



# Improving Access to Pediatric Cardiac Care in the Developing World: the South African Perspective

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## Abstract

*Purpose of Review* The paper outlines the current status of health care and pediatric cardiac services in South Africa and the challenges faced in providing pediatric cardiac care in the country.

*Recent Findings* As infant and child mortality rates in South Africa and most of Sub-Saharan Africa continue to decline, establishing and improving the infrastructure to manage congenital heart disease increases in importance.

*Summary* South Africa has well-established pediatric cardiac units in most major centers in the country. These have been able to train sufficient numbers of pediatric cardiologists to double the number in the country in just over a decade as well as train fellows from surrounding countries. A significant proportion of funding for this training comes from non-government sources. The number of pediatric cardiologists is however still far less than required with services spread unevenly throughout the country. Pediatric cardiac surgical services remain severely constrained with an urgent need to train more pediatric cardiac surgeons. Further progress depends not only on focussing resources on cardiac disease but also improvements in the health care systems and socioeconomic conditions in general.

## Introduction

Congenital heart disease (CHD) is the most common congenital abnormality and the most common cardiac condition in children with an estimated 12,000 children born with CHD annually in South Africa. In the rest of Sub-Saharan Africa, the number born per million people annually is likely higher with higher fertility rates in many countries [1•]. In addition, the burden of undetected and untreated CHD adds to the total prevalence.

Rheumatic heart disease remains a significant cause of acquired heart disease within the continent with declarations calling for dedicated plans of action towards the prevention and elimination of the disease being made first in 2006 and again in 2018 [2•, 3]. While some areas within South Africa have seen a substantial decline, it remains an important cause of morbidity and mortality, particularly in provinces with large rural populations [4–7].

## Current Health Care Systems in South Africa

Health care in South Africa is divided into parallel private and public health care systems. Private health care caters between 20 and 25% of the estimated 60 million population while the remaining 70–75% only have access to the public health care system [8]. Public health care is heavily subsidized according to income, and is provided free of charge at primary care level and to anyone who cannot afford it. In addition, it is free for pregnant and breastfeeding mothers, all children under 6 years, as well as those over 6 years of age with moderate to severe disabilities [9]. Health care in South Africa is regarded as the best in Africa, and private health care is regarded as comparable to that of most developed countries. Significant inequity exists, however, with the equivalent of \$1500 per person per year spent on private health care and only \$150 per person per year on public health care. In addition, 70% of health care workers are employed in the private sector. Concerns have been raised regarding the need for improvement in the overall quality of care in the public sector, and that the level of care provided is regarded as disproportionate to state health expenditure [10]. In 2017, the government gazetted a National Health Insurance Policy document aimed

at reducing inequity within the health care system [11]. This has generated considerable controversy and has still to be implemented [12].

Formal medical training at all levels occurs almost exclusively within the public sector within state universities and hospitals. The examination process for postgraduate training in specialties and subspecialties is undertaken by a central institution—the College of Medicine of South Africa.

## Pediatric Cardiology Services

Major centers for pediatric cardiology in both public and private sectors are based solely in the main centers—Johannesburg, Pretoria, Durban, Bloemfontein, and Cape Town. More recently, a pediatric cardiology service has been set up in Gqeberha (Port Elizabeth). Four of the 9 provinces have no pediatric cardiac center.

Pediatric cardiology training within these centers is undertaken over 3 years with a prerequisite for training being previous qualification as a pediatrician. For certification as a pediatric cardiologist, it is necessary, among other requirements for candidates, to demonstrate adequate skills in echocardiography and cardiac catheterization, submit a satisfactorily completed logbook, and sit a certification examination [13]. Few dedicated training posts are available and, in most centers, training is generally offered when a specialist post becomes vacant. Further training has been facilitated by outside funding.

## Pediatric Cardiac Surgery

Pediatric cardiac surgery occurs largely within the major centers in both public and private institutions. The number of pediatric cardiac surgeons remains small both within the private and public sector with some having retired or soon reaching retirement age. There is no specific qualification for congenital or pediatric cardiac surgery. Cardiac surgeons qualify as general cardiothoracic surgeons before training in congenital heart surgery. While training within the country has occurred [14•], most pediatric cardiac surgeons spend a year or more training at an international center before returning to South Africa.

## Progress and Challenges

An audit of pediatric cardiac services conducted over a decade ago raised concerns regarding a number of systemic deficiencies within South Africa. These included inadequacies in the detection of congenital heart disease and the inability of the service to cope with the number of patients presenting for surgery [15•]. Additional issues identified were the paucity of pediatric cardiologists and surgeons for the population served. A subsequent editorial

in 2016 again emphasized the vulnerability of the service and the need for greater resource allocation [16].

Significant positive changes have been noted since. The most striking has been the doubling of pediatric cardiologists, from 24 in 2007 to over 40 in 2022, almost equally distributed between the public and private sectors. While far from the developed world recommendation of 120 for the 60 million population, this is a considerable improvement which can be attributed to active, successful training programs in all centers. While state-sponsored posts for training have been very limited, the increase in training has been through sponsorships by private health consortiums and nongovernmental organizations, most notably the Nelson Mandela Children's Fund and African Paediatric Fellowship Program (APFP). In addition, some training has been by secondment from parent institutions within the country.

Effective and active interventional cardiac catheterization programs have developed substantially with the capacity to manage both simple and more complex lesions. Collaboration between units and interventional "workshops" held in centers throughout the country has accelerated interventional programs. This has helped reduce the surgical load with the added benefit of shorter hospitalization periods and reduced mortality and morbidity.

Specific challenges to the pediatric cardiac services differ from center to center. They include poor maintenance and upkeep of infrastructure, human resource shortages, as well as delayed referrals. Services in some areas have been crippled when cardiac catheterization equipment fails and then takes years to replace [17, 18]. Failure to address these challenges often has a "knock-on effect" leading to resignation of staff and ultimately collapse of the service.

Capacity for congenital heart surgery remains the greatest challenge with most centers overwhelmed by the demand. Obstacles include lack of theatre time and intensive care facilities as well as a severe shortage of surgeons. A handful of pediatric cardiac surgeons operate within the country, with some centers utterly dependent on a single surgeon or part-time surgeons. The shortage of pediatric cardiac surgeons with expertise to perform the full repertoire of congenital heart operations is a serious concern and threatens some pediatric cardiac programs. Explanations given for the failure to produce sufficient pediatric cardiac surgeons include the long training time required after qualifying as a cardiothoracic surgeon, the absence of any dedicated training programs for pediatric cardiac surgery, the lack of local trainers, and the need for a candidate to spend at least 1 and often 2 years abroad, as well as the limited posts available within the public service for such candidates. The problem is exacerbated by many experienced surgeons having either retired or nearing retirement with no one to take their place. While the problem has been recognized by the fraternity and some steps taken to correct these deficiencies, there are concerns that these may not be enough. On 1 February 2022, the South African government implemented a new "Critical Skills List" which made provision for those occupations eligible to work in South Africa under a "Critical Skills Work Visa." The fact that no medical professionals were on the list draws attention to the lack of awareness at the government level to this critical need [19].

These challenges relate easily to the state of South African public health care in general. While there have been a number of initiatives to improve health care, the level of care is generally regarded as below the standard expected. Challenges identified include lack of human resources, long waiting times for services, avoidable adverse events with increasing litigation, poor infection control, and poor record keeping [20•].

These health care challenges, in turn, occur against a background of economic inequity, with an estimated 60% of people living below the upper-, middle-income country poverty line [21]. Among the challenges that the country struggles to overcome are high unemployment, poor rural infrastructure, corruption, and an unstable energy supply. The COVID-19 pandemic and civil unrest experienced in some parts of the country have exacerbated these challenges [22].

## Sub-Saharan Africa

The situation is far worse in the rest of Sub-Saharan Africa where pediatric cardiac care remains inaccessible to the vast majority of children. Significant progress has been recorded in some countries with the establishment of cardiac catheterization and local surgical services in countries such as Uganda, Namibia, and Ghana [23•, 24•, 25].

Facilities for echocardiography have improved in many countries with small numbers of pediatric cardiologists or pediatricians trained in echocardiography. For a large proportion of the continent, surgical intervention has to be sought elsewhere. In two countries with relatively high gross national income, Botswana and Namibia, the government has made available the resources to purchase cardiac services from the private sector in South Africa when necessary [19, 26]. In many countries, however, if a cardiac condition requiring intervention is diagnosed, the cost of intervention and travel has to be borne by the family. Small programs with assistance from centers in the developed world operate in many countries. These have not always, however, translated into a sustainable long-term service.

The experiences and opinions of many centers and experts have been published on the subject regarding services in lower middle-income and low-income countries in general and Sub-Saharan Africa in particular. The key factors that are reiterated universally is that provision of adequate and sustainable services depends on early, efficient diagnosis, governmental support, adequate financial and human resources, education and training of all team members, need for a broad multidisciplinary framework with collaboration between all stakeholders, as well as collection and evaluation of data and quality control programs [27–30, 31•, 32•].

## The Role of South Africa

The platforms on which successful, efficient programs have been built are pediatric cardiologists or pediatricians with the equipment and training to make accurate diagnoses and management plans for children with heart defects. The primary contribution of South African public sector hospitals has been in the training of some of these pediatric cardiologists for the rest of Africa. Pediatric cardiologists undergoing or completed training have come from Tanzania, Botswana, Kenya, Malawi, Zambia, Zimbabwe, Libya, Uganda, and Namibia. In the case of some countries like Namibia, this has been through government funding. For most, however, funding is through non-governmental organizations (NGOs), the most active of which has been the APFP. The implications for the hosted countries can be profound. For example, in Zimbabwe, before the return of the APFP fellow in 2021, there was only one pediatric cardiologist for the entire country.

As demonstrated in Uganda, cardiac catheterization programs can be initiated rapidly by local cardiologists after undergoing an intensive period of training elsewhere together with “skills transfer camps” where international interventional teams visit for a short while to assist with specialized procedures and bolster skills [33•]. However, sustainability remains a problem with the need for maintenance of equipment and the high cost of consumables. South African units have the capacity to assist in training for interventional procedures as well as provide a springboard for international experts to share skills with cardiologists from South Africa and neighboring countries.

## Role and Impact of Technology

While still lagging behind most of the world, mobile and internet connectivity has grown phenomenally and is available throughout most of Sub-Saharan Africa, particularly within urban areas [34]. This has allowed unprecedented communication between colleagues and mentors throughout the world. Easily available online applications allow easy, cost-effective videoconferencing and almost instantaneous sharing of images and videos. This has become an invaluable method of connectivity for those working in geographically isolated areas. A pioneering online platform specifically designed for the cardiac catheterization has been “Cathchat,” based in the cardiac catheterization laboratory at Red Cross Children’s Hospital in Cape Town [35]. The main strength of the system is that it allows sharing of high-resolution images and real-time interaction between many units and individuals simultaneously. Its preferential utilization of national research and education networks as opposed to commercial networks increases cost-effectiveness and accessibility. While

use thus far has been primarily for cardiac catheterization, it has potential value for other aspects of health care education and training [32•].

Another pioneering and innovative use of technology is the web-based application “Hridyam” launched in the Indian state of Kerala. This state-run online application registered all patients diagnosed with congenital heart disease and allowed tracking of their progress, from diagnosis through treatment and follow-up. This, together with coordinated programs to improve diagnosis, transport and management of patients is credited with significantly reducing mortality from congenital heart disease [36••, 37•]. Establishment of similar programs may be feasible within the Sub-Saharan context and need to be explored.

## Donor Funding in South Africa

NGOs have played a key role in cardiac care throughout the world in low- and middle-income countries [38, 39•]. In Sub-Saharan African countries such as Mozambique, Uganda, Rwanda, Ethiopia, and Ivory Coast, cardiac services have been established with NGO support [38, 39•, 40•, 41•, 42, 43•]. The most beneficial have been those that while providing service work to build local capacity within the country. In South Africa, foundations attached to specific private hospitals raise funds for operating on patients in these centers while others help fund purchase of consumables or additional human resources required for surgery. The highest impact of donor funding in South Africa has been training of pediatric cardiologists as undertaken by the APFP, the Nelson Mandela Children’s Fund, and private hospital groups.

## Conclusion

While Sub-Saharan Africa has experienced challenges in meeting the Sustainable Development Goals adopted in 2015, in terms of child health care, considerable reductions in infant and child mortality rates have been recorded in most countries [44]. As these improvements continue, further reduction will only be achieved by focussing attention on conditions such as congenital heart disease. South African infrastructure, proximity, and level of development make it ideally positioned to spearhead further development of pediatric cardiac services in Sub-Saharan Africa and, more specifically, the Southern African Region. Within South Africa, the need for more pediatric cardiac surgeons and addressing the huge backlogs in pediatric cardiac surgery remains the greatest obstacle to progress.

Stability and growth of the service depend on political and economic stability, maintenance of infrastructure, and a coordinated program involving both government and NGOs to develop the entire team necessary for pediatric cardiac care in particular and child health care in general.

## Compliance with Ethical Standards

### Conflict of Interest

Ebrahim G. M. Hoosen declares that he has no conflict of interest. Antoinette M. Cilliers declares that she has no conflict of interest. Stephen Brown declares that he has no conflict of interest. Belinda Mitchell declares that she has no conflict of interest.

### Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

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