## RESEARCH





Profile of Chief Medical Officers and performance of health zones in crisis contexts: a cross-sectional study in three provinces of the Eastern Democratic Republic of Congo

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## Abstract

**Context** In crisis-affected health systems, the performance of health zones (also known as health districts) is challenged by recurrent armed conflicts and state fragility. The profiles of health zone managers and contextual factors can significantly influence the zones' ability to effectively respond to population health needs. This study explores these interactions to identify key factors associated with health zones performances in three provinces of Eastern Democratic Republic of Congo (DRC), a region that has endured over three decades of conflict.

**Methods** This mixed-methods study was conducted between October 2022 and April 2024, using data covering the period from 2017 to 2022. In the DRC, health zones are managed by Chief Medical Officers (CMOs). We assessed the functionality and performance of health zones using key indicators related to primary healthcare delivery and management. Data on CMO profiles and the operational contexts of their health zones were analyzed to identify factors influencing functionality and performance, through multivariate regressions (p < 0.05). In addition, 17 individual interviews with key health system actors were analyzed thematically to capture perceptions on CMO performance and stability.

**Results** CMOs with training in primary healthcare management and extensive professional experience were statistically associated with higher health zone performance. Conversely, instability among CMOs, due to frequent rotations driven by political influences and weak collaboration between decision-making bodies, negatively impacted performance. However, support from international and faith-based partners was associated with improved health zone performance.

**Conclusions** This study highlights the importance of investing in capacity-building for health managers to strengthen health systems and improve resilience in crisis settings. Establishing robust governance frameworks that promotes transparency in the recruitment and management of health managers, and ensure stability in human resources, is critical for maintaining and improving health system performance.

Keywords Health system management, Conflicts, Health human resources, DRC

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#### Introduction

The Democratic Republic of Congo (DRC) has faced prolonged crisis for nearly three decades. This situation has led to severe deterioration across all sectors of the country, including the health system [1-3]. Existing research recommends strengthening human resources skills to achieve health system goals [4, 5]. This is especially important in systems exposed to multiple crises, such as in the DRC and other low-income countries [6]. Similarly, the World Health Organization (WHO) emphasizes that a strong health system requires competent, stable, and committed personnel [7]. It encourages states to establish mechanisms to strengthen staff skills and stability, particularly in managerial roles [8]. These two elements are key prerequisites for effective and productive leadership, contributing to a high-performing health system. In the context of a crisis, research highlights the essential role health personnel play in health systems' resilience [9]. Their responsibility is to implement adaptation mechanisms to sustain health system functionality during crisis [6, 10, 11].

In the DRC health system, the Health Zone (HZ) serves as the operational unit for implementing health policies and delivering care. According to DRC standards, the HZ is managed by a lead official known as the Health Zone's Chief Medical Officer (CMO), who must have at least a general medicine degree [12]. The performance and functionality of HZs reflect the health system's effectiveness in improving community health outcomes.

Health system performance depends on multiple interdependent factors, including organizational climate, internal policies, and working conditions, which can significantly influence the quality of care [13]. In addition, organizational culture, effective leadership, strategic planning, ongoing training, and adequate resource management contribute to improved health services [14]. A comprehensive analysis of the factors influencing health system performance is often limited by a lack of empirical evidence on performance determinants [15]. While some performance indicators are more likely to be influenced than others [16], external factors, such as cultural dynamics, political instability, security threats, economic challenges, and environmental crises, play a critical role [17–19].

This study examines how the performance of HZs relates to the broader health system environment in three crisis-affected provinces in Eastern DRC. It assesses the profiles of CMOs and explores the contextual and individual factors influencing the HZs functionality and performance. Finally, the study examines the power dynamics involved in the management and stability of the CMOs, as well as the performance of the HZs.

## Methods

## Study region

This study was conducted in three provinces in Eastern DRC (Fig. 1), a region affected by protracted crisis and armed conflict over the past three decades. As of October 2023, the DRC hosted the largest number of internally displaced persons in Africa, with approximately 6.9 million displaced [20].

The DRC health system is structured into a three-tiered management pyramid. At the top, the central level, based in the capital city, is led by the National Minister of Public Health, supported by the General Secretary for Public Health. This level oversees health policies and standards development. The intermediate level, the Provincial Health Division (PHD), coordinates operations under the Provincial Health Division Chief Officer (PHD-CO). Each province is administered by a Governor. The peripheral level of the health pyramid consists of operational HZs managed by CMOs with support from their management team. Each HZ delivers healthcare through a General Referral Hospital (GRH) and several Health Centers. The DRC counts 519 HZs across 26 provinces [21, 22].

The performance of the DRC health system remains highly concerning. A 2023 evaluation of the National Health Development Plan (2019-2022) revealed that 3.9% (20 out of 519) of HZs lack a GHR. Among the 496 HZs with a GRH, 85.5% (441) only provide the Minimum Package of Primary Health Care (PHC) Activities, which is ideally offered by Health Centers, whereas GRHs should deliver a more specialized Complementary Package of Activities. Only 6.5% of GRHs (34 GRHs) meets this standard, while 4.0% (21 GRHs) provide care below the minimum level required. Furthermore, only 20% of the DRC's Health Centers provide a full Minimum Package [23]. According to the standards, the expected referral rate between Health Centers and GRHs is 5% [12], but the evaluation revealed that the average referral rate across the country is only 3%.

The three provinces of Eastern DRC covered by this study are North Kivu, South Kivu, and Maniema. These three provinces are particularly affected by the generalized crisis context in the country, and experience recurrent clashes between armed militias and the regular army [2]. More than 2.5 million people lived in a displacement site in North Kivu alone in 2023, representing 37% of the total number of internally displaced persons in the DRC [24]. South Kivu counted 1.5 million internally displaced persons as of December 31, 2023, and Maniema hosted 500,000 in the same period [25, 26].

#### North Kivu

North Kivu, a historical hotspot of conflict in Eastern DRC, is managed by a military government in response



Fig. 1 Study region

to tensions generated by a rebel movement since October 2022 [27, 28]. Some areas, such as Masisi, Rutshuru, and Walikale, are beyond government control due to local power fragmentation and militia's influence [24, 28]. Healthwise, North Kivu is affected by frequent cholera and Ebola outbreaks, exacerbated by conflicts and population displacement [29–31]. The region is also vulnerable to natural disasters, such as volcanic eruptions, earthquakes, and floods [32, 33]. International partners, including NGOs and bi- and multilateral cooperation agencies, support health efforts, especially in areas of intense conflict.

#### South Kivu

Since the 2002 peace agreement, South Kivu, although in a post-conflict phase, still experiences sporadic clashes between ethnic groups or between militias and the regular army. These conflicts, often related to land and identity issues, are exacerbated by local and regional political interests [2, 28]. The local health system, limited by inaccessibility of certain areas and lack of resources, struggles to deploy effective health policies. Endemic diseases and epidemics, as well as natural disasters, such as fires, floods, and earthquakes [31, 32, 34], including the 2007 earthquake that damaged a major hospital still awaiting rehabilitation [11], further complicate the situation. Health initiatives, supported by international partners, aim to strengthen local capacities and improve access to PHC.

#### Maniema

Created as a province in 1988, Maniema, geographically isolated, faces numerous challenges such as insufficient funding, inadequate infrastructure, and limited access to electricity and clean water. The province heavily relies on transfers from the central government, with a reduced capacity to generate local revenue [35]. It must manage a precarious stability while attempting to implement reforms [36, 37]. Healthwise, Maniema faces medical personnel shortages and outdated health infrastructure, hindering the challenges of combating transmissible diseases and malnutrition [38]. Poor road infrastructure also hampers healthcare access [35]. Partnerships with international organizations provide medical support to the most isolated and often unstable areas.

In addition to international partners, the HZs in the three study provinces, like several other areas in the country, are supported by faith-based organizations. Their key role and place are recognized by the health system and described by several authors [39, 40]. These organizations, primarily managed by Catholic and Protestant churches, co-manage several GRHs, secondary hospitals, and Health Centers across the provinces. They operate under diverse models, including subsidized care and cost-recovery approaches, and collaborate with the Ministry of Health and the PHD in managing human resources for the HZs.

Politically, the DRC has experienced several government changes over the past decade (2014–2023). Each appointment of a new prime minister triggers the formation of a new government, including a new Minister of Health. Ministerial appointments are often guided by geopolitical representation and socio-linguistic inclusivity [21, 22, 41]. New ministers commonly reorganize their teams, reshuffling key positions within the Ministry and sometimes replacing staff. At the provincial level, a similar pattern occurs: when a new governor is appointed, provincial health ministers are also selected based on political rather than professional. These appointments often lead also to staff changes within the provincial health sector [41].

Reports from national and PHD achieve across the three provinces provides insights into the frequent reshuffling of political and health executives between 2014 and 2023. Table 1 summarizes these movements at both national and provincial levels. For confidentiality, names are represented by initials, with an 'X' used when first names are unavailable. Index numbers indicate individuals who returned to the same position more than once.

#### Study design and period

This was a cross-sectional study using a mixed-methods approach, with data collection conducted between December 2022 and April 2024.

- CMO profiles were assessed based on data collected in December 2022, covering the CMOs in place at that time.
- Indicators of functionality and performance of the HZs covered the period from January 1, 2022, to December 31, 2022, and were analyzed in March 2023.
- Contextual data about HZ characteristics spanned the period from 2017 to 2022 and were collected retrospectively in February 2024.
- Qualitative data were gathered through semi-structured interviews conducted between June 2023 and April 2024.

## Quantitative arm of the study Dependent variables

The health outcomes of the HZs were assessed based on their functionality and performance, which served as the dependent variables. These composite variables were constructed from fifteen key health indicators, selected for their relevance [9] and extracted from the national health information system software DHIS2 [42] for the period spanning January 1, 2017, to

Table 1 Political and health executives' appointments between 2014 and 2023

Level of governance	Position of the executive	Number of permutations	Initials of the executives	Average length in post
National	МоН	5	KN-OI-EL-JJM-RK	2.0 years
	GS Health	7	MX-LX <sub>1</sub> -EL-SY <sub>1</sub> -LX <sub>2</sub> -BX-SY <sub>2</sub>	1.4 years
Maniema province	Governor	2	TB-MN	5 years
	МоН	8	OP-LC-MJ-LX-KY-KM-KJ-KA	1.4 years
	PHD-CO	1	BF	10 years
North Kivu province	Governor	4	PJ-NK-NC <sup>*</sup> -CK <sup>*</sup>	2.5 years
	МоН	6	MM-KM-NC-KM-NE-LP	1.6 years
	PHD-CO	2	KL–KJ	5 years
South Kivu province	Governor	3	CM-NC-NT	3.3 years
	МоН	4	MN-BC-MK1-MK2	2.5 years
	PHD-CO	2	NP-LG	5 years

MoH Ministry of public health, GS Health General Secretary of Public Health, PHD-CO Provincial Health Division Chief Officer \*Military Governor December 31, 2022. The indicators were grouped into two categories: performance indicators and functionality indicators (Table 2).

Functionality and performance were evaluated using internal benchmarking [42, 43]. Each indicator was rated on a scale from 0 to 4, with 4 representing the achievement of the recommended threshold. Each indicator was assigned a score based on predetermined criteria, considering the constraints and indicator-specific objectives, to allow for comparative analysis. We then compared the HZs achievement levels of the fifteen key indicators with the standards set by the DRC's health system [44, 45]. Results are expressed as percentages, reflecting the annual average scores for functionality and performance over a 6-year period (2017–2022). Both variables were treated as continuous variables.

#### Independent variables

The CMOs profiles were established based on their individual characteristics, while contextual elements were used to define the HZs profiles. These data served as independent variables and were collected from the PHD offices in the three provinces. Additional information that was unavailable or outdated was gathered directly from the PHD-COs and some CMOs during follow-ups by the research team. The collected variables are summarized in Table 3.

#### Qualitative arm of the study

We conducted semi-structured individual interviews with actors involved in health system management at the provincial and operational levels in the three provinces, with four categories of respondents (Table 4), to understand the dynamics of factors influencing CMOs assignment and effectiveness. Interviews were conducted in French, by experienced researchers affiliated with the School of Public Health of the "Université Catholique de Bukavu" and recorded. These researchers had prior knowledge of the health system in the study region through previous collaborations and fieldwork. However, they were not directly involved in the management structures of the HZs, minimizing any potential

**Table 2** Performance and functionality indicators

Performance indicators		Functionality indicators	
First line of cares (in Health Centers)	Second line of cares (at the GRH)		
Rate of first antenatal visit	Bed occupancy rate	Rate of monthly supervisions carried out in health centers by the HZ management team	
Rate of first antenatal visit at the 16th week of amenorrhea	In-hospital mortality rate after more than 48 h of hospitalization	Existence of an updated annual HZ's Operational Action Plan	
Rate of fourth antenatal visit	Average duration of hospital stays	Number of monthly management board meetings	
Rate of births assisted by qualified personnel	Rate of use of curative services	Number of monthly management board meetings with minutes	
Rate of preschool visits	_	Number of weekly service meetings at the HZ Central Office	
Rate of referrals to the GRH	-	-	

#### Table 3 Independent variables

Individual variables (related to CMOs)	<b>Contextual variables (related to HZs)</b> Geographical accessibility <sup>4</sup>	
Age (in 2022)		
Sex	At least one active armed conflict between 2017 and 2022	
CMO's highest academic degree <sup>1</sup>	At least one Ebola or Cholera epidemic between 2017 and 20	
Training in management of PHC <sup>2</sup>	Presence of at least one local faith-based partner	
Length of experience in management <sup>3</sup>	Presence of at least one international partner	
Family residence (in the HZ or outside the HZ)	Stability in the HZ management between 2017 and 2022 <sup>5</sup>	
Length of service in the HZ Administrative status (urban or rural HZ)		

<sup>1</sup> Highest degree obtained by the CMO during their university training

<sup>2</sup> Whether the CMO received continuing education/retraining in management of Primary Health Cares (PHC) organized by the MoH or its partners in the last 5 years as part of strengthening human resources in the health sector

<sup>3</sup> Number of years of managerial experience the CMO has accumulated in the health sector administration, in the zone or elsewhere in the province, including their current position as CMO

<sup>4</sup> The road between the HZ and the PHD was passable, and the journey could be made within half a day (approximately 6 h) in 2022

<sup>5</sup> The zone managed in a stable manner had at most 2 different CMOs between 2017 and 2022. A moderately stable zone had 3 CMOs between 2017 and 2022. An unstable zone was managed by more than 3 CMOs between 2017 and 2022

#### Table 4 Type and number of participants

Province	Profiles				Total
	СМО	PHD	Partner (international et faith-based)	Provincial government	
North Kivu	02	01	02	01	06
South Kivu	02	01	02	01	06
Maniema	02	01	01	01	05

bias arising from hierarchical relationships. Respondents were informed about the study's purpose, the interviewer's affiliation, and asked to provide informed consent before the interview. The interviews average duration was approximately 45 min, ranging from 34 to 67 min, depending on the respondent's availability and depth of discussion. The total number of interviews, seventeen, was determined according to the principle of data saturation. The interview guide, formulated based on our objectives and some normative and strategic texts from the DRC health system-the "Health System Strengthening Strategy, 2010", the "Revised National Health Development Plan 2019-2022", and the "Collection of Norms for the Organization and Operation of Health Zone Structures in the Democratic Republic of Congo, 2012" [12, 21, 22]—allowed us to explore the following themes:

- Criteria for selection and the process of appointment and rotation of CMOs.
- The role and collaboration of different actors in supporting the stability and capacity building of CMOs.
- Opinions on functionality and performance by the different actors involved in HZs management.

Data collection tools were previously tested on a small scale with a population similar to the study's target group.

#### Data analysis

#### Quantitative data analysis

Quantitative data were collected in an Excel file and analyzed using Stata 17. Categorical variables were summarized as frequencies and proportions. Quantitative variables were presented as means±standard deviation or as medians (min-max), depending on whether the variable had a normal or skewed distribution.

For each province, linear regressions were performed to determine the factors associated with performance and functionality. To address collinearity among variables, two regression models were constructed for North Kivu, three for South Kivu and two for Maniema. The significance level was set at 5%.

#### Qualitative data analysis

The individual interviews records were transcribed and anonymized, with an alphanumeric code assigned to each transcription (CMO, PHD, TFP, or PROV initial indicating the type of respondent, followed by a number corresponding to the order of processing the transcriptions). The analytical approach was deductive [46]. Manual coding from structural codes derived from the interview guides was initially done within each respondent group to extract semantic categories and identify relevant verbatim quotes. A second cross-sectional analysis across the four respondent groups allowed for triangulation and information comparison. An unexpected theme emerged from the cross-sectional analysis and was integrated into the analyses. Finally, thematic grouping within each theme explored the factors involved in the assignments and effectiveness of CMOs to understand how they impact the results achieved by the HZs.

#### **Ethical considerations**

The protocol for this study was approved by the Ethics Committee of the "Université Catholique de Bukavu" under authorization N° UCB/CIES/NC/033/2021. Informed consent was obtained from each participant before any interview. Data were collected and analyzed confidentially. All stages of the study were conducted in compliance with the ethical principles of the Declaration of Helsinki, ensuring informed consent, protection of participants, and research integrity [47].

#### Results

#### **General characteristics**

Table 5 summarizes the profiles of CMOs and the contextual characteristics of HZs in the three provinces. There is significant diversity between the provinces.

#### Profile of CMOs

Data from the three provinces reveal a male predominance among CMOs. In North Kivu and South Kivu, most CMOs have over five years of experience in management of PHC. In addition, more than half of the CMOs in each of these two provinces have completed at least one training course in management of PHC during the last five year before that data collection. Among them, 38% in North Kivu and 26.47% in South Kivu hold a master's degree in public health. In contrast, in Maniema, nearly three-quarters of the CMOs have less than five years of experience in management of PHC. Only 27.8% have more than five years of experience. In addition, the highest degree held by all CMOs in Maniema is that of a general practitioner. This province also shows a low rate of stability in HZ management. Indeed, 72.2% of HZs in Maniema exhibit moderate or unstable management, with up to three or more changes of CMOs over a six years period. Conversely, in North Kivu and South Kivu, analysis of management stability shows that 100% and 70.6% of CMOs, respectively, experienced only one or two changes during the same period.

#### **Contextual characteristics**

International partners presence is notably high in North Kivu and Maniema, while religious partners are more prevalent in South Kivu. North Kivu and South Kivu have been significantly affected by epidemics, as evidenced by the data, with 94.1% of HZs in North Kivu and 70.6% in South Kivu exposed to Ebola or Cholera between 2017 and 2022. During the same period, armed conflicts were predominantly recorded in North Kivu (82.4% of HZs). In contrast, Maniema is the most isolated province, with the highest proportion of HZs facing difficult road accessibility (55.6% of HZs).

#### Functionality and performance

North Kivu and South Kivu show relatively high and stable performance scores, with average scores of 72.6% and 70.0%, respectively. These scores are complemented by high functionality scores (71.8% and 79%). In contrast, Maniema shows significantly lower and insufficient performance and functionality scores (57.6% and 51.4%, respectively).

## Factors associated with functionality and performance in the three provinces

## North Kivu

The factors associated with functionality in North Kivu are the presence of faith-based partners and the tenure of the CMO in the HZ. The difference in functionality between HZs supported by traditional partners and those without such support was 20%, while the difference between HZs, where the CMO had been in place for at least two years versus those where the CMO had been in place for less than two years was 17% in the first model and 20% in the second model. No factors were found to be statistically associated with performance (Table 6).

#### South Kivu

The CMO's tenure in the HZ and the involvement of international partners in the HZ were statistically associated with functionality. The difference in functionality between HZs supported by at least one international partner and those without such support was 20% (Model

2) and 17% (Model 3), while the difference between HZs, where the CMO had been in place for at least two years and those where the CMO had been in place for less than two years was 20%. For performance, the support of an international partner was associated with a 10.4% difference in performance (Model 2) between HZs with such support and those without. However, this difference was at the edge of statistical significance, with a confidence interval ranging from -0.35 to 21.15 (Table 7).

### Maniema

Neither functionality nor performance-associated factors were identified in either of the two models applied to Maniema's data. However, it is noteworthy that each CMO permutation was associated with a 5% decrease in the performance score of the affected HZ. This difference approached statistical significance, with a confidence interval ranging from -10.53 to 0.47 (Table 8).

#### Opinions on HZs management dynamics and performance

The qualitative analysis explored respondents' opinions, perceptions and experiences regarding the management of HZs. Three predefined themes (Criteria for selecting and appointing CMOs, Collaboration between CMOs and various actors, and Opinions about HZs performance) were complemented by a fourth theme that emerged from the analysis (Profile of the CMO).

#### Theme 1: CMO profile

Respondents described the career paths of CMOs, revealing a diversity in professional trajectories that influence their approach to HZ management. The analysis suggests that CMOs with more advanced training in management or in public health tend to have a more structured and strategic view. However, respondents indicated that experience could compensate for the lack of a specialized management degree.

"It is essential for a CMO to have solid training in public health to navigate the complexities of health management at this level." (CMO1)

"If you have a higher degree, you have added value... Because for doctors, it's the doctor-patient relationship. But a health zone cannot be managed solely through the doctor-patient relationship, which is why public health training is invaluable as it provides an understanding of the community and adds to management." (PROV2)

"Normally, it is not a recruitment position... it is a promotion position. In principle, they should have gone through the normal career path of all doctors... starting as a treating doctor, then chief of staff, hos-

pital director, and then promoted to the CMO position." (PHD3)

# Theme 2: selection criteria and appointment process for CMOs

The process of CMOs appointment, although theoretically based on candidates' experience, is significantly influenced by political and administrative considerations, which seem to hold the final say. Respondents from various categories expressed concerns about various authorities influence on appointments, which can compromise CMOs effectiveness and stability.

"Today, the decision on appointments is more influenced by politics than by professional skills and previous performance." (PHD1)

"Generally, experience is considered... but the final decision rests with the competent authorities." (PROV1)

"There are those who are reassigned due to their mediocrity, and there are also those reassigned based on opinions or political trends." (CMO3)

#### Theme 3: role and collaboration of different actors

The data show a complex collaboration between CMOs, technical and financial partners, and government institutions. Despite established structures and mechanisms for collaboration, there are challenges in practice, often due to unilateral decisions, political interference, or lack of communication between parties.

"Although the collaboration structure is in place, practice often reveals a lack of cohesion and effective communication between actors." (TFP2)

"There is a deficit of collaboration in making major decisions despite an apparently good interaction with partners and provincial coordination structures." (PHD1)

"The main recommendation we can make today is to allow the administration to do its job normally. There is now a very significant political influence in the administration." (PHD2)

#### Theme 4: opinions on functionality and performance

Perceptions of CMO performance vary significantly, with some actors expressing satisfaction and others indicating deficiencies related to management and leadership. It appears that HZs with proactive leadership, stable CMOs, and support from external partners tend to perform better. "The ability of a CMO to initiate and actively engage their community is often a key predictor of success." (PROV1)

"We, the Ministry of Health, have always called for a permanent presence (of the CMOs) in their zones... Spending a long time here in the city and leaving a lifetime interim in the zone negatively impacts the functioning of the zone." (PROV3)

"Management is so different. Zones with partners receive support, and this support means even the fees for services are moderated, whereas zones without support operate with their own funds... even in terms of equipment, supported zones have sufficient equipment... In short, unsupported zones face many difficulties compared to supported ones." (PROV2)

#### Discussion

This study aimed to explore, using a mixed-methods approach, the individual and contextual factors affecting the performance and functionality of HZs in a persistent crisis context.

#### **Challenges overview**

North Kivu and South Kivu generally feature experienced CMOs and stable HZ management. In contrast, Maniema has less experienced CMOs, all with a general medicine degree, and who frequently rotate. Contextually, while North Kivu and South Kivu face epidemics and armed conflicts, Maniema struggles with poor road accessibility. Thus, functionality and performance scores are high in the two Kivus, but remain unsatisfactory in Maniema.

#### Manager's profiles influence

Our findings indicate that the individual characteristics of HZ managers are statistically associated with performance. In addition, respondents emphasized the importance of management training, and our quantitative data confirm that professional experience improves HZ functionality and performance in the two Kivus, although the effect on performance was marginal. These findings align with previous studies demonstrating a positive relationship between management skills and health service efficiency [48, 49].

Regression analyses reveal that the stability of managers is statistically associated with better HZ performance. HZs in North Kivu and South Kivu, where CMOs had more than two years of tenure, achieved better functionality scores. Conversely, each CMO rotation in Maniema was associated with a five-point decrease in the performance score. This instability echoes the frequent ministerial reshuffles observed in Maniema (Table 1), where provincial health ministers averaged just 1.4 years in office between 2014 and 2023. In the DRC, new ministerial appointments often trigger cascading changes in health sector staff, including CMOs [41].

Despite similar instability in South Kivu (29.4% of CMOs with turnover time of 2 years or less), no significant negative association emerged from our analyses. This may be attributed to compensatory factors such as better accessibility or stronger support from international partners. These results underscore how CMO instability, compounded by additional vulnerabilities, can degrade health system performance, as observed in Maniema.

They also highlight the need for stability and expertise among health staff in conflict zones, along with efforts to maintain staff motivation in face of insecurity, resources constraints, and stressful working conditions [9, 41, 50, 51].

Differences in human resource management among decision-makers further hinders performance, as noted by respondents and reported in prior studies [51, 52]. These discrepancies often arise, because the Minister of Health is a politically appointed position, while PHD-CO roles are technical and less subject to frequent reshuffles. Yet, these two entities are expected to collaborate on health human resource management.

Better synchronization of decisions between provincial health ministries and provincial health divisions, and possibly with partners, is essential to ensure staff competence and stability and to mitigate combined vulnerabilities affecting the local health system. Frequent appointments and rotations, often carried out without adequate consultation, create discontinuity that hinders the effectiveness of HZ development plans. These practices go against the philosophy of PHC, which values staff stability [7, 53].

#### **Context and partnership**

The positive association of international and faithbased partners with HZ functionality and performance observed in this study is consistent with prior work documenting the importance of external support in crisis-affected regions. Partner support can address resource deficits and strengthen local capacities and system resilience [39, 40, 52, 54]. This is particularly critical in contexts, where health infrastructure is degraded or insufficient, and where state contributions to health system functioning remain insufficient.

However, this study did not systematically evaluate the diversity and alignment of aid types, which could nuance interpretations of the relationship between external aid and HZ outcomes. Evaluating international aid's impact on health systems is complex and multifaceted, with mixed results. Besides challenges in interpreting indicators used to measure aid effectiveness, the diversity and complexity of aid, as well as power dynamics among stakeholders, complicate this evaluation [53, 55, 56].

Furthermore, while international support is essential in resource-limited contexts, drawbacks associated with aid dependency should be recognized. As several authors have noted, reliance on external aid can hinder local health managers autonomy, forcing them to prioritize donor agendas over specific local needs and priorities [41, 52, 57]. A more collaborative approach in health program planning is needed to ensure that these programs align with local priorities and support autonomous leadership development [56, 58]. Thus, rather than dictating the terms of engagement, donors should assume a facilitative role, supporting locally led initiatives for sustainable health and increased health managers autonomy.

In the same vein, conflicts and epidemics do not appear to have a detrimental association with HZs performance according to our findings. This could be related to the fact that these crisis periods, despite the instability they cause, present opportunities [59, 60] and chances for resilience building [9]. They often attract an influx of funding and engagement from national and international actors [61], thereby improving health system performance. The Ebola outbreak in 2018 in the Equateur Province of DRC, for example, allowed the government to implement a policy of free care with the support from international donors. This intervention had a markedly positive impact on overall performance in the affected HZs [62].

However, in areas experiencing prolonged crises like the two Kivus [3], this improvement could come at the cost of increasing dependence on external aid. This raises important questions about the sustainability of health interventions in prolonged crisis contexts.

#### The case of Maniema province

Maniema's health outcomes are particularly concerning. They are not only lower than those of the two Kivus but also poor compared to national standards [12]. Despite the widely recognized positive influence of faith-based and international partners on health sector outcomes [52, 63], their impact in Maniema appears to be limited. This suggests potential under-prioritization by donors who focus more on major humanitarian crises in neighboring Kivus provinces.

Known as a model of effective PHC organization in the 1990s [64], Maniema now suffers from the advanced deterioration of its health and communication infrastructure [35, 37]. Moreover, our results indicate that local health managers seem poorly prepared for their managerial roles. The analyses also indicate that the high staff turnover rate, while statistically marginally significant, negatively impacts HZ's performance. This observation is also reported in our individual interviews, as well as in several studies on the impacts of managerial instability [50, 65, 66]. These combined elements likely explain Maniema's disappointing performance.

#### **Practical implications**

Our findings highlight the influence of political and administrative factors on HZ managers' performance. Stability among HZ managers is crucial, and policies aimed at reducing frequent rotations are needed to foster local knowledge and community engagement.

Our analyses also emphasize that interventions aiming at health system strengthening should consider local political and social dynamics to be effective, particularly in crisis contexts [67]. The positive association between partnerships and HZ performance underscores the need of integrated and transparent governance to coordinate contributions effectively for health system strengthening.

Finally, consistent with WHO guidelines, our findings highlight the importance of systematic management training for CMOs [7]. This training would ensure effective and adaptive management in the face of local challenges [68, 69]. The most effective HZs are, beyond technical and financial partner support, led by experienced PHC managers. Similar observations were made in our study region in the past. Efforts to stabilize and build the capacities of managers, as well as to implement effective PHC activities were successfully carried out in Kasongo (Maniema), Bwamanda (former Equateur Province), and Kirotshe, Masisi, and Rutshuru (North Kivu), as well as Katana and Walungu (South Kivu) during the 1980s and 1990s. These initiatives were recognized as successful models [64, 70-72] and remain historical references in the region. They underscore the critical role of strong leadership and the committed dedication of managers in ensuring high-performing HZs.

#### Study strengths and limitations

This study has some limitations that should be considered when interpreting the results. Although the study covers three provinces significantly affected by crises, the findings may not be generalizable to other DRC provinces or similar contexts, as socio-political and health conditions may vary.

In addition, the cross-sectional design limits the ability to establish causal relationships between CMOs' profiles and HZ performance. Longitudinal studies will be necessary to complement our observations and strengthen the evidence base.

While this study provides valuable insights into health zone performance and functionality, the indicators used to calculate these scores require contextual interpretation. For instance, the hospital bed occupancy rate does not account for variations in hospital capacity, and referral rates are often influenced by accessibility and local health-seeking behaviors. Supervision visits were measured by frequency but not by quality or impact, and annual operational plans were considered without assessing their implementation. Future research should incorporate complementary assessments to refine the interpretation and applicability of these indicators.

We also acknowledge the potential influence of interviewer positionality on the data collected during interviews. While the interviewers were researchers with prior knowledge of the health system in the study region, they were not directly involved in the management of the HZs. This minimized hierarchical bias but may still have shaped respondents' openness. To mitigate this, interviews were conducted in a neutral and professional manner, and informed consent was obtained to foster trust and transparency.

Despite these limitations, this study provides valuable insights for informing human resource management policies and practices in health. With appropriate adjustments and further research, these findings would support efforts to strengthen health systems in crisis-affected contexts.

#### Conclusion

This study reveals that individual HZs managers characteristics, such as training in management of PHC, substantial professional experience, and stability in their position, are critical for better HZ performance in crisis contexts. Well-trained, experienced, and stable CMOs are significantly associated with better capacities of response to health challenges in their HZs. In addition, international and faith-based partnerships have a positive association with health outcomes by providing resources and supporting HZ management. The findings also highlight governance challenges in human resource management. Frequent and uncoordinated rotations of health decision-makers, often driven by political pressures, negatively affect health system performance.

To improve HZ performance in crisis-affected areas, stakeholders should prioritize stability and expertise among health managers, while foster effective and transparent coordination with external partners. Investing in targeted managerial training and addressing political and administrative constraints can further improve HZ functionality and contribute to overall health system strengthening in crisis contexts.

## Appendix

See Tables 5, 6, 7, 8

## Table 5 Profiles of CMOs and HZs

Variables	Numbers (Proportion); Mean ± SD or Median (min; max)			
	North Kivu (n=34)	South Kivu (n = 34)	Maniema ( <i>n</i> = 18)	
Sex				
Female	2 (5.9)	1 (2.9)	2 (11.1)	
Male	32 (94.1)	33 (97.1)	16 (88.9)	
Age				
<40 years	7 (20.6)	8 (23.5)	6 (33.3)	
40-49 years	22 (64.7)	19 (55.9)	8 (44.4)	
> = 50 years	5 (14.7)	7 (20.6)	4 (22.2)	
CMO's highest academic degree				
General practitioner	21 (61.8)	25 (73.5)	18 (100)	
MPH	13 (38.2)	9 (26.5)	0 (0)	
Training in management of PHC				
No	14 (41.2)	11 (32.4)	8 (44.4)	
Yes	20 (58.8)	23 (67.7)	10 (55.6)	
Years of experience in management of PHC				
<5 years	12 (36.4)	9 (26.5)	13 (72.2)	
> = 5 years	21 (63.6)	25 (73.5)	5 (27.8)	
Length of service in the HZ				
<2 years	6 (17.7)	9 (26.5)	6 (33.3)	
>=2 years	28 (82.4)	25 (73.5)	12 (66.7)	
Family residence				
Within the HZ	13 (38.2)	6 (17.7)	18 (100)	
Outside HZ	21 (61.8)	28 (82.4)	0 (0)	
Presence of at least one local faith-based partner				
No	25 (73.5)	16 (47.1)	12 (66.7)	
Yes	9 (26.5)	18 (52.9)	6 (33.3)	
Presence of at least one international partner				
No	0 (0)	14 (41.2)	0 (0)	
Yes	34 (100)	20 (58.8)	18 (100)	
At least one active armed conflict between 2017 a	and 2022			
No	6 (17.7)	25 (73.5)	14 (77.8)	
Yes	28 (82.4)	9 (26.5)	4 (22.2)	
Administrative status		- ()	. ()	
Bural HZ	29 (85 3)	32 (94 1)	16 (88 9)	
Urban HZ	5 (147)	2 (5 9)	2 (11 1)	
Geographical accessibility		_ ()	- ( · · · · )	
No	20 (58 8)	17 (50)	8 (44 4)	
Yes	14 (41 2)	17 (50)	10 (55 6)	
At least one Ebola or Cholera epidemic between 2	2017 and 2022	., (30)	10 (00.0)	
No	2 (5 9)	10 (29 4)	14 (77 8)	
Yes	32 (94 1)	24 (70.6)	4 (22 2)	
Stability in the HZ management between 2017 ar	ad 2022	21(70.0)	1 (22.2)	
Stable (1–2 CMO in 6 years)	34 (100)	24 (70.6)	5 (27.8)	
Middle (3 CMO in 6 years)	0 (0)	6 (17 7)	6 (33 3)	
Hinduc (5 - 4 CMO in 6 years)	0 (0)	4 (11.8)	7 (38 0)	
Number of permutations of CMOs in the $H7$	1 (1.2)	2 (1.4)	, (JO.9) 3 (J: 5)	
(2017–2022)	1 (1, 4)	2 (1, T)	J (2, J)	
HZ functionality score	71.8±21.6	79±18.1	$51.4 \pm 34.1$	
HZ performance score	72.6±14.8	70±13.2	57.6±10.3	

SD Standard deviation

# Table 6 Factors associated with functionality and performance in North Kivu

	FUNCTIONNALITY ß aj (Cl 95%)	
	Model 1 (n=34)	Model 2 (n=34)
Age		
< 40 years	0	NI
40–49 years	- 10 (- 30.9; 11.3)	
> = 50 years	- 8.5 (- 30.3; 13.4)	
Training in management of PHC		
No	NI	0
Yes		- 9.8 (- 25.4; 5.8)
Years of experience in management of PHC		
<5 years	0	0
> = 5 years	6.4 (- 11.4; 24.3)	3.6 (- 12.8; 20)
Length of service in the HZ		
< 2 years	0	0
> = 2 years	17 (0.6: 33.2)	20.2 (1.6: 38.8)
Family residence		
Within the HZ	NI	0
Outside H7		- 7 (- 24 9·11)
Presence of at least one local faith-based partner		/ (, / / )
No	0	NI
Ves	20 5 (3 4: 37 6)	
At least one active armed conflict between 2017 and 2022	20.5 (3.1, 57.0)	
No	0	0
Voc	170 ( 12.260)	0 2 2 ( 15 5· 20)
Administrativo status	17.9 (= 1.2, 50.9)	2.2 (= 15.5, 20)
	0	0
	17.5 (= 15, 47.5)	2 (- 20.3, 32.3)
Geographical accessibility	0	NII
NO		NI
Yes	2.9 (- 14.7; 20.5)	
Number of permutations of CMOs (2017–22)	1.9 (- 7.4; 11.1)	3.1 (- /; 13.3)
	PERFORMANCE ß aj (CI 95%)	
	Model 1 ( <i>n</i> =34)	Model 2 (n = 34)
Age		
< 40 years	0	NI
40-49 years	5.3 (- 12.6; 23.2)	
> = 50 years	4.4 (- 14.2; 22.9)	
Training in management of PHC		
No	NI	0
Yes		- 1.2 (- 13.4; 11)
Year of experience in management of PHC		
< 5 years	0	0
>=5 years	- 1.5 (- 16.7; 13.7)	1.5 (- 11.2; 14.3)
Length of service in the HZ		
< 2 years	0	0
> = 2 years	3.6 (- 10.2; 17.5)	4.4 (- 10.1; 19)
Family residence		
Within the HZ	NI	0
Outside HZ		- 4 (- 18; 10)

## Table 6 (continued)

	PERFORMANCE ß aj (Cl 95%)	
	Model 1 ( <i>n</i> =34)	Model 2 (n = 34)
Presence of at least one local faith-based partner		
No	0	NI
Yes	13.3 (- 1.2; 27.8)	
At least one active armed conflict between 2017 and 2022		
No	0	0
Yes	9.1 (- 7.1; 25.2)	3.1 (- 10.8; 16.9)
Administrative status		
Rural HZ	0	0
Urban HZ	12.9 (- 12.8; 38.6)	0.97 (- 22.7; 24.7)
Geographical accessibility		
No	0	NI
Yes	- 5.3 (- 20.3; 9.7)	
Number of permutations of CMOs (2017–2022)	- 2.7 (- 10.6; 5.1)	- 2 (- 9.9; 6)

ß aj Adjusted ß coefficient, N/ Not Included in this model

>=2 years

5.3 (- 6.8; 17.3)

	FUNCTIONALITY ß aj (CI 95	%)	
	Model 1 (n=34)	Model 2 ( <i>n</i> = 34)	Model 3 (n = 34)
Age			
<40 years	0	NI	NI
40-49 years	- 0.9 (- 19.6; 17.9)		
> = 50 years	2.6 (– 17.3; 22.5)		
Training in management of PHC			
No	0	0	0
Yes	- 5.3 (- 22.5; 11.9)	4.4 (-10.1; 18.8)	5.2 (-8.2; 18.5)
Years of experience in management of PHC			
< 5 years	NI	0	0
>=5 years		4.7 (-11; 20.4)	4.4 (-10.2; 18.9)
Length of service in the HZ			
<2 years	0	NI	NI
> = 2 years	20.2 (4.6; 35.7)		
Family residence			
Within the HZ	0	0	0
Outside HZ	- 1 (- 22.2: 20.2)	8.3 (-10.2: 26.7)	6.9 (-9.9; 23.7)
Presence of at least one local faith-based partn	er		
No	NI	NI	0
Yes			116 (- 11·242)
Presence of at least one international partner			
No	NI	0	0
Yes	1.41	20 (6 7 33 3)	169(41.297)
At least one active armed conflict between 20	17 and 2022	20 (0., / 55.5)	1010 (111/2017)
No	0	NI	NI
Yes	0.8 (- 18 2.198)		
Administrative status	0.0 ( 10.2, 19.0)		
No	0	0	0
Yes	2 7 (_ 25 9· 31 3)	2 7 (- 24 7: 30 2)	7 5 (_ 17 7· 32 7)
Geographical accessibility	2.7 ( 23.7, 51.5)	2.7 ( 21.7, 50.2)	1.5 ( 11.1, 52.1)
No	NI	0	NI
Voc		15 (- 11 9: 14 9)	i Ni
Number of permutations of $CMOs$ (2017–22)	NI	= 6.2 (-14.16)	<u> </u>
		6)	_ 0 (_ 15.5, _ 0.5)
	Model 1 (n - 24)	Model 2 (n - 24)	Model 2 (n - 24)
	Model 1 ( <i>11</i> = 34)	Model 2 ( <i>II</i> = 54)	Model 5 (11 = 54)
Age			
< 40 years	0	NI	NI
40-49 years	– 4.8 (– 19.3; 9.7)		
> = 50 years	- 0.9 (- 16.3; 14.5)		
Training in management of PHC			
No	0	0	0
Yes	– 5.8 (– 19.1; 7.5)	- 0.8 (- 12.4; 10.9)	0.1 (- 11.2; 11.5)
Years of experience in management of PHC			
<5 years	NI		0
> = 5 years		- 3.2 (- 15.9; 9.5)	- 3.9 (- 16.3; 8.5)
Length of service in the HZ			
< 2 years	0	NI	NI

## Table 7 Factors associated with functionality and performance in South Kivu

## Table 7 (continued)

	PERFORMANCE ß aj (Cl 95%)		
	Model 1 (n=34)	Model 2 ( <i>n</i> = 34)	Model 3 (n=34)
Family residence			
Within the HZ	0	0	0
Outside HZ	- 10.4 (- 26.8; 6)	- 5.5 (- 20.4; 9.4)	- 5.1 (- 19.4; 9.2)
Presence of at least one local faith-based partne	r		
No	NI	NI	0
Yes			4.9 (- 5.9; 15.7)
Presence of at least one international partner			
No	NI	0	0
Yes		10.4 (- 0.4; 21.2)	8.6 (- 2.3; 19.4)
At least one active armed conflict between 2017	7 and 2022		
No	0	NI	NI
Yes	– 0.6 (– 15.3; 14.1)		
Administrative status			
Rural HZ	0	0	0
Urban HZ	2.2 (- 20; 24.3)	3.8 (- 18.4; 26)	4.2 (- 17.2; 25.7)
Geographical accessibility			
No	NI	0	NI
Yes		- 2.3 (- 13.2; 8.6)	
Number of permutations of CMOs (2017–2022)	NI	- 1.9 (- 8.2; 4.4)	- 3.0 (- 9.4; 3.4)

ß aj Adjusted ß coefficient; N/ Not Included in this model

## Table 8 Factors associated with functionality and performance in Maniema

	FUNCTIONALITY ß aj (Cl 95%)	
	Model 1 ( <i>n</i> =33)	Model 2 (n = 33)
Age		
<40 years	0	NI
40–49 years	- 8.5 (- 53.6; 36.5)	
> = 50 years	- 47.5 (- 104.5; 9.5)	
Training in management of PHC		
No	0	0
Yes	18.3 (- 26.8: 63.4)	10.7 (- 26.9; 48.3)
Years of experience in management of PHC		
< 5 vears	NI	0
> = 5 years		- 78 (- 55 2· 396)
Length of service in the H7		7.0 ( 33.2, 35.0)
	0	NI
$\sim 2 y_{cars}$	- 14 0 (- 58 3· 30 2)	T NI
2 - 2 years	- 14.0 (- 30.3, 30.2)	
No	0	0
NO	(0)	U
	28.9 (- 10.1; 73.8)	20.3 (- 17.0; 70.2)
At least one active armed conflict between 2017 and 2022		
No	NI	0
Yes		15.1 (– 31.2; 61.5)
Administrative status		
Rural HZ	NI	0
Urban HZ		- 6.4 (- 68.3; 55.6)
Geographical accessibility		
No	0	NI
Yes	- 3.8 (- 42.6; 35.1)	
Number of permutations of CMOs (2017–22)	NI	16.9 (- 3.6; 37.4)
	PERFORMANCE ß aj (CI 95%)	
	Model 1 ( <i>n</i> = 33)	Model 2 (n = 33)
Age		
< 40 years	0	NI
40–49 years	3.6 (- 10.2; 17.5)	
> = 50 years	12.3 (- 5.2; 29.9)	
Training in management of PHC		
No	0	0
Yes	3.9 (- 10; 17.8)	4.7 (- 5.4; 14.8)
Years of experience in management of PHC		
< 5 vears	NI	0
> = 5 years		2 48 (- 10 3· 15 2)
Length of service in the H7		2.10 ( 10.0) ( 10.2)
	0	NI
$\sim -2$ years	57(-79.193)	1 11
Presence of at least one local faith-based partner		
No	0	0
NU		U 01/ 100.27
Its	- 9.4 (- 23.2; 4.4)	- 0.1 (- 19.9; 3./)
At reast one active armed connict between 2017 and 2022	NI	0
NU Mar	INI	U 72( 107 52)
res		- 7.2 (- 19.7; 5.3)

#### Table 8 (continued)

	PERFORMANCE ß aj (Cl 95%)	
	Model 1 ( <i>n</i> =33)	Model 2 ( <i>n</i> =33)
Administrative status		
Rural HZ	NI	0
Urban HZ		3.3 (- 13.3; 20)
Geographical accessibility		
No	0	NI
Yes	- 0.1 (- 12.1; 11.8)	
Number of permutations of CMOs (2017–2022)	NI	- 5.0 (- 10.5; 0.5)

 $\mathit{\texttt{B}}\mathit{aj}$  Adjusted ß coefficient,  $\mathit{\texttt{NI}}$  Not Included in this model

#### Abbreviations

СМО	(Health Zone's) Chief Medical Officer
DRC	Democratic Republic of Congo
GRH	General Referral Hospital
HZ	Health Zone
PHC	Primary Health Care
PHD	Provincial Health Division
PHD-CO	Provincial Health Division's Chief Officer
МоН	Ministry of Health
WHO	World Health Organization

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#### Author contributions

R.B., and G.B. conceived the study design and data collection tools. A.Mw. supported design of methods. R.B. led the data collection and analysis. JC.L. and C.C. assisted in data analysis. G.B. and D.P. have provided substantial insight for data results interpretations. R.B., with G.B. and JC.L. assured manuscript preparation. P.M. and A.Mu. provided critical feedback. All authors read and approved the final manuscript.

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#### Availability of data and materials

All quantitative data generated and analyzed during the current study are available on request from the corresponding author. However, qualitative data are not publicly available due to confidentiality restrictions.

#### Declarations

#### Ethics approval and consent to participate

The protocol for this study was approved by the Ethics Committee of the "Université Catholique de Bukavu" under authorization N° UCB/CIES/NC/033/2021. Informed consent was obtained from each participant before any interview. Data were collected and analyzed confidentially. All stages of the study were conducted in compliance with the ethical principles of the Declaration of Helsinki, ensuring informed consent, protection of participants, and research integrity.

#### **Consent for publication**

Not applicable.

## **Competing interests**

The authors declare no competing interests.

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