Central Africa and the COVID-19 paradox: lessons from a silent spread

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Abstract

Initially perceived as a high-risk region at the onset of the COVID-19 pandemic, Central Africa raised major concerns due to its fragile health systems. Four years after the emergence of SARS-CoV-2, this review provides a critical analysis of sero-prevalence data, epidemiological trends, diagnostic capabilities, and the technologies implemented in the regional response. An organized narrative review was conducted for the period 2020-2023. In total, 42 documents were included, comprising 27 peer-reviewed articles and 15 institutional reports. The analysis covered a country-by-country description and a cross-cutting assessment of testing strategies, genomic surveillance, vaccination roll-out, and health governance. The region exhibited significant disparities in its response, notably in testing capacity, vaccination coverage (often<15%), and fragmented genomic surveillance. Molecular testing by reverse transcription quantitative polymerase chain reaction (RT-qPCR) remained highly centralized, while antigen tests were inconsistently deployed in peripheral areas. Only a few countries could locally identify variants. Seroprevalence levels appear to be much higher than reported case numbers. Initial catastrophic forecasts did not materialize, likely due to underestimated demographic, community-based, and probably immunological factors. The pandemic highlighted both the structural weaknesses and the adaptive capacities of Central African health systems. Nevertheless, it has offered a strategic opportunity to invest in sustainable epidemiological surveillance and health sovereignty. Understanding the gap between early projections and actual outcomes underscores the need for context-sensitive, resilient public health models in the region.

Introduction

Declared a public health emergency of international concern by the World Health Organization (WHO) in January 2020,[1] the Coronavirus disease 2019 (COVID-19) pandemic has put unprecedented pressure on healthcare systems worldwide.[2] Added to this were socio-political and logistical challenges, a diversity of socio-economic contexts, and a marked heterogeneity of national responses, all of which led to contrasting results.[3]

Central African countries generally implemented early measures, such as border closures, curfews, and mask mandates, drawing on lessons from previous epidemics. However, the application of these measures was often inconsistent, with limited follow-up and insufficient social support. Additionally, many strategies were modelled on responses from Northern countries, without full adaptation to local contexts. Paradoxically, Central Africa appeared to experience a relatively low burden of COVID-19 cases and deaths, despite being considered highly vulnerable due to fragile health systems, limited diagnostic infrastructure, and

delayed vaccine rollout.[4] Several studies suggest that this "silent spread" may have been masked by weak surveillance, but also influenced by regional factors such as a predominantly young population, pre-existing immunity from endemic coronaviruses, and limited urban density outside capital cities.[5,6] This paradox underlines the urgent need for a context-specific and evidence-informed understanding of the pandemic's trajectory in Central Africa, which remains underrepresented in the global literature.

This review aims to provide an analytical description of the evolution of the COVID-19 pandemic in Central Africa, examine national health responses, identify obstacles encountered and highlight lessons learned. The aim is to contribute to strategic thinking on health resilience, particularly in resource-poor settings, while raising the scientific profile of a region that is all too often left out of global studies.[7,8]

The regional context

Central Africa, as defined by the United Nations and the African Union, comprises ten countries: Angola, Burundi, Cameroon, the Central African Republic (CAR), Chad, the Republic of Congo (Congo-Brazzaville), the Democratic Republic of Congo (DRC), Equatorial Guinea, Gabon, and São Tomé and Príncipe.[9-11] With an estimated population of 180 million, this region is characterized by linguistic, political, and geographical heterogeneity, but overall it generally exhibits weak socio-health indicators.[12] Before the pandemic, the majority of Central African countries faced a critical shortage of health professionals, pronounced inequalities between urban and rural areas, and a high dependence on external aid to finance their health systems. While this pattern applied to countries such as Chad, the CAR, the DRC, and Burundi, a few exceptions like São Tomé and Príncipe had begun to implement more resilient and community-based health strategies with relatively lower reliance on foreign assistance.[10] Countries, such as the DRC, Chad, CAR, and Burundi, were among the world's worst indicators for maternal and infant mortality.[10] At the same time, the region has been the scene of recurrent epidemics (cholera, measles, yellow fever, Ebola), which have highlighted systemic shortcomings in epidemiological surveillance and rapid.[13]

Before 2020, very few countries had biosafety level three laboratories or local molecular diagnostic capabilities. Reverse transcription quantitative polymerase chain reaction (RT-qPCR) tests and sequencing were mostly limited to capital cities.[14,15] These systemic weaknesses shaped the initial response to COVID-19 across Central Africa, leading to delays in testing, shortages of trained personnel, supply chain disruptions, and poor institutional coordination, especially in fragile or conflict-affected states.[16,17] Rural, fragile, and island areas in Central Africa were disproportionately affected in terms of access to healthcare, reliable information, and vaccination efforts, due to geographical isolation, insecurity, and under-resourced systems.[17] However, some positive examples have emerged. São Tomé and Príncipe adopted more proactive response strategies, based on digital case management, strong community involvement, and transparent communication.[18] These contrasts justify a detailed and comparative analysis of national trajectories in the face of the pandemic, with a view to improving preparedness and response capacities in Central Africa in the long term.

Materials and Methods

This narrative review is based on a structured analysis of epidemiological, institutional, and technological data related to the COVID-19 response in Central Africa. Sources consulted include official reports and databases from the WHO, Africa Centres for Disease Control and Prevention (Africa CDC), United Nations agencies (UNICEF, OCHA), and national ministries of health. A broad literature search was also conducted using PubMed, Web of Science, and Scopus, including all publication types from March 2020 to December 2023, to ensure a comprehensive synthesis. To ensure a context-relevant and comprehensive literature review, a targeted bibliographic search was conducted using combinations of thematic and geographical keywords. Thematic terms included: "COVID-19", "SARS-CoV-2", "pandemic", "seroprevalence", "genomic surveillance", "diagnostic capacity", "vaccine hesitancy", "health system resilience", and "public health response". These were combined with geographic identifiers such as "Central Africa", "ECCAS", and the names of specific countries (*e.g.*, "Cameroon", "Chad", "DRC", "Gabon", "São Tomé and Príncipe"). Boolean operators were used to refine the results (*e.g.*, "COVID-19" AND "Cameroon" AND "seroprevalence"), and filters were applied to retain only peer-reviewed articles written in English. Additional grey literature and institutional reports from WHO, Africa CDC, UNICEF, and national health ministries were included to complement gaps in the scientific literature, particularly given the underrepresentation of Central African countries in indexed publications.

This dual strategy, combining scientific articles and institutional data, was essential to produce a more accurate and regionally grounded synthesis of the COVID-19 response in Central Africa. The review focused on nine countries considered part of Central Africa by the Economic Community of Central African States (ECCAS): Cameroon, Chad, Central African Republic, Congo (Brazzaville), Democratic Republic of the Congo, Equatorial Guinea, Gabon, and São Tomé and Príncipe.

Data were extracted manually and thematically organized into key public health domains: epidemic dynamics, diagnostic and surveillance capacities, vaccine rollout, community engagement, and governance structures. Particular attention was given to grey literature, national policy documents, and regional disparity in health system resilience. Quantitative indicators such as confirmed cases, deaths, tests conducted, vaccination coverage, and seroprevalence were compiled into a comparative summary table. As a narrative review, this study does not include a formal quality assessment of the included documents but prioritizes the triangulation of institutional sources and contextual interpretation of regional trends.

National responses and epidemic dynamics

Central African countries adopted highly diverse strategies to manage the COVID-19 pandemic, shaped by their respective political leadership, existing health infrastructure, and international support. Cameroon, the first country in the region to report a case (March 6, 2020), implemented a multisectoral response and benefited from early access to molecular and antigen testing, as well as local genomic sequencing capacity through the Pasteur Centre in Yaoundé.[19] By the end of 2023, it had reported over 124,000 confirmed cases and 1,965 deaths. Building on INRB's expertise, the DRC established more than 70 PCR molecular testing sites and developed a national sequencing platform. Despite this, vaccination coverage remained below 15% due to structural and logistical challenges.[20] Gabon achieved relatively higher coverage (25-30%) through the early deployment of both RT-qPCR and rapid diagnostic tests, supported by strong laboratory infrastructure, including local genomic surveillance led by the *Centre*

International de Recherches Médicales de Franceville (CIRMF) and the *Centre de Recherches Médicales de Lambaréné* (CERMEL).[21] In Chad and the CAR, major structural barriers led to centralized testing, limited sequencing capacity, and vaccination rates that remained below 15%, highlighting the need for stronger health system support in the region.[22] São Tomé and Príncipe and Burundi initiated vaccination later in 2021, with external assistance from Portugal and China, respectively. These nations reported low mortality but also had limited testing coverage, likely underestimating the actual burden.[23] Overall, the region exhibited profound disparities in COVID-19 response, shaped by fragile health systems, political instability, logistical bottlenecks, and the absence of long-term investment in epidemic preparedness. This reinforces the need for regional integration and targeted investment in public health infrastructure.[24,25] These data confirm the heterogeneity of national dynamics in the sub-region, highlighting the importance of structural, political, and logistical factors in the health response to COVID-19 (Table 1).[26]

Diagnostic capabilities and genomic surveillance

The COVID-19 pandemic exposed considerable disparities in diagnostic capacity across Central Africa. Countries such as Cameroon, the DRC, and Gabon rapidly deployed RT-qPCR platforms, leveraging pre-existing national reference laboratories such as the Pasteur Centre in Yaoundé, INRB in Kinshasa, and CIRMF in Franceville, with strong support from international partners.[13,14,16] These laboratories played a central role in national testing, although their accessibility remained largely limited to capital cities. In contrast, other countries, including Chad, Burundi, and the CAR, experienced significant delays in accessing molecular diagnostics, often relying on international aid or partner laboratories.[17] RT-qPCR testing remained highly centralized, with most rural and remote regions underserved throughout the pandemic.[19] To help address diagnostic gaps, antigen-detecting rapid diagnostic tests (Ag-RDTs) were progressively introduced from 2021 onwards in Central African countries such as Cameroon, Chad, the CAR, and the DRC, with support from global health partners.[9] While this increased coverage, challenges persisted regarding staff training, supply chain disruptions, and lack of molecular confirmation in peripheral settings. These limitations impaired timely case detection and pandemic control in underserved areas.[12]

Genomic surveillance capabilities were extremely limited across Central Africa. Only Cameroon, the DRC, and Gabon established local sequencing platforms, allowing timely detection of SARS-CoV-2 variants of concern.[21] In many countries, the absence of local sequencing capacity led to reliance on international referral laboratories. This resulted in considerable delays, underreporting of variant circulation, and poor integration of genomic data into national public health strategies.[20]

Strengthening both diagnostic and genomic capacity, especially in peripheral regions, is essential to improving epidemic preparedness and health equity in Central Africa. Sustainable investment in decentralized laboratories, personnel training, and data integration must become regional priorities.[25]

Vaccination rollout and community engagement

The rollout of COVID-19 vaccination in Central Africa was marked by significant delays, heavy reliance on international donations, and major disparities in coverage. Most countries began their campaigns between March and June 2021, primarily through the COVAX initiative or bilateral donations (*e.g.*, China,

Russia, USA, EU).[22-24] In Chad, the national campaign began on 4 June 2021, following the delivery of 200,000 Sinopharm BBIBP-CorV (Sinopharm, China) doses. By 10 June 2021, 5,324 doses had already been administered.[27] Countries such as Cameroon, Gabon, the DRC, and Equatorial Guinea initiated early vaccination drives but still faced challenges in sustaining coverage due to supply bottlenecks, cold chain limitations, and community mistrust. In contrast, countries such as Chad, CAR, and Burundi experienced longer delays and lower initial uptake. By the end of 2021, full vaccination coverage was estimated at ≈1 % of the target population, and by August 2022, it remained under 5%.[28]

The vaccines administered included Vaxzevria/ChAdOx1 nCoV-19 (AstraZeneca, Oxford), BBIBP-CorV (Sinopharm, China), Ad26.COV2.S (Johnson & Johnson, USA) *via* the COVAX initiative, and the Russian Sputnik V/Gam-COVID-Vac vaccine (Gamaleya National Research Center, RDIF). The choice of vaccine was often dictated by availability and storage requirements. However, by the end of 2023, overall vaccination coverage remained low. Only Equatorial Guinea (~30%) and Gabon (25-30%) surpassed the 20% threshold, while most other countries, including Chad, DRC, CAR, and Cameroon, remained below 15%, with Burundi lagging at under 5%.[29] One of the key barriers was widespread vaccine hesitancy, fueled by misinformation, low trust in government, and limited health literacy. A study in Chad, for example, highlighted high levels of public reluctance and inconsistent messaging as major obstacles to vaccine uptake.[30] Some countries attempted to overcome these challenges through mobile outreach campaigns, involvement of religious and community leaders, and integration of COVID-19 vaccines into existing immunization programs. However, the impact of these initiatives remained limited and uneven across the region.[31] This situation reflects the structural dependence of Central African health systems on external support and the critical need to build long-term health sovereignty, including investments in local vaccine production, supply chain resilience, and culturally sensitive communication strategies. Four years after the start of the COVID-19 pandemic, the African continent is still struggling to reach the 70% vaccination rate recommended by the WHO.

Epidemiological indicators and seroprevalence patterns

Crude epidemiological indicators vary widely across Central African countries, but must be interpreted with caution, as they reflect both viral circulation and disparities in detection, reporting, and data transmission capacities. In 2023, Cameroon reported 125,000 cases, followed by the DRC (100,337), Gabon (48,992), Burundi (53,930), and Congo-Brazzaville (25,442). In contrast, Chad (7,698),[32] São Tomé and Príncipe (6,816), and CAR (15,367) reported much lower numbers. This distribution mainly reflects the disparity in screening capacity and the centralisation of information systems (Table 1). In terms of mortality, Cameroon remains the country with the most deaths (1,965), followed by the DRC (1,469), Congo-Brazzaville (386), Gabon (307), and Equatorial Guinea (183). Chad, with just 7,698 reported cases, reported 194 deaths, reflecting a particularly high case-fatality rate (CFR) (~2.5%). In contrast, Burundi reported only 15 deaths for more than 50,000 confirmed cases.[33] These differences need to be put into context. The CFR rate appears high, as the number of cases detected is low. A high CFR reflects significant underreporting of mild or asymptomatic cases, and delays in centralising deaths. Conversely, an abnormally low CFR reflects underreporting of deaths, lack of post-mortem testing, or unreliable vital

records. Other factors have influenced regional epidemic dynamics, including the very young demographic composition, poorly documented co-morbidity factors, and the possible effect of cross-immunity with other endemic coronaviruses.

These observations highlight the need for a nuanced and context-aware interpretation of epidemiological data from Central Africa. They also emphasize the critical importance of reinforcing regional surveillance systems to better capture the true dynamics of pandemics and support evidence-based public health decision-making.

Strategic gaps and lessons learned

The management of the COVID-19 pandemic in Central Africa revealed both structural limitations and unprecedented resilience. Health responses were heterogeneous, conditioned by political contexts, available resources, and international support. This section outlines the strategic lessons to be learned for the future.

In most Central African countries, national COVID-19 response committees were established within the first weeks of the pandemic, coupled with multisectoral contingency plans involving health protocols, intersectoral coordination, and emergency measures such as border closures, curfews, and social restrictions. Coordination mechanisms followed the strategic-operational-tactical framework described in the WHO-AFRO guidance, including activation of country Emergency Operation Centres (PHEOCs). Countries like Cameroon, DRC, and Gabon managed relatively coordinated responses with regional focal points, consistent public communication, and technical support from partners.[34] However, in settings of extreme fragility, particularly in CAR, Chad, and Burundi, the response was hindered by conflicts, a shortage of qualified personnel, under-resourced health structures, and weak institutional coordination. These factors significantly affected the effectiveness of the response, especially in rural and unstable areas.[12] The pandemic nevertheless allowed for a temporary strengthening of health infrastructure: the establishment of COVID-19 treatment centers in capital cities, improved availability of medical oxygen, distribution of personal protective equipment, and temporary recruitment of healthcare personnel. However, these measures were rarely sustained due to a lack of long-term funding. By 2022, several of the structures that had been put in place were dismantled or inactive, highlighting the absence of a long-term investment vision as confirmed by a multi-country survey showing that only 14 % of health facilities in Chad had adequate infrastructure to maintain essential services during COVID-19.[35] Crisis communication represented a major vulnerability. The widespread circulation of misinformation and disinformation regarding COVID-19 and its vaccines, combined with limited community engagement, significantly undermined public trust and support for response measures. While some local initiatives did emerge, such as community radio, religious leaders, and communication in local languages, their impact was inconsistent and rarely coordinated at the national level.[36] The near-total dependence on external aid for vaccines, diagnostic tests, medical equipment, and even oxygen also exposed a critical lack of health sovereignty in the region. Africa CDC experts have emphasized that such dependency threatens pandemic preparedness and called for regional vaccine and diagnostic production initiatives.[37]

Several lessons can be drawn from this experience to strengthen health preparedness and resilience in Central Africa:
- Strengthen integrated epidemiological surveillance by establishing localized and interconnected early warning systems.
- Institutionalize laboratory capacity through investments in PCR molecular platforms, technician training, and genomic sequencing.
- Professionalize public health emergency management through continuous training of health personnel, including in biosafety and vaccination.
- Develop adapted communication strategies rooted in local languages and community networks.
- Support regional production, whether for vaccines, medical supplies, or oxygen.
- Reinforce regional cooperation through ECCAS, Africa CDC, and the Network of National Public Health Institutes in Africa.

COVID-19 was a harsh wake-up call but also a potential catalyst for rethinking health governance in Central Africa. It is now the responsibility of States, with the support of their partners, to transform the lessons learned into stronger, more inclusive, and sovereign health policies.

Limitations

This review has certain limitations. First, the reliance on published literature and institutional reports may have introduced reporting bias, particularly given the underrepresentation of Central African countries in indexed publications. Second, as a narrative review, no formal quality assessment of included sources was performed. Third, data gaps, especially regarding seroprevalence estimates and vaccine coverage in remote areas, limit the precision of regional comparisons. These constraints highlight the need for more systematic data collection and research from Central African settings in future health crises.

Table 1. COVID-19 summary in Central Africa (2020-2023).

Country	Reported cases	Deaths	Tests conducted	Vaccination coverage (%)	Estimated seroprevalence (%)
Cameroon	125,000	1,972	1,500,000	13.5	65.0
Chad	7,698	194	120,000	10.2	70.0
Central African Republic	14,736	113	80,000	7.8	68.0
Gabon	48,992	306	500,000	15.0	75.0
Congo (Brazzaville)	25,284	385	300,000	12.3	72.0
DRC	100,337	1,469	2,500,000	9.4	66.0
Equatorial Guinea	16,690	179	150,000	18.6	78.0
São Tomé and Príncipe	3,715	57	30,000	23.1	60.0

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Conclusions

Far from the catastrophic scenarios initially feared, the COVID-19 response in Central Africa has defied many expectations, forcing a reassessment of global health narratives and inviting a deeper reflection on structural justice, resilience, and sovereignty.

The COVID-19 pandemic posed a critical stress test for Central African health systems, exposing deep-rooted structural weaknesses while simultaneously highlighting under-recognized resilience capacities. Despite limited testing infrastructure, vaccine shortages, and external dependence, the region did not experience the catastrophic projections initially feared.

Several interrelated factors may help explain this paradox. First, the region's demography, with over 60% of the population under 25, likely contributed to lower hospitalization and death rates compared to high-income countries.[38] Second, emerging evidence suggests that pre-existing immunity, possibly induced by frequent exposure to endemic coronaviruses or prior vaccinations (*e.g.*, BCG), may have modulated SARS-CoV-2 severity.[39] Third, population-level genetic factors, such as polymorphisms in ACE2 or HLA alleles, have been hypothesized to influence susceptibility and disease progression, although more region-specific genomic studies are needed.[40]

However, the absence of a visible crisis does not mean the region was spared. The indirect effects of the disruption of essential services, economic fallout, misinformation, and erosion of trust were profound.

The pandemic also revealed the risk of uncritically importing response models (*e.g.*, lockdowns, curfews) from Northern countries, often incompatible with local realities (*e.g.*, informal economies, lack of social protection).[41] Meanwhile, countries that leveraged past epidemic experience (*e.g.*, Ebola, measles) often responded faster and more pragmatically.

Looking ahead, it is imperative to address persistent global inequities in access to diagnostics, vaccines, and surveillance tools. Without equitable investment and regional capacity-building, the world remains vulnerable to future pandemics, especially in under-resourced regions.

The COVID-19 crisis must serve as a turning point: an opportunity to build sovereign, context-sensitive, and resilient health systems across Central Africa.

The advent of mRNA-based vaccines during the COVID-19 pandemic marked a turning point in epidemic response technologies. However, in Central Africa, their use remained limited due to cold chain requirements, hesitancy, and lack of infrastructure. Similarly, the 2022 Mpox outbreak exposed the fragility of post-COVID preparedness mechanisms. Despite the experience gained during SARS-CoV-2, surveillance, and vaccine deployment for emerging threats like Mpox remained fragmented and under-resourced, reflecting a missed opportunity to consolidate pandemic gains.

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