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Priority areas for cholera control, Cameroon

This online first version has been peer-reviewed, accepted and edited,
but not formatted and finalized with corrections from authors and proofreaders

Identification of priority areas for cholera control, Cameroon

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(Submitted: 7 February 2025 – Revised version received: 28 October 2025 – Accepted: 30 October 2025 – Published online: 3 February 2026)

Abstract

Objective To identify of priority areas for multisectoral interventions for cholera control in Cameroon.

Methods We collected data on cholera cases from January 2016 to September 2023 in all 10 regions of Cameroon sourced from the DHIS-2 software, national cholera line lists, situation reports, and databases of the Centre Pasteur du Cameroun and the National Public Health Laboratory. We entered these data into the Global Task Force on Cholera Control tool to determine a priority index for districts based on four cholera indicators: incidence, mortality, persistence and test positivity. We calculated a vulnerability index based on 12 vulnerability factors. We categorized districts with a priority index ≥ 9 and districts with a priority index < 9 but with ≥ 9 vulnerability factors as priority areas for multisectoral interventions.

Findings Between 2016 and 2023, Cameroon reported 24 813 suspected cholera cases in nine regions. Of 200 health districts, we identified 48 (24.0%) as priority areas for multisectoral interventions, 35 based on a priority index ≥ 9 and 13 based on vulnerability factors. These priority areas are home to 40.4% (11 488 089/28 433 067) of the country's population in 2023 and accounted for 91.3% (22 668/24 813) of the cholera cases between 2016 and 2023. Centre, Littoral, South-West and Far North regions account for 85.4% (41/48) of the priority areas for multisectoral interventions.

Conclusion Identification of priority areas for multisectoral interventions provided evidence for decision-making to enhance cholera preparedness and prevention. The availability of data facilitated this classification, and the ownership and leadership of the main governmental stakeholders were essential.

Introduction

Worldwide, cholera trends show a threatening global health challenge. Cholera is a marker of inequity and poverty^{1,2} with the highest burden in the World Health Organization (WHO) Eastern Mediterranean and African regions.³ The main determinants of cholera are insufficient access to potable water, basic sanitation and hygiene, environmental disasters including floods, droughts, population displacement and conflicts, and poor access to health care.⁴⁻⁶

Cameroon is vulnerable to cholera, with recurrent outbreaks since 1971.⁷ Transmission patterns vary by season, with the infections occurring during the rainy season in the southern regions and the dry season in the northern regions.⁷ Cameroon's long border with Nigeria,⁸ where cholera is also endemic, increases the risk of cross-border transmission.⁹ As a lower middle-income country with more than 27.9 million people,¹⁰ Cameroon faces major sanitation and hygiene challenges, with limited access to safe water, inadequate hygiene and poor water treatment.¹¹ Ongoing insecurity, humanitarian crises and climate shocks further exacerbate vulnerabilities, resulting in nearly half a million internally displaced people and a similar number of refugees.¹²

From 2018 to 2023, persistent cholera transmission in Cameroon led to the creation of a national cholera plan following the four-phase framework of the Global Task Force on Cholera Control: (i) inception during which countries make political commitments and identify cholera priority areas for multisectoral interventions; (ii) development; (iii) implementation; and (iv) monitoring and reporting of the national cholera plan.^{13,14} Central to the plan was identifying priority areas for multisectoral interventions, which are zones where conditions favour recurring cholera outbreaks. Given global resource constraints,³ focusing efforts on these high-risk areas is important for sustainable cholera control. In this study, we describe the process of identifying these priority areas in Cameroon and the implications for cholera control in the country.

Methods

Study design and site

We conducted a retrospective cross-sectional descriptive study in Cameroon, which has 10 regions, 203 health districts and 1819 health areas. We analysed district-level cholera data covering January 2016 to September 2023. A national multisectoral technical team led by the health ministry, supported by WHO, conducted the analysis following guidelines of the Global Task Force on Cholera Control.¹⁵

Definitions

In outbreak regions, a suspected cholera case was any patient older than 2 years with acute watery diarrhoea and severe dehydration or death from the diarrhoea. In non-outbreak regions, a suspected cholera case was any case of or death from acute watery diarrhoea. Community cases included any person 2 years and older with profuse acute watery diarrhoea and/or vomiting who remained in the community.¹⁶ A confirmed case was any person with *Vibrio cholerae* O1 or O139 confirmed by culture or gene amplification.¹⁷ Epidemiological indicators included incidence (cases per 100 000 person-years), mortality (deaths per 100 000 person-years), persistence (percentage of weeks with one or more suspected case) and positivity (percentage of suspected cholera cases positive by rapid diagnostic test or culture to detect *V. cholerae*). We defined weekly testing coverage as the percentage of weeks in the study period with at least one suspected case tested by either a rapid diagnostic test or culture. If the weekly testing coverage was greater than 50% in at least 80% of the geographical units, then we considered the representativeness of the cholera laboratory data acceptable and positivity was automatically scored in the tool.¹⁵

Data sources

We obtained data from the DHIS-2 software (University of Oslo, Oslo, Norway), national cholera line lists, national and regional situation reports, databases of the Centre Pasteur du Cameroon and National Public Health Laboratory, and weekly reports (2016–2025) of the Directorate for the Fight Against Disease, Epidemics and Pandemics. We obtained population projections per district for 2016–2023 from the health ministry information unit. We used updated shapefiles for Cameroon's 10 regions and 203 health districts from the information unit to map priority areas for multisectoral interventions.

Vulnerability data

We collected a vulnerability data set in September 2023 using KoboCollect (Kobo, Cambridge, United States of America) at regional and district levels. The 12 factors assessed were: (i) lack of access to unimproved water sources ($> 30\%$ of the population); (ii) lack of access to improved sanitation ($> 50\%$); (iii) lack of access to handwashing facilities ($> 50\%$ without access); (iv) accessibility of the area; (v) cross-border risk; (vi) travel routes; (vii) overcrowding; (viii) mass gatherings; (ix) presence of high-risk populations (including fishers, internally displaced people and refugees); (x) lack of recent cholera vaccination (> 3 years); (xi) exposure to extreme climate events; and (xii) complex humanitarian emergencies.¹⁵

Data analysis

Epidemiological and vulnerability data sets were analysed using the 2023 Excel (Microsoft, Redmond, USA) tool of the Global Task Force on Cholera Control.¹⁵ This tool automatically calculates a priority index by summing four cholera indicators: incidence, mortality, persistence and test positivity. Indicators were scored from 0 to 3 based on centile thresholds (0: none, 1: $< 50\text{th}$ centile, 2: 50th – 80th centile and 3: $> 80\text{th}$ centile). We considered test positivity representativeness acceptable with 88.5% weekly testing coverage ($\geq 50\%$ weekly testing coverage in $\geq 80\%$ of the geographic units). Districts with positivity rates of 0%, $\leq 10\%$, $> 10\text{--}30\%$ and $> 30\%$ were scored 0, 1, 2 and 3, respectively.¹⁵

We calculated the priority index as: incidence score + mortality score + persistence score + positivity score.¹⁵ By summing the 12 binary vulnerability factors (1 point each), we obtained the vulnerability index. The final prioritization score to rank districts was these two indices combined.

Mapping

We used QGIS version 3.34 (Chicago, USA) and official health ministry shapefiles to map priority areas for multisectoral interventions by district using polygon boundaries.

Validation and prioritization

A multisectoral validation workshop was held in Mbankomo from 27 November to 1 December 2023, led by the Prime Minister's Office. Eighty participants from key ministries (health, water and energy, territorial administration, justice, environment, education, finance and local development), technical partners (WHO, United Nations Children's Fund, United States Agency for International Development, International Federation of Red Cross and Red Crescent

Societies, and *Médecins Sans Frontières*), and civil society (VTCAM, DEMTOU Humanitaire) attended. The workshop validated results for the priority areas for multisectoral interventions through consensus. Districts with a priority index ≥ 9 were classified as priority areas for multisectoral interventions. Additionally, districts scoring 0–8 but with ≥ 9 vulnerability factors were also classified as priority areas for multisectoral interventions. The threshold of 9 ensured targeted focus and resource optimization.

Ethical considerations

The study used secondary, anonymized population data, thus ethical clearance was not required. The Directorate for the Fight Against Disease, Epidemics and Pandemics approved data use and ensured compliance with national data protection policies, guaranteeing confidentiality and secure data management.

Results

Cholera data

Between 2016 and 2023, Cameroon reported 24 813 suspected cholera cases in nine regions with a persistence rate of 51.2% (213 epidemiological weeks out of 416 weeks). Of these cases, 14 036 were tested for *V. cholerae* and 9442 were positive (positivity rate 67.1%): 9620 were tested with a rapid diagnostic test and 7643 (79.4%) were positive, while 4871 were tested by culture and 2018 (41.4%) were positive (Table 1). A total of 680 deaths from cholera were recorded during the same period giving a case fatality rate of 2.7% (680/24 813), a mortality rate of 0.32 per 100 000 inhabitants $((680/215\ 353\ 780) \times 100\ 000)$ and an incidence of 11.52 per person year $((24\ 813/215\ 353\ 780) \times 100\ 000)$.

Evolution and mapping

Between 2016 and 2023, the region of Adamawa did not report any confirmed cholera cases. In 2016, six regions were affected (Centre, East, Far North, Littoral, North and South), with Centre region reporting the most cases (35 without deaths, case fatality rate 0.0%) and Littoral the fewest cases (1 case with 1 death, case fatality rate 100.0%). In 2017, four regions were affected (Centre, Littoral, North and West), with Littoral having the highest number of cases (18 cases with no deaths, case fatality rate 0.0%) and North and West regions the fewest cases (1 case each, with no deaths, case fatality rate 0.0%). In 2018, five regions were affected (Centre, Far North, Littoral, North and South-West). North region reported the most cases (637 cases with 41

deaths, case fatality rate 6.4%) and South-West the least (1 case with no deaths, case fatality rate 0.0%). In 2019, two regions were affected (North and South-West), with the North reporting most cases (536 cases with 22 deaths, case fatality rate 4.1%) and South-West reporting fewer cases (370 cases with 16 deaths, case fatality rate 4.3%). In 2020, four regions were affected (Centre, Littoral, South and South-West), with Littoral reporting the most cases (951 cases with 53 deaths, case fatality rate 5.6%) and Centre the fewest (63 cases without deaths, case fatality rate 0.0%). In 2021, four regions were affected (Centre, Littoral, South and South-West), with South-West reporting the most cases (556 cases with 21 deaths, case fatality rate 3.8%) and Littoral the fewest (30 cases with 1 death, case fatality rate 3.3%). The highest cholera burden during the study period was recorded in 2022, when eight regions were affected (Centre, East, Far North, Littoral, North, West, South and South-West). Littoral reported the highest number (7093 cases with 153 deaths, case fatality rate 2.2%) and East the lowest number (12 cases with 2 deaths, case fatality rate 16.7%). In 2023, six regions were affected (Centre, East, Littoral, West, South and South-West), with Centre reporting the most cases (4653 cases with 155 deaths, case fatality rate 3.3%) and East the fewest (8 cases with 3 deaths, case fatality rate 37.5%).

Fig. 1 illustrates the trends in cholera cases in Cameroon from 2016 to 2023. The geographical distribution of cases fluctuated over the years, with recurring hotspots in Littoral, Centre and Far North regions.

In 2016, cholera cases were primarily concentrated in Far North, North, East and South regions. By 2017, there was a reduction in the number of cases, with clustering mainly in Littoral and North. In 2018, there was a notable increase in cases, spreading across Centre, Littoral, Far North and West regions (Table 1 and Fig. 1). Between 2019 and 2021, the distribution of cases fluctuated, with persistent hotspots in Littoral, Centre and Far North regions. In 2022, a significant increase and broader dispersion of cases was seen across these same regions. This regional trend continued in 2023, although no cases were confirmed in Far North (Table 1 and Fig. 1). Adamawa, East, North-West and West regions did not record any cases between 2016 and 2023.

Identification of priority areas

In total, we identified 35 health districts as priority areas for multisectoral interventions with a priority index ≥ 9 . An additional 13 districts with a priority index < 9 and vulnerability index of ≥ 9 were considered as additional priority areas for multisectoral interventions. Therefore,

nationwide, 48 priority areas for multisectoral interventions were identified, with Centre and Littoral regions accounting for 50.0% (24/48) of these priority areas (Table 2 and Table 3). Clustering of these priority areas was noted in four of the 10 regions (Littoral, Centre, South-West and North, in order of the highest number of districts) in Cameroon (Fig. 2).

Cholera trends, 2024–2025

In 2024, 130 suspected cholera cases were reported, including five confirmed cases: two in Far North region (Maroua 3 district) and three in Centre region (Soa, Djoungolo and Odza districts). In the first half of 2025, 36 suspected cholera cases were reported, 22 of which were positive by rapid diagnostic testing and none confirmed by culture.

Discussion

Our study highlights how historic epidemiological data and vulnerability factors can be used to identify priority areas for multisectoral interventions. Using data between 2016 and 2023, 48 health districts in Cameroon were identified as priority areas for multisectoral interventions with an estimated average population at risk of 11 488 089, representing 40.4% of the total population of Cameroon (28 433 067 people in 2023). Our study emphasizes the urgent need to scale up sustainable cholera interventions in these priority areas to reduce this number.

Cholera epidemiology was consistent in Cameroon over the study period and affected a minimum of four regions every year. The northern regions of the country had intense outbreaks between 2018 and 2019, which stopped in 2020. In contrast, from 2020, southern parts of the country became the focus of cholera outbreaks. Cholera persisted between 2018 and 2022 in the South-West region which was almost not affected by cholera outbreaks before 2018.

These trends in cholera outbreaks can be explained by factors including extreme climate events (droughts and floods), a decreased intensity of the humanitarian crisis in Far North region and increased crises in South-West and North-West regions leading to population displacement towards Littoral, West and the Centre regions.¹⁷ In February 2024, there were more than 1 million internally displaced people and nearly 500 000 refugees and asylum seekers with 1.8 million people in need of sanitation and hygiene services in crisis-affected regions. In Far North region, as of April 2024, the population included 573 263 internally displaced people and refugees from Nigeria, who had moved there due to violence and natural disasters. With only 40% of the population in Far North estimated to have access to improved sanitation and hygiene

services, the risk of cholera outbreaks is high in this part of the country.¹⁷ Violence and fear of attacks from armed groups in South-West and North-West regions have led to regular population displacements. Cameroon is also home to 353 000 refugees from the Central African Republic who mostly live in eastern region of the country.¹⁷ A similar dynamic pattern of priority areas for multisectoral interventions has been observed in Ethiopia,^{18,19} which has faced substantial humanitarian crises associated with climate shocks, disease outbreaks and conflicts in a challenging socioeconomic context.¹⁹ Continued insecurity and cross-border movements sustain high vulnerability, highlighting the need for regular updates to the priority areas for multisectoral interventions, as recommended by the Global Task Force on Cholera Control, to reflect Cameroon's dynamic humanitarian and environmental context.²⁰

Nearly half of all priority areas for multisectoral interventions are in the urbanized Centre and Littoral regions, which host 34.3% (9 742 188/28 433 067) of the country's population, including the political and economic capitals. Rapid urbanization, informal settlements and poor town planning have created conditions conducive to cholera transmission, with limited access to sanitation and hygiene services.^{21–24} There is a serious shortage of water in urban and peri-urban areas in Cameroon.²⁴ Rapid urban growth has also led to limited access to health care and the establishment of informal care structures. As such, access to oral rehydration points is limited resulting in many deaths from cholera. Although cholera deaths declined during the study period, we found a national case fatality rate of 2.7% (680/24 813) which is still higher than the WHO 1% target, indicating challenges in access to health care.²⁵ This situation underscores the urgent need for sustained, targeted interventions in high-risk urban and peri-urban priority areas for multisectoral interventions.

One in four districts in Cameroon is at risk of cholera outbreaks and 40.4% (11 488 089/28 433 067) of the total population is at risk of cholera. Thus, Cameroon remains a country with high cholera transmission, which suggests that the country should engage in a control strategy in the national cholera plan rather than an elimination strategy. Similarly, countries such as Burundi, where priority areas for multisectoral interventions represent 25.5% (12/47) of all health districts, would likely opt for a cholera control strategy.²⁶ According to the Global Task Force on Cholera Control, to achieve cholera control or elimination, it is important to organize activities around immunization, surveillance, risk communication and community engagement, sanitation and hygiene, and health-system strengthening, and to ensure an effective

multisectoral coordination mechanism,^{13,15} focusing on priority areas for multisectoral interventions. With so many people living at risk of cholera in the priority areas, there are significant financial implications for the cholera control strategy in Cameroon and the need for substantial investment.

The use of oral cholera vaccine for long-term control²⁷ in Cameroon would require vaccinating about 11.5 million people with two doses across the 48 priority areas for multisectoral interventions, which poses important cost, logistical and cold-chain challenges. Limited global oral cholera vaccine stockpiles²⁸ and co-financing constraints further hinder large-scale preventive campaigns. This global shortage of oral cholera vaccine has prompted a shift to a one-dose strategy.²⁹ As such, a phased approach targeting high-risk areas with one dose of the vaccine, combined with strengthened sanitation and hygiene services and behaviour-change interventions, offers a more feasible and sustainable path to cholera control in Cameroon.

The identification and prioritization of priority areas for multisectoral interventions in Cameroon have strengthened cholera control by enabling targeted deployment of rapid diagnostic tests, prepositioning of cholera kits and the development of the 2026–2030 National Cholera Plan. This plan focuses on sanitation and hygiene, surveillance, community engagement, case management, vaccination and governance. Governmental leadership and ownership was important for ensuring a successful implementation of the exercise. Such cholera control efforts have led to reduced cholera cases since 2024 in Cameroon. Targeting prioritized areas will ensure the optimal use of resources and coordinated multisectoral action in the most vulnerable areas, which aligns with the roadmap of the Global Task Force on Cholera Control.¹³ Without a detailed prioritization process, cholera control efforts risk becoming inefficient and fragmented, with resources spread thin and high-risk areas left vulnerable. This situation can lead to persistent transmission, delayed outbreak response, higher morbidity and mortality, and reduced cost-effectiveness. Ultimately, a lack of prioritization undermines national progress towards cholera elimination and weakens public trust in health interventions.

Despite filling an important evidence gap for decision-making, our study has some limitations, including: missing data in newly created districts; incomplete laboratory data before 2018; selection bias in test positivity due to non-systematic testing; variations in surveillance and health-seeking behaviour (notably during the coronavirus disease 2019 pandemic); and effects of administrative changes on trends. These limitations were partially addressed through data

imputation, complementary epidemiological indicators, data triangulation with expert validation and harmonized spatial data. Nonetheless, our comprehensive analysis is a first step towards long-term cholera control in Cameroon and beyond.

To conclude, our study sheds light on the use of the Global Task Force on Cholera Control methods to identify priority areas for multisectoral interventions in Cameroon. Our findings provide evidence for public health decision-making to enhance cholera preparedness and prevention in Cameroon and in the African Region by directing interventions to locations where the burden of cholera could be reduced.

Competing interests:

None declared.

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Table 1. Summary of cholera epidemiology, Cameroon, 2016–2023

Year	Population	Suspected cases, no.	Deaths, no.	Case fatality rate, %	Incidence, per 100 000 population	Mortality, per 100 000 population	Total tests, no. ^a	Positive, no. (%)	Tested by rapid diagnostic test	Positive by rapid diagnostic test, no. (%)	Tested by culture	Positive by culture, no. (%)	Weeks with ≥ 1 suspected case, no.	Persistence, %
2016	24 114 482	78	1	1.3	0.32	0.00	78	78 (100.0)	78	78 (100.0)	1	1 (100.0)	13	25.0
2017	25 935 614	22	NR	0.0	0.08	0.00	22	22 (100.0)	22	22 (100.0)	1	1 (100.0)	9	17.3
2018	26 212 331	1 072	64	6.0	4.09	0.24	426	133 (31.2)	243	87 (35.8)	139	26 (18.7)	23	44.2
2019	26 926 900	906	38	4.2	3.36	0.14	375	298 (79.5)	180	151 (83.9)	78	60 (76.9)	21	40.4
2020	27 730 987	1 879	82	4.4	6.78	0.30	846	523 (61.8)	765	496 (64.8)	76	30 (39.5)	40	76.9
2021	28 729 954	698	24	3.4	2.43	0.08	219	127 (58.0)	72	50 (69.4)	167	74 (44.3)	10	19.2
2022	27 270 447	13 911	272	2.0	51.01	1.00	6 493	3 350 (51.6)	2 495	1 773 (71.1)	4 303	1 758 (40.9)	52	100.0
2023	28 433 067	6 247	199	3.2	21.97	0.70	5 577	4 891 (87.7)	5 765	4 986 (86.5)	106	68 (64.2)	45	86.5
Total	215 353 782	24 813	680	2.7	11.52	0.32	14 036	9 422 (67.1)	9 620	7 643 (79.4)	4 871	2 018 (41.4)	213	51.2

NR: not reported.

^a Some cases are tested with both a rapid diagnostic test and culture, or only culture, or only rapid diagnostic test depending on the situation (e.g. beginning of an outbreak, availability of reagents, logistics for sample transportation and security).

Table 2. Priority areas for multisectoral interventions for cholera based on priority index and vulnerability, Cameroon

Region	No. of districts		
	Priority index ≥ 9	High vulnerability	Total priority areas
Adamawa	0	0	0
Centre	12	0	12
East	0	0	0
Far North	1	5	6
Littoral	12	0	12
North	3	2	5
North-West	0	5	5
West	0	0	0
South	1	0	1
South-West	6	1	7
Total	35	13	48

Table 3. Final priority areas for multisectoral interventions for cholera, Cameroon, 2024

Region, ^a health district	Population, no.	Vulnerability index	Incidence score	Persistence score	Mortality score	Test positivity score	Priority index ^b
Centre							
Biyem-Assi	422 270	5	2	3	2	3	10
Cité-Verte	472 015	6	2	3	1	3	9
Djoungolo	575 409	7	2	3	2	3	10
Ebebda	23 602	5	2	1	3	3	9
Efoulan	480 107	5	2	3	1	3	9
Mfou	112 210	6	3	2	2	3	10
Mvog-Ada	411 968	4	2	3	1	3	9
Nkolbisson	192 440	6	3	2	2	3	10
Nkolndongo	599 793	8	2	3	2	3	10
Obala	147 550	4	3	3	3	3	12
Odza	442 785	4	2	3	1	3	9
Soa	49 369	5	3	2	2	3	10
Littoral							
Bangue	395 315	9	3	3	1	3	10
Boko	373 983	7	3	3	2	3	11
Bonassama	568 369	6	3	3	2	3	11
Cité des palmiers	348 001	4	3	3	1	3	10
Déïdo	640 608	2	3	3	2	3	11
Japoma	187 006	9	3	3	1	3	10
Logbaba	279 923	4	2	3	1	3	9
Manoka	31 050	9	3	2	3	3	11
Melong	112 946	8	2	2	2	3	9
New-Bell	324 169	8	3	3	3	3	12
Njombe-Penja	59 250	8	3	2	3	3	11
Nylon	462 815	8	3	3	3	3	12
South-West							
Bakassi	37 390	7	3	2	3	3	11
Buea	188 293	8	3	2	2	3	10
Ekondo-Titi	61 031	8	3	2	3	3	11
Limbé	215 410	9	3	2	3	3	11
Mbonge	97 999	10	1	1	0	3	5
Mundemba	23 267	8	2	1	3	3	9
Tiko	164 284	8	3	3	3	3	12
Far North							
Bourha	90 077	9	1	1	0	3	5
Fotokol	74 704	10	2	2	0	3	7
Makary	144 528	7	2	1	3	3	9
Mokolo	333 305	9	2	1	1	3	7
Mora	328 959	9	1	1	1	3	6
Yagoua	272 701	10	0	0	0	0	0
North							
Bibeni	176 023	7	2	2	2	3	9
Garoua	315 119	9	2	2	1	3	8
Golombe	77 146	5	2	2	2	3	9
Pitoa	172 652	8	2	3	3	3	11
Touboro	335 091	9	0	0	0	0	0
North-West							
Ako	66 074	9	0	0	0	0	0
Kumbo-East	119 735	9	0	0	0	0	0
Kumbo-West	108 723	9	0	0	0	0	0
Ndop	193 116	10	0	0	0	0	0

Nwa	60 931	9	0	0	0	0	0
South							
Kribi	118 579	9	3	3	3	3	12
Total population	11 488 090	NA	NA	NA	NA	NA	NA

NA: not applicable.

^a Ordered by the number of priority areas for multisectoral interventions.

^b Calculated as incidence + mortality + persistence + positivity scores.

Fig. 1. Cholera cases, by district and year, Cameroon, 2016–2023

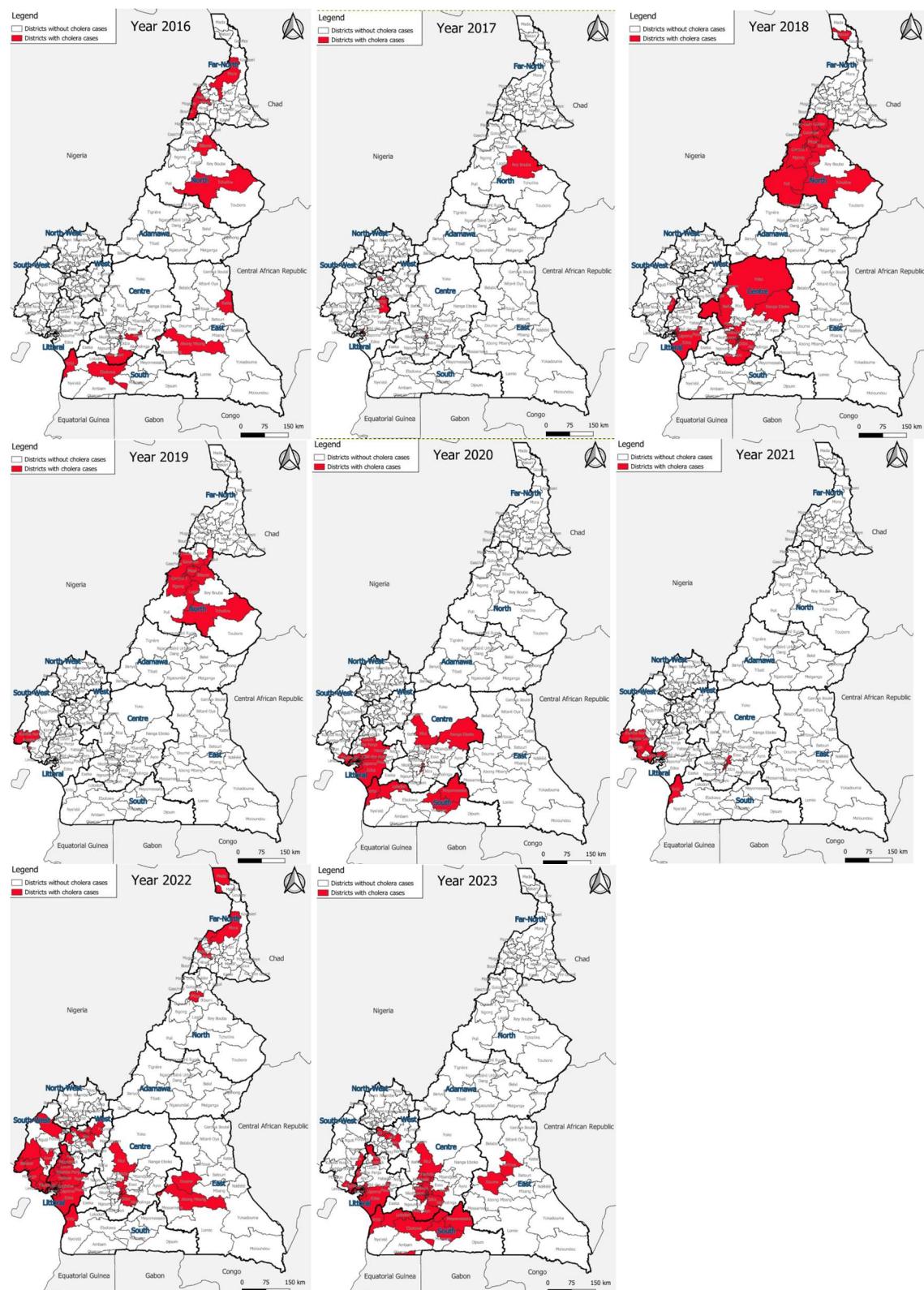
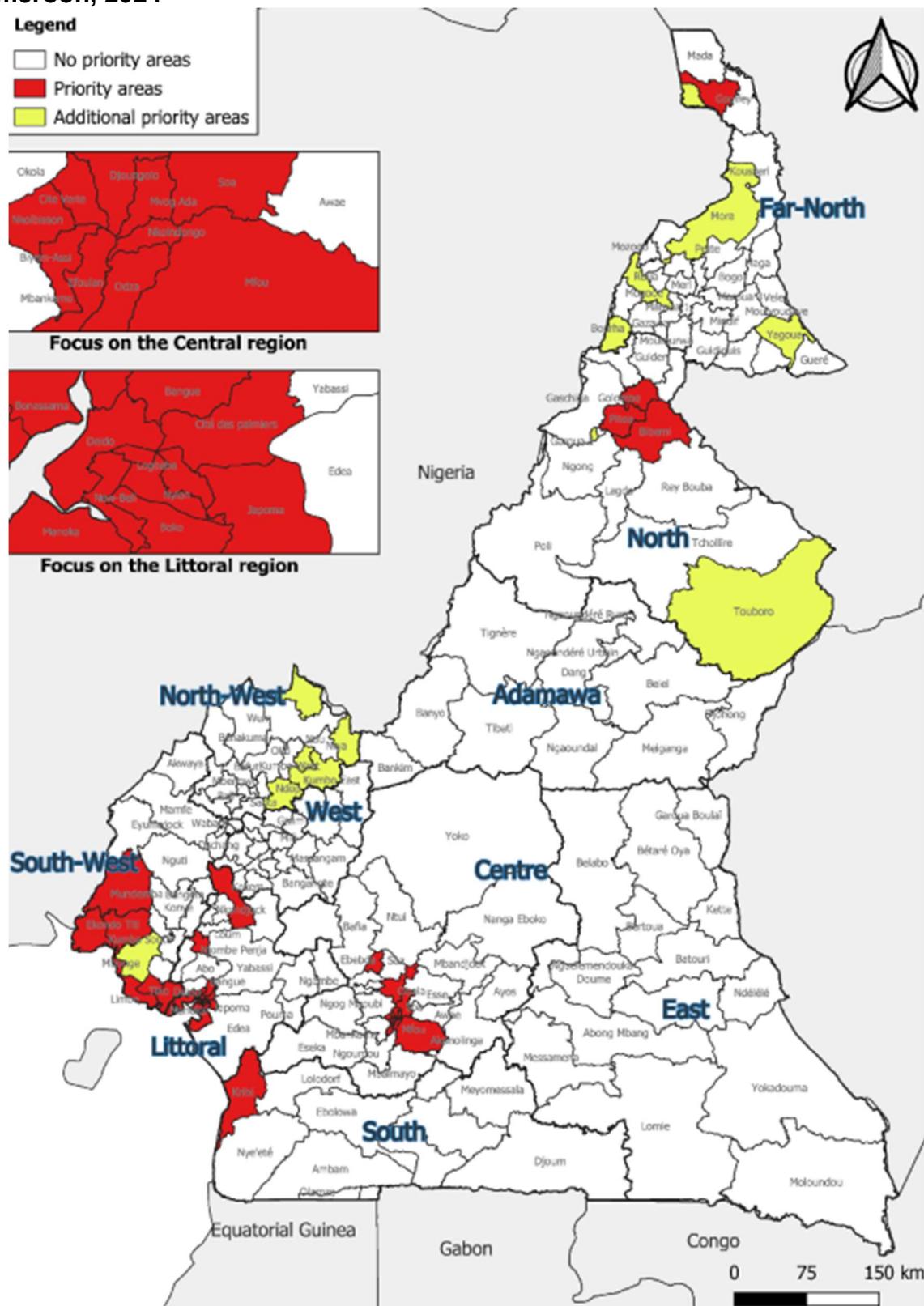


Fig. 2. Priority areas for multisectoral interventions for cholera, by district, Cameroon, 2024



Note: The final prioritization integrates four indicators (incidence, mortality, persistence and testing) each assigned specific scores, as well as vulnerability.

