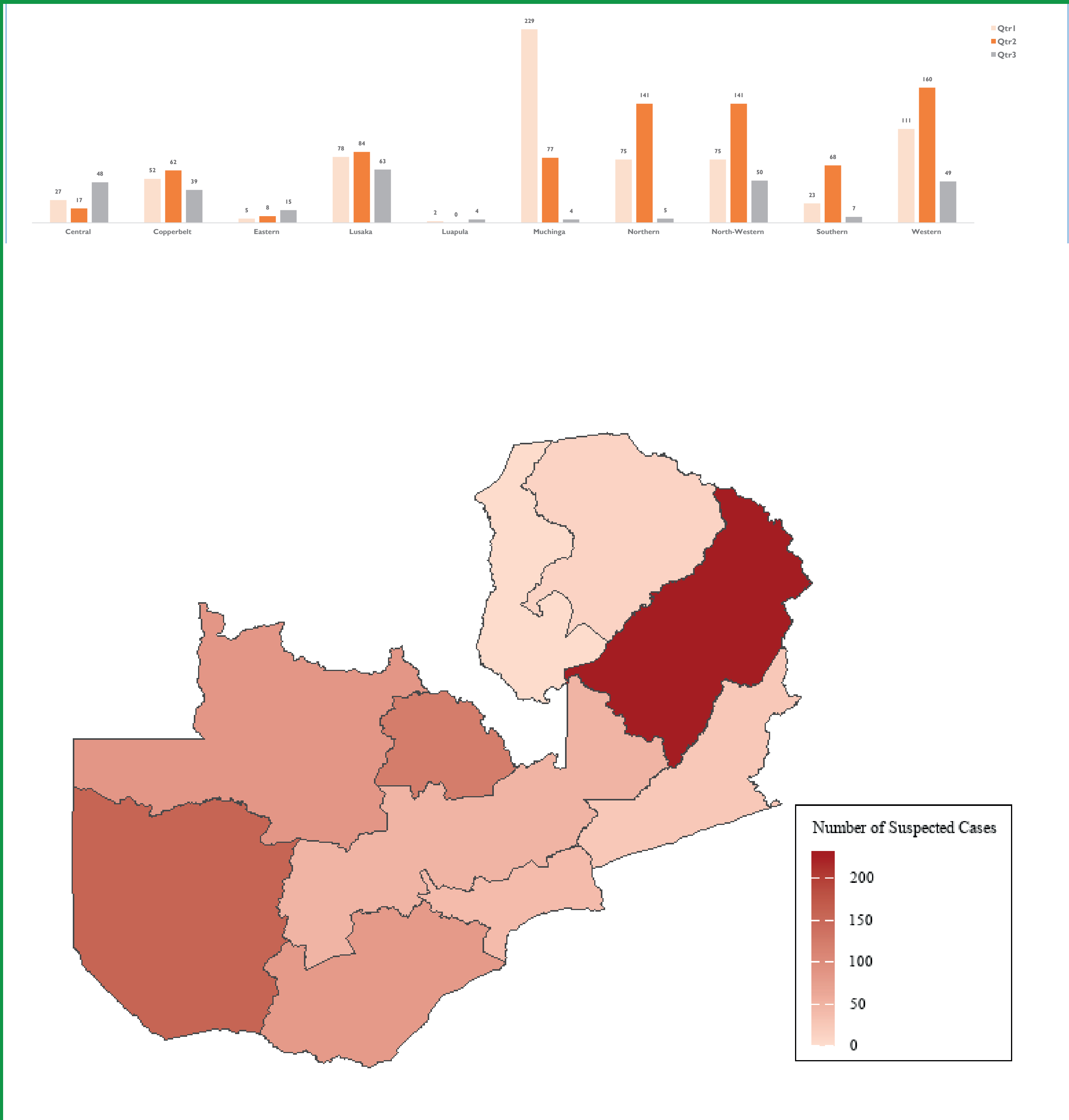


Figure 4: Mpox Cases in Zambia by Province (January - September 2025)

Typhoid Fever

Figure 5 shows that suspected typhoid fever cases declined in most provinces in Quarter 3 of 2025. Northern Province was an exception, recording a sharp rise to 3,911 cases. Lusaka and North-Western declined moderately, while Copperbelt slightly increased. Most other provinces reported few or no cases.

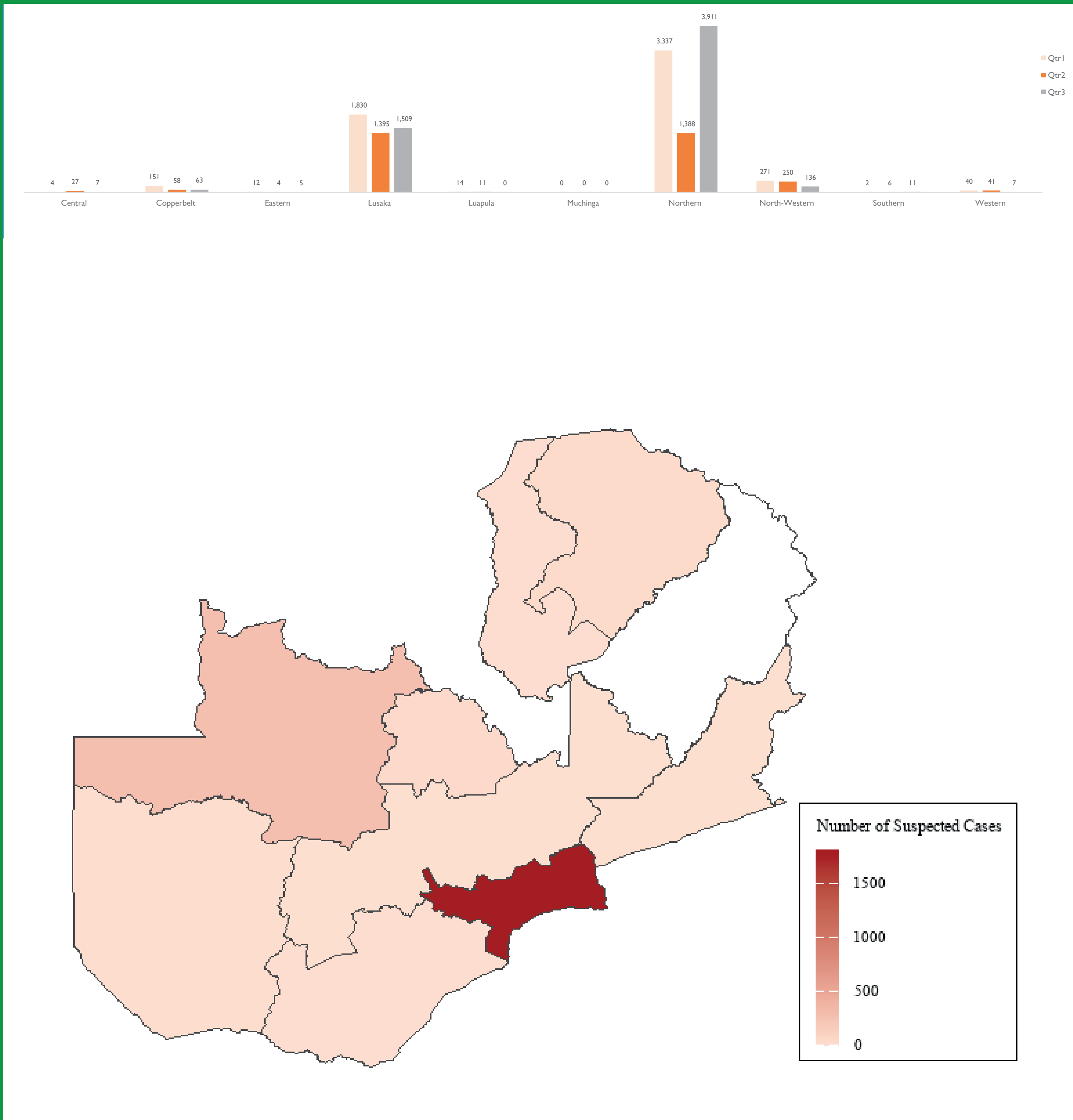


Figure 5: Suspected Typhoid Fever Cases in Zambia by Province (January - September 2025)

Measles

Figure 6 shows quarterly trends in suspected measles cases across Zambia's provinces in 2025. Overall, cases declined in Quarter 3 compared to the first two quarters. Northern, Southern, and Western provinces recorded the largest drops, while Eastern and Luapula showed slight increases. North-Western was the only province with a notable rise in Quarter 3, reaching its highest level for the year.

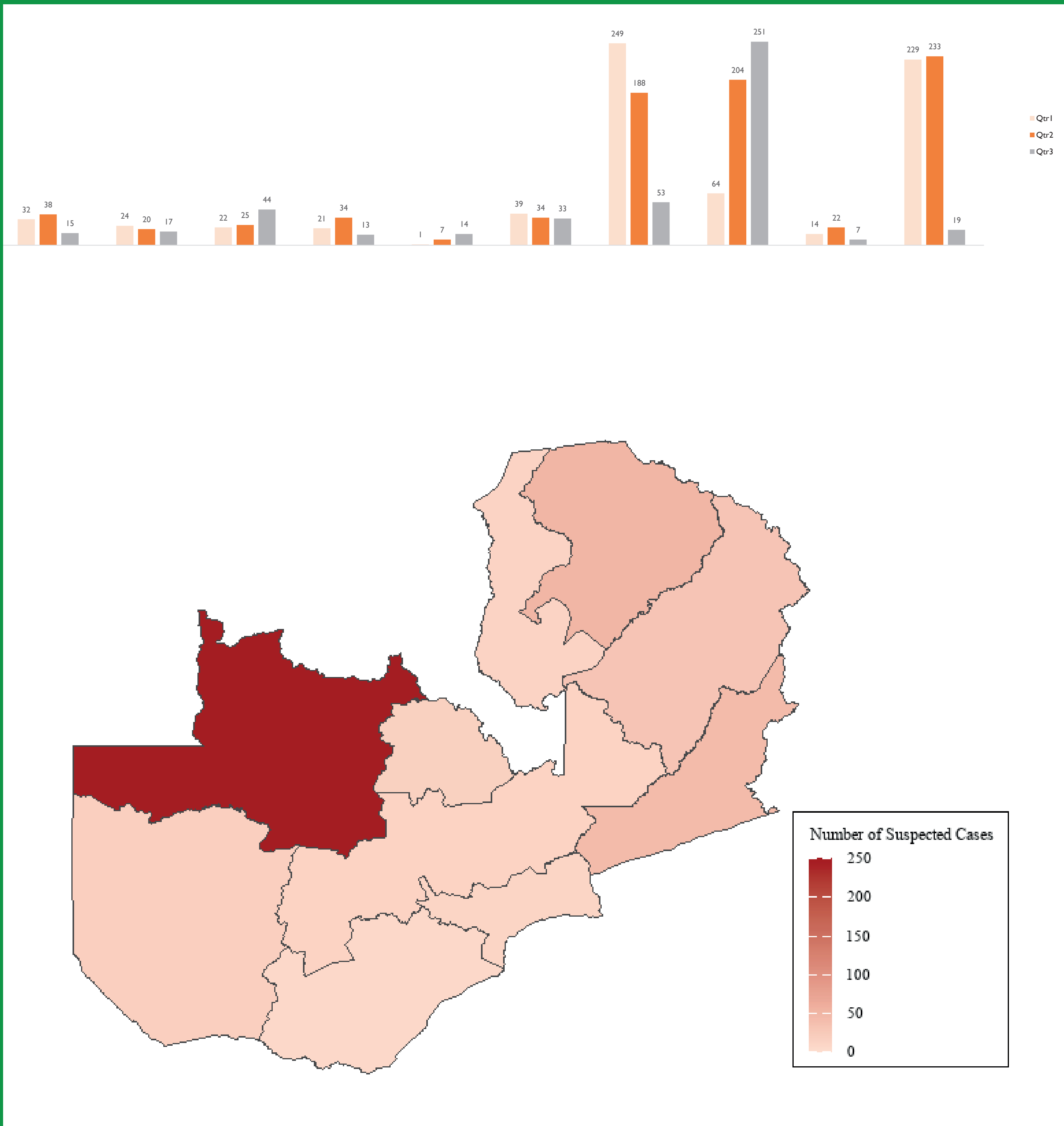


Figure 6: Measles Cases in Zambia by Province (January - September 2025)

Data used was extracted from eIDSR on 8th October 2025
About eIDSR

The Electronic Integrated Disease Surveillance and Response System (eIDSR) is a disease surveillance system that is used to continuously and systematically collect, analyse, interpret, and visualize public health data. Data is collected at facility level and captured by district surveillance officers. The data reported in this bulletin was extracted from the system (except were indicated otherwise) on the aforementioned date.

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