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REVIEW

Cardiovascular Health Priorities in Sub-Saharan Africa

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Abstract

The overall burden of cardiovascular disease (CVD) in Sub-Saharan Africa (sSA) tends to be underestimated. Model predictions, estimating CVDs are responsible for approximately 13% of all deaths and 38% of all non-communicable disease (NCD) deaths in sSA, are based on data mainly from urban areas and primarily hospital-based clinical data. Conservative estimates report NCD account for a total of 2.6 million deaths in sSA. Additionally, upstream determinants of poor health in general such as poverty and level of education extend beyond established and reliable data-capture systems. Majority of these present challenges require multi-sectoral and inter-disciplinary strategies to effectively address. However, the limitations notwithstanding, available estimates show that countries in sSA are facing a double burden of infectious and non-communicable diseases. The infectious disease burden in sSA has previously been high; however, populations in Africa are undergoing both an epidemiological and demographic transition with increased survival from childhood to adulthood. There has also been a rise in modifiable risk factors, such as dietary and sedentary lifestyle, accounting for an increasing prevalence of cardiovascular diseases and other non-communicable diseases. This shift and a rise in cardiovascular morbidity have placed substantial strain on healthcare systems in Sub-Saharan Africa that require to be prioritized right from policy to practice. The recent COVID-19 pandemic with a disproportionately higher incidence of morbidity and mortality among patients with pre-existing risk factors for cardiovascular disease has also highlighted challenges and potential areas of improvement in the delivery of cardiovascular healthcare in Sub-Saharan Africa.

Keywords Cardiovascular disease · Health · Priorities · Sub-Saharan Africa · COVID-19

Introduction

Disease burden in Sub-Saharan Africa (sSA) was previously largely attributable to infectious diseases. However, with the epidemiological and demographic transition and an increase in the prevalence of non-communicable diseases (NCDs), sSA currently faces a double burden of both infectious and non-communicable diseases such as cardiovascular diseases [1]. The leading causes of hospital admission and in-hospital deaths among adults in sSA were both cardiovascular and infectious diseases [2]. In 2020, cardiovascular diseases remained the leading cause of global disease burden [3]. Previously, the estimated number of deaths in sSA that were attributable to cardiovascular diseases (CVDs) were one million, constituting 5.5% of all global CVD-related deaths and 11.3% of all deaths in Africa; however, recent data show increasing survival with attendant co-morbidities from CVDs [3, 4]. The global incidence of CVD-mortality is increasing [5], and overall NCDs are projected to account for more than 50% of deaths in sSA by 2030 [6]. Additionally,

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these CVD-related deaths form 38% of all NCD-related deaths in Africa [7].

Despite these attempts in quantifying the burden of CVDs in sSA, there are still challenges that need to be addressed, some of which have been previously reviewed by Yuyun et al. [5]. Firstly, data on CVDs in low-and-middle income countries (LMICs) beyond urban centres can be very sparse [8] and in majority of cases non-existent. Secondly, rapidly advancing technologies in the spectrum of cardiovascular medicine ranging from novel diagnostics to therapeutics remain inaccessible to majority of patients living in LMIC settings in sSA. Thirdly, public health policies and systems favouring preventive and promotive health are needed. Fourthly, existing curative healthcare systems require strengthening for efficient service delivery including adequate resource allocation for specialised human resource staffing and equipping. Finally, the on-going COVID-19 pandemic is an additional challenge on already strained healthcare systems in sSA and the long-term sequelae of COVID-19 infection on the cardiovascular system remain largely unknown.

Therefore, the aim of this paper is to provide an updated overview of the challenges encountered in the management of CVDs in sSA countries. It also highlights some of the important priorities for management of CVDs in sSA countries post the COVID-19 pandemic.

Gaps

Data on Burden of Cardiovascular Disease in Africa

The burden of cardiovascular diseases in Africa remains largely under-estimated primarily due to factors such as weaker systems of data collection that are mainly centred in and around urban centres, reduced funding for research as well as shortage of skilled expertise [9]. According to the World Health Organization (WHO), 77% of all reported NCD-related deaths occur in low- and middle-income countries (LMICs), and the burden being even higher accounting for 85% of deaths preventing adults over 30 years from reaching their full life-span [10]. In a 2014 study investigating the use of linked clinical and demographic surveillance data to measure the burden of disease among adults living in coastal Kenya, we showed that there are several factors at play including distance from the hospital and gender-based health-seeking behaviour [11]. Nevertheless, there was evidence of a combined burden of infectious and non-infectious diseases including cardiovascular illnesses in this rural cohort [11]. Yuyun et al. also highlighted the challenges of incomplete epidemiological data collection on CVDs in sSA [5]. Despite these challenges, some efforts have still been made at describing the burden and types of CVDs commonly seen in sSA. Mebrahtom et al. recently reported a high prevalence of rheumatic heart disease (RHD) affecting one in seven people in East Africa with over one million children affected [12]. Approximately 500,000 children born annually in Africa have a significant congenital heart disease (CHD) requiring specialist cardiac care which is limited and largely confined to urban areas [13]. Zikarg et al. reported a pooled-prevalence of approximately 30% for cardiac septal defects among children in East Africa [14]. Majority of CHD patients in Africa die early during infancy, while the minority that survive to adolescence and adulthood have a reduced quality of life due to significant morbidity and chronic illness [13]. The international congestive heart failure study (INTER-CHF) conducted across Africa, Asia, Middle East and South America reported a high mortality rate of heart failure in Africa (34%) that was double the global average [15]. Overall, the lack of proper disease surveillance programmes and weaker health systems compromise the ascertainment of the true burden and trends of CVDs in sSA. Additionally, discrepancies in prevalence reported in the literature arise from differences in capacity to detect cases due to lack of standardised diagnostic assessment procedures and tools or requisite expertise across different countries in sSA and also between rural and urban centres within the same country [12]. Current evidence shows a higher burden of CVDs in urban areas compared to rural areas in sSA [5, 16].

Technological Advances

Technological advances and the use of artificial intelligence algorithms continue to exponentially increase in delivery of healthcare. Ranging from the incorporation of digital health innovations to more advanced diagnostic and therapeutic technologies, there is growing evidence of improved delivery of CVD care as well as patient outcomes with the use of these technologies.

In 2020, Santo and Redfern reported that short message services (SMS) were the most studied type of digital health intervention, showing positive results in improved education, medication adherence and reduction of CVD risk [17]. Over the last two decades, sSA has seen increasing use of digital technologies in healthcare systems, including *mHealth* and *tele-medicine* [18]. However, while these are generally good in improving access, they come with new challenges such as data privacy, regulation, costs and sustainability among others [19]. According to the Global System for Mobile Communications (GSMA), there are 5.3 billion people (67%) connected to mobile services globally [20]. In sSA, mobile phone subscribers were 46% of the total population with Nigeria having the highest number of mobile phones [21–23]. However, there is sparse data showing effective

linkage of mobile and digital technology with access, and/or delivery of healthcare for CVDs in sSA.

Existing technologies such as automated blood pressure measurements which form the basis for the diagnosis and management of hypertension have also been shown to simplify measurement processes and minimize misclassification errors that could have serious implications in the management of CVDs [24]. Other higher-end diagnostic and therapeutic technologies for CVDs remain largely out of reach for majority of the populations living in sSA due to several factors such as costs, access, availability and general lack of awareness.

Health Policies and Systems

Universal access to healthcare for CVDs which includes the full range of essential health services — ranging from health promotion to prevention, curative treatment, rehabilitation and palliative care — remain out of reach for majority of the populations living in sSA. In instances where there is the ideal coverage for CVDs, this comes at a prohibitively high cost, limiting universal access. According to the WHO, universal health coverage (UHC) implies that all people have access to the health services they need, and of sufficient quality, without suffering financial hardship [25]. UHC is embedded within the third United Nations Sustainable Development Goal (UN SDG-3) and requires effective healthcare financing policies and strategies; however, these remain a challenge in sSA [26]. Catastrophic health expenditures have been reported to impoverish over 100 million people annually worldwide, majority of whom are in sSA where more than 56% of countries are affected by direct out-of-pocket (OOP) payments for healthcare services [27]. In 2022, Eze et al. reviewed population-level and disease-specific factors associated with catastrophic health expenditure in sSA. Morbidities related to NCDs including CVDs, lack of access to specialist healthcare and absent health insurance are examples of contributing factors to high direct OOP payments affecting mainly the elderly, people of lower socioeconomic status, those with chronic illness and those living in rural areas [28].

Human Resources

According to the WHO estimates, Africa has 14% of the world population and bears nearly a quarter of the overall global disease burden but only accounts for less than 4% of the global workforce in healthcare [29]. Another challenge facing not just sSA but most low- and middle-income countries (LMICs) has been brain drain of professional healthcare workers seeking better career and employment prospects in high income countries (HICs) [30–33]. Of the estimated 23,000 qualified academic and health professionals who emigrate from Africa annually, specialists in CVD healthcare tend to be one of the highest affected [31]. Faced with a double burden of communicable and non-communicable diseases alongside a growing demand for chronic health care, there is need for developing integrated models of healthcare at all levels of health systems in sSA [34]. This will incorporate attraction, training and retaining of competent and skilled personnel as well as capacity building for routine epidemiology and demographic health surveillance systems and research platforms [34].

COVID-19 Pandemic

Infection with severe acute respiratory syndrome coronavirus type-2 (SARS-CoV-2) causing coronavirus disease of 2019 (COVID-19) led to a global pandemic that left the already weak healthcare systems in sSA more vulnerable. This only served to further emphasise the existing gaps in UHC and CVD services within sSA [26]. The epidemiological review by Yuyun et al. was conducted prior to the COVID-19 pandemic [5]. Elderly patients and those with chronic CVDs have been shown to be at a higher risk of morbidity and mortality from COVID-19 compared to the rest of the population from published literature [35]. Emerging data from cohorts of patients in the West who recovered from COVID-19 and survived have revealed increased risk to the cardiovascular system [36], including in those who were vaccinated [37]. There has been limited data on the impact of COVID-19 on CVDs in sSA with one published report showing discordant association of COVID-19 on overall mortality in sSA [38]. One plausible hypothesis for the relatively lower mortality of COVID-19 in sSA has been the possible mandatory and high use of the Bacille Calmette-Guérin (BCG) vaccination against tuberculosis and background anti-retroviral therapy for human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) infection [39]. In 2020, Escobar et al. explored the potential mechanisms underlying BCG vaccination and protection from viral infections of the respiratory tract such as COVID-19. While BCG protection against *Mycobacterium tuberculosis* is through a cellular immune response, they described an additional long-lasting innate immune response beyond those specific to mycobacteria including modification of macrophages that led to a broad immune protection, a phenomenon referred to as trained immunity [40]. In 2021, the African COVID-19 Critical Care Outcomes Study (ACCCOS) that specifically focused on critically ill and intensive care patients reported higher mortalities in African countries than that reported elsewhere [41]. Some of the factors attributed to this finding of higher COVID-19 related deaths among critically ill Africans included limited critical care resources, comorbidities such as HIV/AIDS and chronic liver, kidney diseases as well as diabetes [41].

The true burden and effect of COVID-19 on CVDs in sSA remains unknown.

Other important challenges which have been previously described by Yuyun et al. include factors such as differences in prevalence of CVDs in different ethnicities [42, 43] and skewed resource allocation. Governments, academic institutions, international health organisations, donors and other stakeholders in sSA ought to develop structured surveillance programmes, seek sustainable funding and invest in research in order to capture vital statistics and the true morbidity and mortality burden from CVDs in sSA [5].

Priorities

In order to address these gaps and effectively reduce the increasing burden of CVDs, there is an urgent need to establish priorities for policy formulation, resource allocation and capacity development for public healthcare, clinical service delivery and research in sSA. Additionally, a wholistic approach aimed at prevention of CVDs through risk-factor modification and overall wellbeing, rather than the fragmented focus on curative services for specific disease entities will be an important priority in reducing the burden of CVDs in sSA. These factors can be considered at different levels; individual, local health institutional regional administrative units, national government, pan-African and global scales.

At the global policy level, the WHO published a resolution recommending prioritization of the implementation, expansion and integration of digital health technologies to strengthen existing health systems [44]. Indeed, the previously untapped potential of digital health became even more apparent during the imposed restrictions on close social contact as a result of the COVID-19 pandemic. However, this served to highlight some policy and regulatory restrictions that hinder digital health expansion and the need for governments to urgently address these, since the benefits of digital health transcend COVID-19 and will impact CVDs as well [45].

The current ratio of 0.8 health workers per 10,000 inhabitants in Africa falls way below the WHO recommended minimum threshold of 44.5 health workers per 10,000 population in 2030 [46]. The ratio of health workers for delivery of specialized healthcare for CVDs in sSA is even lower and needs to be addressed through policies and programs aimed at expansion of training opportunities as well as retention of these specialists in hospitals and health institutions within sSA. One way to address the shortages is through collaborations. These can be between universities, hospitals and research institutions within a county or even across different countries. The leading hubs for cardiovascular research collaboration in sSA are the Hatter Institute for Cardiovascular Research in Africa (HICRA) at the University of Cape Town and the Chris Baragwanath Hospital that is affiliated with the University of Witwatersrand all in South Africa [47]. Through a number of multi-country studies and collaborations, other sSA countries have benefitted from the resources, expertise and training in CVD research at these institutions [47]. There are other inter-university collaborations happening predominantly in the Anglophone-speaking compared to Francophone-speaking sSA countries that is partly attributed to dominance of institutions in South Africa and Nigeria; however, the Pan-African Society of Cardiology (PASCAR) continues to advocate for collaboration, networking and resource-mobilisation for CVD research and training in sSA [47–49]. These efforts could help increase the availability and access to specialist healthcare workers for CVDs in rural and other under-served areas in sSA. Other unique collaborations focusing on CVDs could arise in a similar way that the ACCCOS collaboration described above developed spontaneously in response to the COVID-19 pandemic [41]. The COVID-19 pandemic led to disruption in the delivery of regular healthcare services including CVD services across most parts of Africa. An explanatory study focusing on the effects of COVID-19 in South Africa reported impact of factors such as increased surveillance and behaviour change on the health system and society in general but not CVD specifically [50]. However, the reorganisation of public health services including incorporation of surveillance systems could be used prospectively for implementation of better monitoring and improved delivery of healthcare to CVD patients [51].

At the level of healthcare facilities, there is increasing research on geospatial mapping, including the recently reported mapping of 98,745 public health facilities [52]. In keeping with SDG-3 on healthcare, access to health services is important for achieving equity and UHC. To achieve this, defining the geographical availability of health services in relation to the communities they serve and increasing complexity of the referral chain is necessary [52]. While attempts have been made at mapping health facilities in sSA, majority of the reports in the literature have focused on primary healthcare facilities offering basic medical and surgical care rather than specialist services including CVD care [52, 53] with the geospatial mapping being done after the COVID-19 pandemic [54, 55]. Prior to the onset of the COVID-19 pandemic, Chikafu and Chimbari (2019), had described a rise in CVD admissions in sSA with rural residence and lower socio-economic status being negatively associated with utilization of healthcare facilities [56]. This could be attributed to both the lack of specialist healthcare facilities for CVD in rural areas as well as a high cost of accessing this care where it was available. Kapwata and Manda (2018) had reported similar findings in South Africa with lower densities of health facilities offering CVD care for populations

living in rural settings leaving populations at risk of CVD-related morbidity and mortality due to factors such as late diagnosis and lack of proper management [57]. Notably, mapping and integration of geospatial datasets to evaluate constraints of physical distancing during the COVID-19 pandemic has been done in Kenya [58]. This can be replicated in the mapping of access to specialist CVD healthcare services. Additionally, infrastructural investment in health facilities to enable reliable data-capture for accurate quantification of the burden of CVD in sSA will be required. These systems will need to ideally leverage on the health technology potential in Africa as well as be scalable for maximal benefit [18].

At the individual level in sSA context, future priorities need to focus on CVD-educational initiatives aimed at increasing health-seeking behaviour [59] as well as maintaining regular follow-up contact with healthcare services when known to have pre-existing risk-factors for CVD [60]. With the potential for many functionalities, future digital health technologies should focus more on features likely to impact an individual's behaviour and that will largely be aimed at preventing CVDs [61]. Existing examples of these include wearable devices which have been shown to impact lifestyle factors like physical activity as well as other outcomes such as blood pressure, management of blood sugars and lipid levels among others [17].

This study has some limitations. The higher prevalence of CVDs reported in urban areas could be due to availability of surveillance and access to diagnostic systems that are unavailable in rural areas. Other factors that could lead to seemingly lower prevalence of disease in rural areas include lack of awareness due to comparatively lower literacy levels as well as lack of access to specialist care for early diagnosis and timely treatment of CVDs. Other limitations that could not be explored due to lack of description in the literature on CVDs included health seeking behaviours and religious beliefs in communities living in sSA countries.

In summary, the interplay of all these factors eventually has a bearing on CVD-related burden and will need strategic planning, prioritization and implementation of policies and practices to reduce CVDs and improve clinical outcomes in sSA.

Abbreviations *ACCCOS*: African COVID-19 Critical Care Outcomes Study; *AIDS*: Acquired immunodeficiency syndrome; *BCG*: Bacille Calmette-Guérin; *CHD*: Congenital heart disease; *COVID-19*: Coronavirus disease of 2019; *CVDs*: Cardiovascular diseases; *GSMA*: Global system for mobile communications; *HICs*: High-income countries; *HICRA*: Hatter Institute for Cardiovascular Research in Africa; *HIV*: Human immunodeficiency virus; *INTER-CHF*: International congestive heart failure study; *LMICs*: Low-and-middle-income countries; *NCDs*: Non-communicable diseases; *OOP*: Out-of-pocket; *PASCAR* : Pan-African Society of Cardiology; *RHD*: Rheumatic heart disease; *SARS-CoV-2*: Severe acute respiratory syndrome coronavirus type-2; *SDG*: Sustainable development goals; *SMS*: Short message services; *sSA*: Sub-Saharan Africa; *UHC*: Universal health coverage; *UN*: United Nations; *WHO*: World Health Organization

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Declarations

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