

Heart Failure in Sub-Saharan Africa: Current and Future Systems of Care

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Abstract

Sub-Saharan Africa is undergoing rapid demographic and epidemiological transitions, fuelled by urbanisation, lifestyle changes and ageing populations. Consequently, the continent is faced with a ballooning burden of both communicable and non-communicable diseases (NCDs). Cardiovascular diseases are the leading cause of NCD-related mortality in SSA, with heart failure (HF) being the common phenotypic manifestation, afflicting a relatively younger population compared to other world regions. Even though the burden of HF is expected to double by 2030, HF systems of care remain poor in sub-Saharan Africa. Poor outcomes are especially aggravated by systemic barriers including under-resourced and siloed prevention, diagnostic, treatment and research efforts. Integrating HF care delivery through a systems approach and addressing risk factor prevention, screening and treatment across various tiers of care is crucial in abating the increasing burden of HF and NCDs. Further, a more patient-centred system of care that strengthens health financing, policies and system capabilities should be adopted to improve HF care and outcomes in sub-Saharan Africa.

Keywords

Systems of care, heart failure, sub-Saharan Africa

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For decades, the narrative surrounding cardiovascular disease (CVD) in sub-Saharan Africa (SSA) has focused on infectious diseases.¹ However, SSA is undergoing demographic and epidemiological transitions fuelled by urbanisation, lifestyle changes and an ageing population.^{2–4} Consequently, SSA now faces a double burden of both communicable and non-communicable diseases (NCDs), with CVDs as the leading driver.^{5,6} Notably, CVDs are the largest contributors to NCD-related mortality in SSA and the second-leading cause of death, accounting for 16% of deaths (95% CI [15.3–16.8%]) after infectious diseases.⁷ Moreover, the prevalence of CVDs in SSA increased by 131.7% from 1990 to 2019 and is expected to double by 2030.^{3,6}

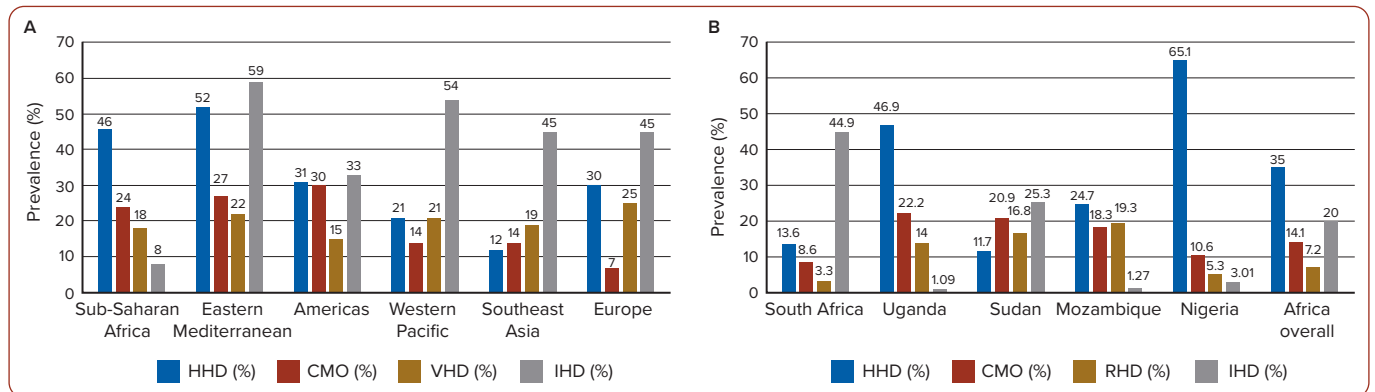
The spectrum of CVDs in SSA includes ischaemic heart disease, rheumatic heart disease, hypertensive heart disease, arrhythmias, cardiomyopathies, endomyocarditis and heart failure (HF).⁷ HF is the common terminal pathway for most CVDs. Additionally, various HF phenotypes share common underlying risk factors, such as smoking, hypertension, diabetes, hyperlipidaemia, physical inactivity and obesity.⁷

Epidemiology of Heart Failure in Sub-Saharan Africa

In contrast to high-income countries (HICs), HF in SSA affects a relatively younger population in their third to fifth decades of life.^{8–10} Although data on sex differences is inconsistent, men appear to be marginally more affected than women.¹⁰ However, globally, women are more affected than men.¹¹ At the time of diagnosis, up to 55.9% of patients present with advanced HF stages in New York Heart Association classes III and IV.^{10,12,13} The INTER-CHF study found that SSA had the highest proportion of patients with health illiteracy (47.6%) and without health insurance coverage (71.6%).⁹

Aetiologically, HF in SSA is most commonly attributed to hypertensive heart disease (46%), idiopathic dilated cardiomyopathy (24%) and rheumatic heart disease (18%; *Figure 1A*).¹⁴ Ischaemic heart disease, which is the most common contributor of HF in HIC, is still underreported in SSA with a prevalence ranging from 8% in the THESUS-HF study to 20% in the INTER-CHF study (*Figure 1B*).^{13,14} Other cardiomyopathies leading to HF include peripartum cardiomyopathy, nutritional

Figure 1: Major Causes of Heart Failure



A: Major causes of heart failure in sub-Saharan Africa compared to other regions. B: Major causes of heart failure in Africa. CMO = cardiomyopathy; HHD = hypertensive heart disease; IHD = ischemic heart disease; RHD = rheumatic heart disease; VHD = valvular heart disease. A: Source: Agbor et al. 2020.¹⁰ B: Data sources: Karaye et al. 2021¹³; Damasceno et al. 2012.¹⁴

deficiencies, viral infections, such as HIV, and genetic factors.^{15–18} Less common causes of HF in SSA include ischaemic heart disease, endomyocardial fibrosis, degenerative valvular heart disease and congenital heart defects.

The Burden of Heart Failure in Sub-Saharan Africa

There are limited data on the exact prevalence of HF in SSA, but it is reported to range from 9% to 45% against a global average of 1–4% (Figure 2A). HF is associated with high rehospitalisation rates, morbidity and mortality. The THESUS-HF study, a multinational HF study in nine countries in SSA, reported a 6-month HF mortality rate as high as 18%.¹⁴ Another multinational study reported a case fatality rate of 34.8%, reflecting the severity and significance of HF in SSA.¹⁹ Besides, with the evolving epidemiological profile and ageing population, the major causes of HF, particularly ischaemic heart disease in SSA, is likely to increase.²⁰ Noting that SSA currently has the youngest population in the world (55% of the population is 15–64 years of age), HF shall, therefore, adversely impact the most productive workforce population if no action is taken to address its causes and mitigate its burden.²¹

HF systems of care in SSA remain suboptimal, despite a rapidly increasing HF prevalence and the preventable nature of associated aetiological factors. The 30-day HF re-hospitalisation rate is as high as 26% against a global rate of 13.2%, while the 1-year mortality rate stands at 33.6% against a global rate of 16% (Figure 2B).^{19,22,23} These disparities reflect poor HF systems of care particularly in low-resource rural settings where barriers to HF care include little awareness of risk factors, lack of access to early risk factor and disease screening, inadequate diagnostic and treatment capabilities and nearly absent secondary and tertiary prevention interventions. Additionally, the impact of sex differences on HF systems of care in SSA remains unclear due to inconsistent data availability. However, men reportedly present with HF with reduced ejection fraction and are 21% more likely to die of HF than women.²⁴ Considering that HF-related in-hospital mortality is associated with higher healthcare costs, optimising HF systems of care in SSA is essential to improving outcomes.²⁵ Low health insurance coverage and high patient illiteracy in SSA further strain an already fragile healthcare system. There is a great need to redesign systems of care in SSA to comprehensively address the growing burden of HF at every stage of the disease. This review highlights key health system components relevant to HF care, identifying potential areas for improvement in prevention, management and follow-up for advanced disease.

Core Health System Domains for Heart Failure in Sub-Saharan Africa

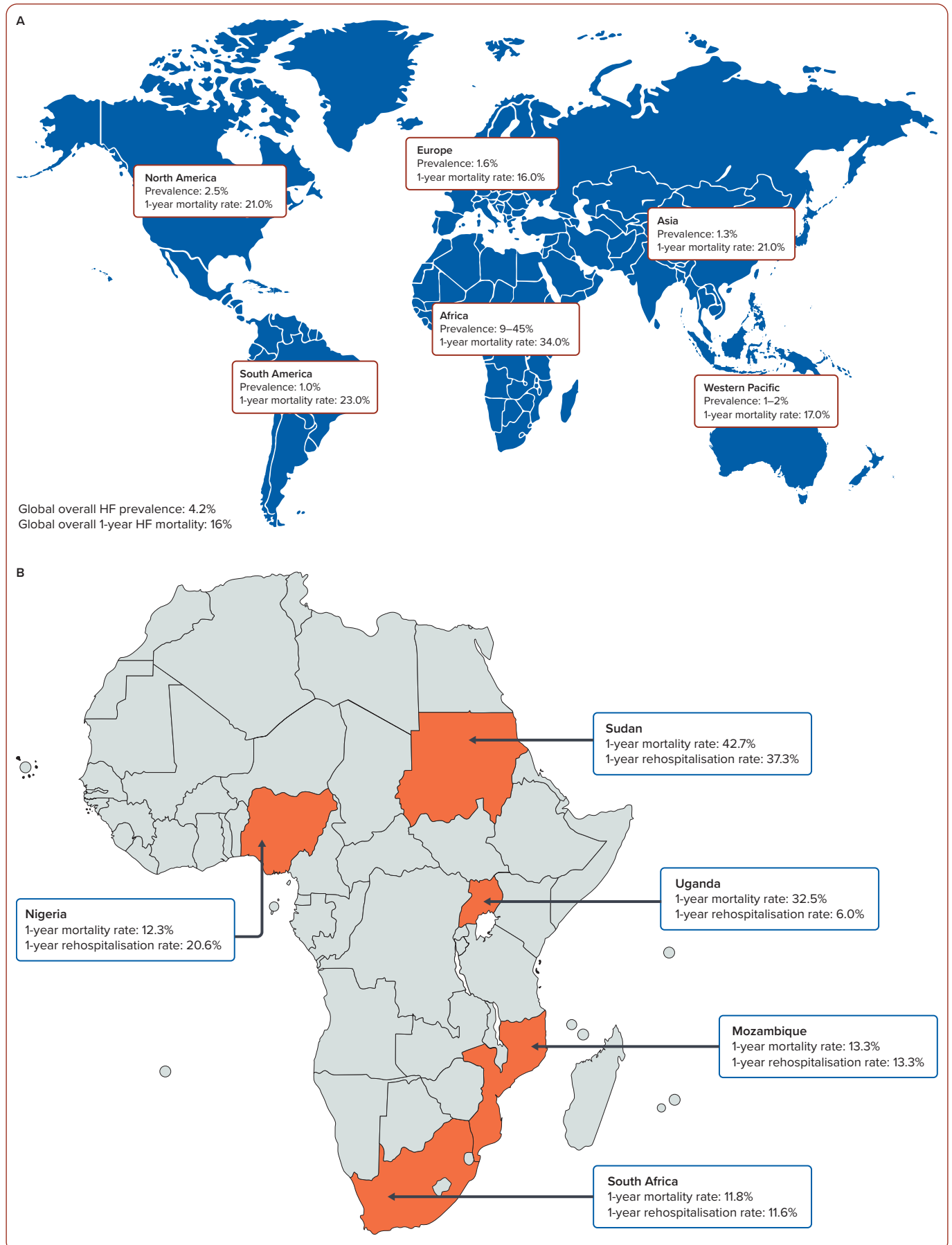
SSA has highly heterogeneous HF systems of care due to its vast geopolitical and socioeconomic landscape. Despite scarce data on HF aetiology and management, available data suggest regional differences in risk factor prevalence and standards of care. However, health system needs and challenges are surprisingly similar across different countries in SSA, and several health system frameworks have been proposed to describe health systems in emerging economies.²⁶ The complex and dynamic nature of chronic diseases, such as HF, limits the utility of these models especially in rapidly evolving regions of SSA. This review, therefore, discusses current HF systems of care in SSA through the lens of core health system domains: policy, financing and system capabilities. We highlight opportunities to use innovative technologies to integrate healthcare delivery across HF stages, including prevention, screening, diagnosis, treatment and monitoring, while keeping healthcare centred on patient and community outcomes (Figure 3).

Policy

The role of health policy in shaping patient-centred HF care and CVD management in SSA cannot be underestimated. In 2013, the WHO, through the UN 66th World Health Assembly, set targets for managing the rising burden of NCDs, including CVDs. The overarching goal was to reduce premature deaths from NCDs by 25% by 2025, known as 25 by 25.²⁷ Subsequently, in 2015, the UN, through Sustainable Development Goal (SDG) 3.4, offered a framework for global health targets, aiming to reduce premature NCD mortality by one-third by 2030.²⁸ In line with the SDG 3.4, the World Health Federation Vision 2030, launched in 2022, outlined a framework for reducing age-standardised cardiovascular incidence and mortality by at least 30% in 2030 and 50% in 2050. This vision recognises cardiovascular health as a fundamental personal and public responsibility and addresses four main areas: cardiovascular health equity, timely implementation strategies, innovation and technology and addressing cardiovascular health with climate policies.²⁹

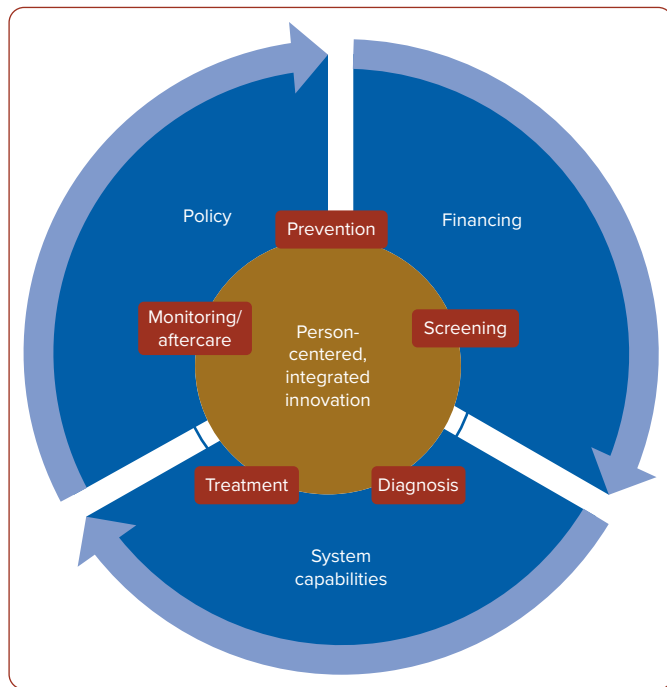
As a result, different countries in SSA have tried to align with global health goals to address the ballooning burden of CVDs. However, there remains a lack of targets related to HF, despite the fact that most CVDs lead to HF, which, in turn, is an important driver of CVD-related mortality in SSA. The WHO 2024 global SDG progress report noted a moderate 10% decline in NCD-related mortality in 2019, but did not mention the contribution of HF to this disease burden.³⁰

Figure 2: Outcomes, Prevalence and Mortality of Heart Failure



A: Global prevalence and 1-year mortality of heart failure. B: Outcomes of heart failure in sub-Saharan Africa. Data sources: A: Data source: Dokainish et al. 2017¹⁹, Tromp et al. 2020⁷⁸ and Savarese et al. 2023.⁷⁹ World map: Adobe Stock. B: Karaye et al. 2021.¹³

Figure 3: Core Domains of Integrated Health Systems for Heart Failure in Sub-Saharan Africa



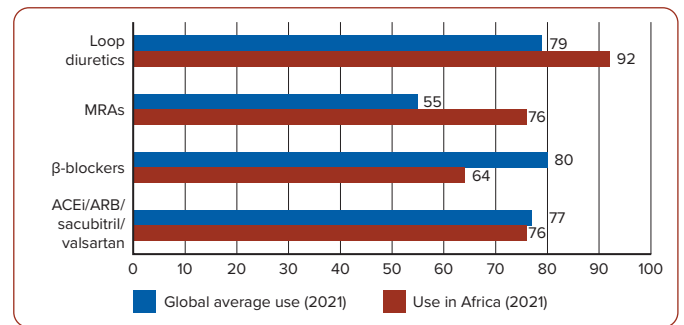
The failure of these important policies to specifically address HF as a key component of CVDs and CVD-related morbidity and mortality leaves a significant gap affecting the overall management of HF across different levels of care in SSA. This omission may further bias government priorities away from adequate resource allocation to HF management in SSA, where the healthcare system is still fragile. There is an urgent need for specific policies and regulations to inform HF management policies, guidelines and resource allocation in the region.

Healthcare Financing

In 2001, heads of state of the African Union agreed to allocate at least 15% of the total government budget towards health expenditures in order to achieve equitable and sustainable health coverage in Africa, in a document that became known as the Abuja Declaration.³¹ However, as of 2021, only two countries, Cape Verde and South Africa, had surpassed the target.³² Healthcare in SSA is therefore significantly hampered by poor financing capacity, with over 40% of healthcare costs being covered through out-of-pocket payments.³³ This is far from the WHO recommendation of 20% for financial protection from catastrophic health expenditure.³⁴ Furthermore, comprehensive national health insurance scheme coverage is very low and only available in about 15% of SSA countries.³³ Given the high cost of HF treatment, this lack of financial protection means that most people with HF in SSA suffer from catastrophic health spending, dipping them into poverty. For example, households with CVDs in Ghana and South Africa were at least three times more likely to face catastrophic health spending compared to those without CVDs.³⁵ Whereas there is broad consensus on the importance of universal health coverage, as encompassed in SDG 3.8, access to quality healthcare services without financial hardship remains particularly elusive in SSA.²⁸ The slow progress towards universal health coverage is alarming as it directly impacts HF care quality and outcomes in SSA. Karamagi et al. found that up to 38% of patients in SSA may delay or forego medical attention due to high costs.³⁶

Ogah et al., describing the cost of HF care in Nigeria, and Aminde et al., describing the cost of treatment of ischaemic heart disease, hypertensive

Figure 4: Use of Guideline-directed Medical Therapy in Africa



ACEi = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; MRAs = mineralocorticoid receptor antagonist. Source: Johansson et al. 2021.⁵³

heart disease and stroke in Cameroon, both found that the cost of basic guideline-directed medical therapy (GDMT) for these conditions was very expensive relative to patient incomes.^{37,38} Advanced lifesaving therapies, such as cardiac resynchronisation therapy, mechanical support and heart transplants, are largely unavailable because of their high cost. The paucity of data, prohibitive cost of care and inadequate health financing mechanisms in SSA form a triple burden that makes achieving optimal HF care an ongoing challenge. It is therefore imperative that key stakeholders rethink HF care financing strategies as many HF patients can have a good quality of life with optimal treatment, particularly GDMT.³⁹

System Capabilities

The health workforce is the keystone of any health system and a motivated health workforce is critical for delivering quality healthcare services.⁴⁰ Similarly, the quality of HF care depends on the availability of qualified healthcare professionals. However, HF care in SSA is severely impacted by a shortage of medical doctors, with fewer than 1 physician per 10,000 people as of 2020. Additionally, the global health workforce shortage was estimated to be 15.4 million.⁴¹ Even though this shortage is expected to decrease by 34% to 10.2 million by 2030, SSA is projected to be substantially and inequitably affected, with an estimated shortage of about 6.1 million healthcare workers, accounting for 52% of the global health workforce shortage.^{40,41} Despite comprising up to 14% of the global population and bearing about 25% of the global burden of disease, SSA accounts for only 4% of the global healthcare workforce.^{42,43} Moreover, SSA has only 2,000 cardiologists serving a population of 1.2 billion people, and approximately 18% of 33 African countries lack registered cardiologists.^{44,45}

Efficient supply chain management of GDMT including HF drugs is crucial for ensuring that health systems can manage HF. There are four main classes of HF drugs with proven mortality benefits: renin-angiotensin-aldosterone system inhibitors (RASi), β-blockers (BBs), sodium-glucose cotransporter 2 inhibitors (SGLT2i) and mineralocorticoid receptor antagonists.⁴⁶ Their routine use in SSA is limited due to inadequate prescription, high cost and low availability.⁴⁷ Availability of HF GDMT ranges from 14–20% in the public sector and 52–60.7% in the private sector.⁴⁸ In a survey of pharmaco-disparities in HF treatment in 10 countries, Averbuch et al. found that the affordability of GDMT was worst in low- and middle-income countries, particularly in Uganda and South Africa, where the cost of angiotensin receptor-neprilysin inhibitors and SGLT2i was not covered by national health insurance programmes.⁴⁹ In Uganda, the overall cost of GDMT ranged from 232.47% of gross national income per capita per month, compared to 1.49% in England.

Table 1: Health Systems for Heart Failure in Sub-Saharan Africa: Challenges and Solutions

Domain	Challenges	Improvement Strategies
Policy	- Lack of HF-specific guidelines and targets in existing healthcare policies. - Need for policies to support comprehensive HF care education and reform rigid systems, including decentralising HF services beyond tertiary and urban centres. - Lack of policies addressing environmental factors such as pollution and the built environment, which exacerbate NCDs and contribute to adverse cardiovascular health outcomes.	- Develop context-specific CVD policies for HF management in different SSA countries, incorporating health education, lifestyle awareness and risk factor management early in school curriculums. - Broad stakeholder engagement in iterative policy development, including expanding the capacity of existing infectious disease care structures and enacting legislation to fund and protect healthcare access and infrastructure development. - Strengthen research and continuous disease surveillance to facilitate early interventions and mitigate the impacts of emerging and endemic diseases.
Healthcare financing	- Competing demands for economic resource allocation leading to a failure to allocate at least 15% of the total government budget towards healthcare in alignment with the Abuja Declaration. - Limited health insurance coverage and high out-of-pocket expenses. - Lack of data on HF management costs to guide resource allocation.	- Improve resource allocation and accountability towards NCDs and HF by recalibrating economic models and factoring in rapidly shifting epidemiologic trends. - Expand comprehensive public health insurance and strengthen universal health access, including bridge funding to mitigate long-term impacts of catastrophic spending associated with HF. - Enable robust economic studies on HF management costs to guide resource allocation and market-shaping strategies.
System capabilities	- Severe shortage of healthcare professionals and HF specialists and training centres. - Unstable GDMT supply chain including unaffordability and inaccessibility of therapies. - Inadequate HF diagnostic capacity, including shortages of X-rays, echo- and electrocardiography, natriuretic peptides and advanced cardiac imaging modalities.	- Expand healthcare workforce through task shifting and improved training programs using digital technology and clinical decision support tools. - Regularly update the essential drug list and digitise procurement systems, ensuring forecasting and ability to predict the future patterns and demands of GDMT to optimise GDMT inventory and supply chain readiness. - Equip primary healthcare centres for early HF detection and referral, adopting interoperable electronic medical records and deploying artificial intelligence to improve HF diagnostic and care capabilities.

CVDs = cardiovascular diseases; GDMT = guideline-directed medical therapy; HF = heart failure; NCD = non-communicable diseases; SSA = sub-Saharan Africa.

The lack of affordability, availability and accessibility of GDMT in SSA could be due to supply chain inefficiencies, procurement challenges and a failure to include HF drugs in national health insurance coverage for NCDs. A cross-sectional survey across 37 countries in SSA found that HF services were only available in 32% of countries, with access concentrated in tertiary centres (60%), secondary centres (32%) and primary care centres (22%).⁵⁰ Given that delayed initiation of GDMT leads to poor outcomes in HF patients, mechanisms need to be put in place to ensure constant affordability, availability and accessibility of GDMT in SSA.⁵¹ On the other hand, it is notable that the use of GDMTs seems to have increased from 2014 to 2018. For instance, the use of RASi improved from 70% to 75.6%, BBs from 25% to 31.4%, MRAs from 46% to 51.5% and diuretics from 73% to 81.6% (Figure 4).^{8,52} This could reflect increased awareness and prescription despite prohibitive costs, implying that enhanced availability and affordability could further increase the utility of GDMT in SSA. However, overall GDMT use in SSA remains below the global average, particularly for BBs (Figure 4), whereas data on SGLT2i is scarce.⁵³

Leveraging Biomedical Innovation

Early diagnosis through early screening and accurate diagnostic capacity is key to HF management. This is pivotal for the timely initiation of lifestyle modifications and pharmacological interventions that improve HF outcomes.⁵⁴ This can be achieved through the use of screening or diagnostic modalities appropriate to the patient's clinical profile. A comprehensive HF evaluation takes into account clinical history, physical examination findings and appropriate laboratory tests including serum brain natriuretic peptide and N-terminal pro-B-type natriuretic peptide levels, chest X-ray, echocardiography and advanced cardiac imaging modalities such as cardiac CT and MRI as well as invasive diagnostic techniques such as cardiac catheterisation.⁴⁶ Emerging techniques such

as artificial intelligence (AI), machine learning and integrated electronic medical records are expected to play an increasingly important role in HF diagnosis and management.^{55,56}

Beyond incomplete epidemiological data and a lack of advanced technologies for CVD data management and surveillance, many healthcare facilities in SSA lack qualified healthcare professionals and basic tools for early HF diagnosis.^{57–59} In a survey assessing HF diagnostic and treatment capacity in Kenya and Uganda, Carlson et al. found that only 55% and 38% of facilities had functional and staffed radiography and ultrasound units, respectively, with less than 50% of facilities in both countries having functional electrocardiography machines.⁶⁰ X-ray services were available in 54% of facilities in Kenya and 36% in Uganda, while ultrasound was available in 38% of Kenyan and 45% of Ugandan facilities.⁶⁰ Although this survey was limited to two countries and had a low response rate of 29%, it reflects common HF diagnostic and treatment gaps in SSA. Additionally, natriuretic peptides are significantly underused in SSA.^{59,61} The I PREFER study reported the use of natriuretic peptides in only 3.8% of 2,539 participants. However, the study was limited to HF patients with preserved ejection fraction recruited from North African regions, the Middle East and Latin America.⁶²

Advanced cardiac imaging techniques such as cardiac CT, cardiac MRI and nuclear imaging play a key role in improving HF care and outcomes.^{63,64} However, SSA has limited access to such technologies in comparison to HICs. A recent review by Lakshmanan and Mbanze showed that SSA has about 0.3 MRI units per million people, with only eight countries having the capacity to provide cardiac MRI.⁶⁵ Most of the scanners were concentrated in the private sector and training centres in South Africa. This underscores the critical need for improved diagnostic tools to enhance HF care in SSA.

SSA is on course to become the most populated continent with the highest burden of HF and other CVDs. Given the complexity of HF as a syndrome, and the heterogeneity of this disease in the African region, deploying advanced clinical decision support tools could improve HF care access and quality. Evaluating the diagnostic accuracy of AI-assisted clinical decision support systems, Choi et al. found a 98.3% concordance rate between HF specialists and AI in diagnosing HF.⁶⁶ Muhammad et al., using an AI computational model with 10 machine learning classification algorithms, reported diagnostic accuracy ranging from 82.33% to 92.08%, with an area under the curve between 91.89% and 97.92% across the models.⁵⁵ This evidence suggests that AI is able to integrate large datasets, improve diagnostic accuracy, predict HF outcomes and aid in optimising HF treatment strategies.^{67,68} However, AI adoption in SSA lags far behind HICs due to a scarcity of resources, hence, the need to test their validity and efficacy in SSA's unique HF patient population before widespread adoption can be recommended.

Strategies for Better Heart Failure Care in Sub-Saharan Africa

There is an urgent need to address the ballooning burden of HF in SSA. Besides, it is imperative that HF is recognised as a significant cause of CVD and CVD-related mortality. Pressing domain-specific interventions should be implemented, ensuring an improved HF system of care that is also resilient to the emerging global causes of CVD morbidity and mortality, such as climate change and air pollution in SSAs. Country-specific policies are urgently needed, including improved reporting of HF patient outcomes, improved uptake of GDMT, the establishment of registries and data linkages for HF and improved transition and referral systems across different settings.

Given the prohibitive cost of treating HF and other CVDs, governments should expand public health insurance systems through innovative health financing mechanisms so that all HF patients can access necessary services without financial catastrophe. National budget allocations should be increased to at least meet the targets of the Abuja declaration with transparent and sustainable accountability systems.³¹ HF medications, including GDMT, should be listed as essential medications in line with the WHO's latest model list and fully covered by national insurance systems across the care continuum.⁶⁹

Strengthening health systems in SSA requires expanding workforce capabilities through innovative task shifting and technology-supported clinical decision-making, especially in low-resource settings. Task shifting, defined by the WHO as "a process whereby specific tasks are moved, where appropriate, to health workers with shorter training and fewer qualifications", has the potential to bridge critical workforce gaps.^{70–72} Training community health workers and nurses to recognise HF signs and symptoms, providing basic education and facilitating early referral to healthcare facilities could improve early HF detection and management. In Guatemala, Mexico, South Africa and Bangladesh, community health workers improved early referrals and management of patients with hypertension and other CVDs.⁷³ In Rwanda, community nurse-led diagnosis and care of HF improved HF mortality from 38.8% to 27.1% during a 10-year study period.⁷⁴ Coupled with improved patient education and empowerment, task shifting and task sharing should be embedded

within existing HF policies.

Health systems in SSA need to develop decentralised, multidisciplinary care models to improve HF care capacity. Establishing multilateral or public-private partnerships, along with centralised procurement systems, is imperative. To ensure consistent access to GDMT, policies should support regular updates to essential drug lists, digitisation of procurement systems and forecasting. These strategies would strengthen primary healthcare services for HF in SSA, making them more widely available and accessible.^{75,76}

HF research, training and innovation centres can be empowered by adequate resource allocation and the establishment of policies addressing the paucity of epidemiological data on HF. Research, training and innovation will accelerate prevention, diagnosis, treatment and monitoring capacity, particularly in SSA where comprehensive HF services are geographically dispersed and scarce. Digital tools such as AI offer great promise in expanding access to expert HF care services and tailored patient education, thereby improving care and addressing the healthcare workforce shortage in SSA. Nurturing such innovation is pivotal for the establishment of holistic and resilient healthcare systems.⁷⁷ Table 1 highlights some challenges of systems of HF care in SSA and potential innovative solutions.

Conclusion

Sub-Saharan Africa is experiencing an epidemiological and demographic transition characterised by an increasing NCD burden. CVDs are emerging as a leading cause of morbidity and mortality, with HF as a principal contributor. Notably, the clinical profile of HF in SSA is unique as it affects relatively younger persons in their third to fifth decades of life, depriving SSA of its economic powerhouse. SSA still suffers a fragile health system incapable of effectively managing the ballooning burden of HF: policies failing to comprehensively address HF and the debilitating effects of climate change on cardiovascular health; insufficient financial coverage and protection; a severe healthcare workforce shortage; the limited availability, accessibility and affordability of GDMT; and underdeveloped biomedical devices and healthcare innovation. There is an urgent need to strengthen and integrate health policies, financing, health system capabilities and innovation to establish resilient health systems to tackle the burden of HF and other emerging NCD risk factors across the care continuum. □

Clinical Perspective

- Heart failure (HF) is an important contributor to cardiovascular disease- and non-communicable disease-related mortality in sub-Saharan Africa (SSA).
- HF care systems in SSA are burdened by inadequate policies, poor funding and financial protection, suboptimal system capabilities and siloed efforts in care delivery across the disease continuum.
- Innovative patient-centred care models, which integrate policies, health financing and system capabilities through technology alongside research, training and environmental adaptation, are crucial to improving HF care and non-communicable disease outcomes in SSA.

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