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Review

Evaluation of resuscitation systems in the Democratic Republic of Congo: A narrative review

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Abstract

Introduction: Limited data exists regarding cardiovascular diseases (CVDs) and related emergencies such as out-of-hospital cardiac arrest (OHCA) in low- and middle-income countries (LMICs). The recent burden of disease report indicates a rising prevalence of CVDs in these settings like the Democratic Republic of Congo (DRC), likely associated with acute complications. Achieving improved outcomes necessitates resilient healthcare systems, including adequate emergency care and resuscitation systems. This study aims to characterize the current state of resuscitation systems in the DRC, contributing to the discourse on the burden of CVDs in LMICs and advocating for context-appropriate interventions to develop and reinforce these systems.

Methods: A narrative review utilizing the modified survival framework of the Global Resuscitation Alliance was conducted. It encompassed the country's CVD epidemiological data, healthcare components, and emergency care system.

Results: Analysis of limited available data revealed an underdeveloped and inadequately resourced healthcare system in the country, particularly its early-stage emergency care component. While specific data on out-of-hospital cardiac arrests were lacking, crucial components of the survival chain necessary for improved post-arrest outcomes were found to be largely deficient. Community-based first aid knowledge and practice were inadequate, the availability of automated external defibrillators (AEDs) and integrated ambulance services were either absent or insufficiently developed, and facility-based resuscitation capacity was predominantly in its infancy. Nonetheless, optimism is warranted due to recent government decisions to increase total health expenditure and progressively implement Universal Health Coverage.

Conclusion: Resuscitation systems in the DRC are largely non-existent, reflecting the country's underdeveloped healthcare system, particularly in emergency care. Urgent action is needed to develop and reinforce context-appropriate resuscitation systems to address the growing burden of CVD-related emergencies in LMICs.

Keywords: Democratic Republic of Congo, DRC, Out-of-Hospital Cardiac Arrest, OHCA, Emergency Care Systems, ECS, Resuscitation systems

Introduction

The burden of cardiovascular diseases (CVDs) poses a major global health challenge, accounting for a substantial share of morbidity and mortality worldwide with prevalence data revealing a twofold increase in CVD cases in the last three decades.¹ Besides CVD-related mortality, disability-adjusted life-years (DALYs) as well as years of life lost (YLLs) attributable to CVDs are rising worldwide.² Low- and middle-income countries (LMICs) account for 82% of global CVD-related deaths,³ and cardiovascular health is likely becoming one of the top public health priorities both in Africa and other LMIC settings.⁴

Although epidemiological and clinical data regarding CVDs and related emergencies such as Out-Of-Hospital Cardiac Arrest

(OHCA) remain limited in the Democratic Republic of Congo (DRC), emerging trends mirror those observed in other low- and middle-income countries (LMICs).^{5,6} Amidst the backdrop of prevalent infectious diseases and socio-economic challenges, the prevalence of CVDs in the country is unfolding as an evolving narrative.⁷ A study examining intensive care unit admissions in a DRC hospital revealed that 32.52% of cases were attributed to CVD-related causes, with strokes accounting for up to 50.8% of CVD emergencies.⁸ The overall mortality rate related to CVDs stood at 38.31%.⁸ These findings align with unpublished 2018 data from the DRC's Ministry of Health Directorate of Cardiovascular Diseases, where strokes emerged as the predominant contributor to morbidity, representing 53% of CVD-related morbidity and 16.6% of the overall morbidity burden; CVD-related mortality accounted for 35.4% of the total reported mortality.

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The emerging trends in the epidemiological profile of CVDs in the DRC have become a pivotal cornerstone for public health initiatives and require tailored strategies resonating with the unique challenges and opportunities in this region. In this context, the necessity of robust emergency care and, within it, an adequate resuscitation system becomes glaringly evident.⁹ However, the DRC healthcare system is underdeveloped and under-resourced, faced with persistent planning issues, funding difficulties and a lack of resources.⁹ The significance of a well-organised resuscitation system is therefore magnified in this context as the ability to administer swift and appropriate resuscitation measures becomes a literal lifeline. The urgency in establishing and optimizing resuscitation systems to mitigate the consequences of CVDs-related cardiac arrests in the DRC surpasses the medical realm and aligns with broader societal and economic imperatives. In this context, the development and enhancement of resuscitation systems emerge not only as a medical necessity but also as a societal obligation.

The present study engages in a thorough examination of CVD epidemiology, followed by an in-depth exploration of the intricate healthcare environment within the DRC, with a specific focus on its emergency care system (ECS). This study is a reflection and a summary of the current multifaceted realities around emergency care in DRC. This assessment is driven by the imperative to ultimately establish an efficacious resuscitation infrastructure, utilising the modified survival framework devised by the Global Resuscitation Alliance.¹⁰ The primary aim of this research is a narrative review evaluating the existing state of resuscitative systems in the DRC within the context of escalating incidences of CVDs and associated complications, underscoring the necessity for targeted interventions capable of potentially enhancing survival rates.

Methods

Design

We conducted a narrative review evaluating resuscitation systems in DRC using the Global Resuscitation Alliance modified survival framework, including CVD epidemiology data, the country's main healthcare components and the key elements of the emergency care system as described in Table 1. The review of the existing literature yielded mostly published data. However, some key unpublished reports from the Ministry of Health Directorate of Cardiovascular Diseases as well as the Directorate for Emergency Care and Disaster were included. The purposeful search used the World Health Organisation (WHO) and World Bank databases, as well as relevant DRC government departmental websites and official reports to collect required information. It also conducted targeted searches related to DRC hospital and prehospital emergency care.

Setting

The DRC is a vast country in central Africa, with an estimated population exceeding 100 million.^{11,12} It comprises 26 provinces, including the capital city of Kinshasa which is home to approximately 12 million inhabitants.¹² The country grapples with numerous socio-economic challenges that significantly impact healthcare provision. With a gross domestic product (GDP) per capita ranking among the lowest in sub-Saharan Africa, recorded at US \$ 514,^{11,12} a substantial 74% of the population lives below the poverty line.¹¹ The healthcare system in the DRC is characterised by its underdevelopment and inadequate resources, with an array of concerning health indicators.¹²

Table 1 – Components of the Global Resuscitation Alliance modified framework.

A. Outer frame

- Political commitment
- Healthcare expenditure
- Legislative environment
- Basic state of preventative health
- Traffic congestion solutions
- Cultural views of death and resuscitation
- Cultural willingness to help strangers
- Research environment
- Road conditions
- Reliable communications

B. Middle frame

- Culture of excellence
- Relationship with government, police, fire, and hospitals
- Quality improvement
- Emergency care network
- Field to facility communication
- Motivation of staff
- Ambulance/population ratio
- Research projects
- Practice of giving way to ambulance
- Willing and competent pool of bystanders CPR/AED
- Health seeking behaviour and appropriate use of EMS
- EMS specialty development
- Good Samaritan law
- Cost-efficient smart technology
- Strong EMS leadership

C. Chain of survival

- Describe chain or chainmail of survival in the country

Public healthcare facilities are notably scarce and often plagued by understaffing and inadequate equipment.¹² This is compounded by the fee-for-service model which leads to treatment delays and imposes substantial out-of-pocket expenses on the majority of citizens; this payment system represents a significant barrier to healthcare access, exacerbating discrepancies between rural and urban regions.¹³

According to the DRC Health Strategic Plan (*Plan National de Développement Sanitaire*, PNDS 2019-22),¹² the overarching healthcare policy framework in the DRC is anchored in primary health care (PHC) principles, with emphasis placed on the health zone as the operational unit. Health services in the country are organised across three levels:

1. *Central level*: Led by the National Ministry of Health, this tier primarily oversees legislative matters, policy formulation, regulation, and standardization, as well as the development of health strategies.
2. *Provincial level*: Comprising Provincial Ministries of Health, Provincial Health Departments, and Provincial Referral Hospitals, this level assumes responsibility for technical supervision, monitoring, and the translation of directives, strategies, and policies to facilitate implementation at the Health Zone level.
3. *Local level*: At the operational forefront are 516 Health Zones, tasked primarily with executing healthcare strategies.

The private sector also plays a significant role and encompasses both for-profit and non-profit entities, including non-governmental

organisations (NGOs) and faith-based organisations, alongside traditional medicine practices.¹²

Results

Outer Frame

Healthcare expenditure per capita in the Democratic Republic of Congo (DRC) remains notably lower than other low-income countries (LICs), with a mere USD 13 allocated per capita.^{14,15} This figure stands significantly below a tenth of the average expenditure observed in other sub-Saharan African nations.^{14,15} Nevertheless, there are signs of improvement in the DRC's health budget allocation, which currently stands at 8.5% of the total national budget.¹⁶ Staffing deficiencies pose a considerable barrier from both quantitative and qualitative perspectives.¹⁷ Rural regions suffer from a lack of adequate healthcare access compared to urban areas.¹² More than 90% of household healthcare expenses are covered through out-of-pocket payments, exposing the population to shattering financial burdens.¹³ However, recent governmental initiatives have commenced the implementation of Universal Health Coverage in response to evident cost-related access challenges.¹⁵

The DRC has a widespread road network with the majority of national and regional roads in a dire state.¹⁸ Major cities, notably Kinshasa, lack adequate public transport infrastructure and experience significant road congestion severely impacting daily life.^{18,19}

Regarding the communication infrastructure, the country largely relies on mobile services. The current mobile phone usage across the DRC stands at an average of 58.6% of the population, with considerable regional variation.²⁰ Mobile phone service providers also serve as the primary suppliers of internet access, with an average internet penetration rate of 30.2%.²⁰

Middle frame

Considering the lack of a noteworthy established emergency care system in DRC and a dearth of related data, this section is mainly informed by a 2019 Emergency Care Systems Assessment (ECSA)²¹ conducted by the DRC Directorate of Emergence Care with the technical support of WHO and the Emergency Medicine Association of the DRC. This data remains unpublished.

While commendable health data collection systems are evident in certain areas of the Democratic Republic of the Congo (DRC), such as maternal mortality and Ebola, the data related to emergency care, including emergency charts, their administration, and resultant outcomes, are inconsistently gathered for use by policymaking entities in health system planning.²¹ A notable lack of data characterizes the pre-hospital sector. Hospitals providing emergency services maintain patient registries with limited data, and the extraction of relevant data occurs infrequently.²¹ Patient charts also often lack sufficient information to evaluate the emergency process.²¹

There is a lack of alternative data sources for examining the emergency care system. Although there is a pre-existing National Health Information System capable of integrating emergency care data, it is underutilised.²¹ Pre-hospital systems suffer from a lack of standardized medical record documentation, and the presence of ambulances does not necessarily correspond with the availability of clinical documentation.²¹ The absence of an electronic medical record system is evident, and clinical data are not systematically used to improve quality at the systemic level.²¹

While some hospitals conduct morbidity and mortality meetings, their frequency is not consistent, and quality improvement initiatives within emergency care are notably absent. Therefore, instituting straightforward Quality Improvement programs throughout the emergency care system is imperative.²¹

Pre-hospital care services are essentially non-existent in the DRC.²² Although some public and private ambulance services exist, they primarily operate within hospitals to facilitate inter-hospital transfers.²¹ Challenges persist in sustaining and integrating ambulance donations into a centralized service structure.²¹

The designated emergency number 119, intended for ambulance services, has been allocated, but associated legislation is pending.²¹ Additionally, there is no mandate to render calls to this number toll-free, and awareness of its existence is limited.²¹

Observations indicate that formal ambulance services effectively serve none of the population due to the absence of a dispatch system, standardized protocol, or regulatory framework.²¹ Provinces possess a limited number of designated vehicles serving as ambulances, which often lack essential components and resemble conventional taxis.²¹ The absence of central coordination or regulatory oversight characterizes the emergency service sector.²¹ Training opportunities for pre-hospital providers are lacking, and the prevailing practice of uncoordinated inter-hospital transfers yields unfavourable outcomes.²¹

Establishing functional, coordinated, and regulated Emergency Medical Services (EMS), in french Service d'Aide Medicale d'Urgence (SAMU), is imperative to mitigate mortality and morbidity rates in pre-hospital emergencies throughout all provinces of the DRC.²¹

Chain of survival

The chain of survival for cardiac arrest currently faces considerable challenges due to widespread deficiencies in the healthcare system in the DRC. Early recognition and activation of emergency response are hindered by the lack of a functioning universal emergency number and limited layperson awareness.⁹ Community-based CPR knowledge is inadequate,⁹ and access to automated external defibrillators (AEDs) is non-existent. The absence of formal EMS²² and inadequate facility-based emergency care further impedes the provision of early advanced care to cardiac arrest patients. Additionally, there is a lack of standardized medical record documentation and systematic utilization of clinical data for quality improvement, hindering efforts to enhance post-cardiac arrest care and outcomes. In general, the National Health Information System currently does not capture emergency care data.²¹

Discussion

This narrative review aimed to delineate the current status of resuscitation systems in the Democratic Republic of Congo (DRC) within the broader healthcare context. The objective was to inform the potential development of tailored interventions capable of enhancing outcomes for out-of-hospital cardiac arrest (OHCA) in resource constrained settings.

The dearth of data pertaining to the burden of cardiovascular diseases (CVDs) in the DRC is a common challenge in LMICs.²³ This underscores the necessity for intensified public health research to obtain more accurate data to inform contextualised policy develop-

Table 2 – Key initiatives to potentially improve the cardiac arrest chain of survival in DRC.

Components of the cardiac arrest chain of survival	Gaps identified in the cardiac arrest chain of survival	Key improvement initiatives
Early recognition of cardiac arrest	Lack of skills among community and bystanders	Roll out community-based First Aid trainings
	Lack of skills among various healthcare workers	Basic skills training for healthcare workers
	No formal EMS to respond to community calls	Roll out WHO Community First Aid Responders program to increase response capacity
Early quality CPR	Lack of skills to perform quality CPR	Roll out basic CPR training in schools, churches. . .
Early defibrillation	Lack of defibrillators	Advocacy for AED availability in public spaces and roll out training on proper usage.
		Healthcare workers defibrillator usage training.
Early advanced care	Emergency units are still underdeveloped. Reduced number of ICU Lack of equipment Lack of readily-available medication Out-of-pocket payment for medical care	Develop emergency unit in each referral hospital.
		Provide WHO Basic Critical Care course in referral hospitals and increase ICU bed capacity.
		Provide cardiac monitoring devices.
		Disseminate the African Federation for Emergency Medicine list of essential drugs.
		Gradually implement universal health coverage

ment. Nevertheless, our analysis, despite the limited data available, aligns with findings from the latest Global Burden of Disease report for LMICs, indicating a progressively growing prevalence of CVDs^{3,4} potentially leading to associated complications such as cardiac arrests. This trend is consistent with observations in other LMICs suggesting a steady surge in CVD-related emergencies, including OHCA, akin to patterns observed in high-income countries several decades ago. Consequently, there is an imperative for bolstering resuscitation systems in LMICs. However, the current best practice guidelines developed by the Seattle Resuscitation Academy and utilised by the Global Resuscitation Alliance to enhance OHCA survival are not tailored to the needs and context of nascent emergency care systems, as seen in the DRC.¹⁰ As proposed by the International Liaison Committee on Resuscitation, teaching and implementation of the cardiac arrest chain of survival should be tailored to different environments and in low-resource settings, efforts should focus to the acquisition of defibrillators or teaching basic skills and discussion around the ethical feasibility of CPR.²³

The overarching underdevelopment and under-resourcing of the healthcare system in the DRC,¹² particularly in its emergency care component, are primary factors contributing to the absence of discernible resuscitation systems. Resource scarcity and competing priorities have compounded the challenge, necessitating difficult healthcare policy decisions. Additionally, the lack of adequate roads and/or frequent instances of congested roads¹⁸ often render transportation of patients perilous. Similarly, poor availability of communication support technology in communities is predicted to limit access to emergency care services once established. Nevertheless, there are promising indications with the government's commitment to incrementally bolster the total health expenditure and progressively implement the Universal Health Coverage.¹²

Despite the unavailability of specific data on OHCA in the DRC, our analysis revealed significant deficiencies in key components of the chain of survival essential for enhancing post-arrest outcomes. Early recognition and activation of emergency response remain hypothetical due to the absence of a universal emergency number

and limited layperson awareness. Inadequate knowledge of first aid, despite a positive attitude,⁹ underscores the necessity for context-appropriate training programs to equip community members with life-saving skills. Initiatives such as the pilot WHO layperson first aid training targeting community health volunteers have shown promise²⁴ and could serve as crucial components in developing pre-hospital care systems in the DRC. Additionally, the lack of formal EMS and inadequate facility-based emergency care pose significant threats to OHCA survival due to interruptions in advanced cardiovascular life support and transportation to definitive care.

Addressing the aforementioned barriers to essential emergency care system functions, along with broader global healthcare challenges such as funding, planning, and workforce competency, is paramount for the DRC, given the escalating complications associated with CVDs. The modified framework of survival for nascent emergency care systems proposed by the Global Resuscitation Alliance represents a vital tool for identifying barriers and implementing systematic prioritisation and cost-effective innovative solutions. These long-term, context-specific solutions aim to progressively enhance OHCA survival rates in challenging LMIC settings and beyond. Steps to potentially improve the cardiac arrest chain of survival in DRC may include elements presented in [Table 2](#).

Conclusion

Despite the increasing prevalence of cardiovascular diseases (CVDs) and related complications, resuscitation systems in the DRC are largely non-existent, primarily due to the country's underdeveloped healthcare infrastructure, particularly in emergency care. Strengthening core healthcare components, including the emergency care system, is imperative for progressive resuscitation system development. Strategic implementation of emergency care system priorities, guided by the WHO-led Emergency Care System Assessment, is essential to integrate Emergency Medical Services (EMS), standardise procedures, upskill staff, and upgrade infrastruc-

ture. Interventions must target all components of the chain of survival, starting with community-based life support, early defibrillation, timely EMS involvement, and post-arrest facility-based care. Urgent action is required to develop and reinforce context-appropriate resuscitation systems to address the escalating burden of CVD-related emergencies in the DRC. In the case of DRC, many of the solutions to promote and sustain the cardiac arrest chain of survival will likely follow the trends of the broader socio-economic development of the country.

CRedit authorship contribution statement

D. Kabongo: Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Investigation, Formal analysis, Conceptualization. **M. Issa:** Writing – review & editing, Writing – original draft, Validation, Resources, Investigation, Formal analysis, Data curation, Conceptualization. **K. Diango:** Writing – review & editing, Writing – original draft, Validation, Resources, Investigation, Formal analysis, Data curation, Conceptualization. **P. Bilomba:** Validation, Resources, Investigation, Conceptualization. **C. Simbi:** Validation, Resources, Investigation, Conceptualization. **A.D. Nsampi:** Validation, Resources, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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