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Prevention of heart disease and healthcare delivery in South Africa: Challenges and opportunities

Africa is a vast and diverse continent, and this is reflected in multiple facets of healthcare prevention and delivery. Africa also shares with many other lower- and middle-income countries (LMIC) the spectre of a global epidemic of cardiovascular disease in juxtaposition with a considerable burden of communicable diseases.⁽¹⁾ This supplement of the South African Heart Association Journal is centred around the Southern African region, but it addresses a wide range of timely issues of relevance not only to other regions of the continent but in the context of LMIC and newly industrialised nations around the world. The concept of the “epidemiologic transition” provides a very useful framework for understanding epidemiological trends in cardiovascular disease against a backdrop of profound changes in many societies evolving from a rural to an urban environment and in the face of challenges posed by the newly industrialised societies.^(2,3) (Table 1)

Stage 1 (the age of pestilence and famine) still exists in parts of sub-Saharan Africa, Southeast Asia, and parts of Latin America. Stage 2 (the phase of “receding pandemics”) was present in the United States around the first twenty years of the 20th century. During this phase the predominance of cardiovascular deaths are secondary to rheumatic heart disease and haemorrhagic strokes. Stage 3 (the phase of degenerative and man-made diseases) was characterised by the rapidly expanding epidemic of cardiovascular disease in the United States from the 1920s to the 1960s, and in Western Europe this occurred approximately ten years later. In this phase of the epidemic, coronary heart disease is initially seen in patients of higher socio-economic status. Stage 4 (which is the phase of delayed degenerative diseases) is the situation in most of the United States, Western Europe, and Australia, and is characterised by a reduction in age-adjusted cardiovascular deaths, but an overall increase in cardiovascular death is the longevity as the population increases. During stage 4 of the epidemic, premature cardiovascular death manifests primarily in patients of lower socio-economic status.

A pivotal question facing these countries such as the United States and Western Europe, which have experienced a consistent reduction in cardiovascular mortality over four decades, is whether the epidemic of obesity, diabetes, and hypertension will reverse the hard won gains. The decline in age-adjusted coronary heart disease mortality over the last 40 to 50 years has been primarily attributable to control of risk factors and, to a lesser extent, upon new therapeutic advances.⁽⁴⁾ Signals from a number of different sources including epidemiologic studies and autopsy data, suggests that the decline in mortality is levelling off or indeed trending upward.⁽⁵⁾

In a different context, the recent experience in Russia is also of great concern in that it emphasises the detrimental effects of social upheaval and economic instability upon the longevity of a population, and in particular the impact upon death due to cardiovascular disease, violence, and accidents.⁽⁶⁾

Distribution of the Epidemiologic Transition in Low- and Middle-Income Countries

Although it is generally accepted that an epidemic of premature death due to cardiovascular disease is occurring on a global scale, it appears likely that the brunt will be born by low- and middle-income countries, which are perhaps at the greatest potential disadvantage of combating this threat. Nonetheless, it is a mistake to consider the developing world as a homogenous entity from a health perspective, and each region has to deal with its own challenges from an epidemiologic, resource, and infrastructural standpoint.

A recent analysis by Gaziano, et al. highlights the different stages of the epidemiologic transition present within regions falling under the umbrella of the LMIC.^(1,2) Cardiovascular and other non-communicable diseases are the leading cause of death in Eastern Europe and Central Asia, the Middle East, North Africa, East Asia and the Pacific, Latin America, Caribbean, and South Asia, but non-communicable diseases still predominate in sub-Saharan Africa. Although phase III of the epidemiologic transition predominates in Eastern Europe, the Middle East, and other regions of the world, phases I, II, and III coexist within the same region, e.g., South Asia, East Asia, and the Pacific, parts of Latin America and the Caribbean, and in sub-Saharan countries such as South Africa. A country like India has to deal with a significant proportion of the population who are malnourished and ravaged by communicable diseases, and yet living alongside another segment of a young population with an extraordinary high incidence of risk factors for cardio-vascular disease. Similarly, South Africa has to deal with the burdens of HIV/Aids, infant and maternal mortality, violence, and growing burden of non-communicable diseases and cardiovascular risk factors in addition to a high prevalence of rheumatic and congenital heart disease and dilated cardiomyopathy (perhaps nutritional from an etiological standpoint).⁽⁷⁾

These data provide a framework for the articles in this supplement which highlight the challenges and opportunities provided by a high prevalence of structural heart disease and the looming presence of an epidemic of coronary heart disease, hypertension, and diabetes. The challenges are many, but there are opportunities too, particularly with regard to developing prevention strategies, since the specific cardiovascular risk factors are well documented and constitute important targets for therapy. What a wonderful

**Guest editor,
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Professor of Medicine

opportunity to telescope the epidemiologic transition and for primary prevention.⁽⁸⁾ The lessons learned would benefit the global community and not just South Africans.

The two cardiac surgical papers by Turina and Kinsley, et al. illustrate quite strikingly the contrast between the challenges and the opportunities. Moreover, the two publications emphasise the burden of established valvular and congenital heart disease in the developing world in addition to the growing numbers of patients with coronary heart disease.

Marko Turina discusses the many challenges involved in transferring knowledge to LMIC, in a discipline as complex, labour intensive, and resource hungry such as cardiac surgery. This is an area that has been addressed from a number of different perspectives by other European Association for Cardiovascular Surgery and other organisations.

The role of international assistance and development in building and equipping suitable hospitals is an obvious solution but one that is not always successful since it requires local expertise to fully utilise the facilities. Moreover, this requires “knowledge transfer” and not just bricks and mortar. The other approach favoured by non-governmental organisations (NGOs) requires the travel of teams who perform procedures in specialised hospitals within the developing world. This has the attraction that patients, especially children, receive the treatment, but the training of individuals locally is not a priority. As such, this approach can only offer an interim solution. Transporting patients to surgical centres in specialised institutions in the developed world is a worthy cause from a humanitarian standpoint, but this is an extremely expensive approach which can only touch the tip of the iceberg.

Given these caveats, it is encouraging to note that the focus of the EACTS is on the transfer of knowledge via assistance of teaching courses with a comprehensive didactic and practical curriculum with access aided by a system of scholarships enabling young surgeons from LMIC to visit advanced centres including the EACTS School established in Bergamo, Italy. The essence of this approach is on training with a view to the acquired skills being practiced in their native countries. Concern relates to the “brain drain” and the need to retain these highly trained professionals in areas in which their skills are direly needed.

Rob Kinsley's description of the experience of the Walter Sisulu Paediatric Cardiac Centre for African (WSPCCA) highlights the challenges and the magnitude of the need, but also illustrates what can be achieved by dedicated individuals in the fields of service, training, and research in the space of only eight years. Africa is the most underserved continent in the field of paediatric cardiac surgery; a discipline which has progressed to the point where 70 to 80% of children born with cardiac disease can now survive into adulthood providing they have access to optimum treatment. Despite the formidable hurdles, the WSPCCA has performed 2 023 operations in 1 738 patients of which 53% are neonates and infants under one year of age. This includes surgery performed at two centres in Cape Town, in addition to Sunninghill Hospital in Gauteng. The results are excellent and provide a service to South Africa and the rest of the continent – not only from a clinical standpoint but as an African led centre for training and relevant research.

15% of patients are funded by the Foundation, and 85% of patients are self-funded. This model of public/private collaboration should be a magnet for funding from foundations and other philanthropic organisations

from abroad. The figure of 15% is extremely low considering the quality of the work and the immediate benefit. Nonetheless, Kinsley has pointed out that long-term solutions lie in participation by African governments and the economies of their own countries and in collaborative efforts like the WSPCCA across regional and national boundaries. Until this happens, regrettably "it appears that the African child with congenital heart disease will continue to depend upon the benevolence of others for cardiac care". Hopefully, the seeds planted and nurtured by Kinsley and his colleagues will continue to grow and receive the support they deserve.

Sandra Pretorius, Simon Stewart and Karin Sliwa review the lessons learnt from the heart of Soweto Study. The Heart of Soweto Study provides an example of what can be achieved under difficult economic, infrastructural, and socio-political circumstances.⁽⁸⁾ Karen Sliwa and her team have been extremely successful in providing South African medicine with a major epidemiologic resource, which could play a crucial role in monitoring the potential epidemic of cardiovascular disease and by providing a profile of the current distribution of heart disease in a largely black urban African population. This demonstrates an extremely low rate of ischaemic heart disease but high rates of hypertensive and valvular heart disease and heart failure due to a multiplicity of conditions including hypertension, idiopathic dilated cardiomyopathy, isolated right heart failure, and peripartum cardiomyopathy. Tuberculosis pericarditis unfortunately continues to be extremely common. Other important observations from the Soweto Heart Study have demonstrated the growing prevalence of all the cardiovascular risk factors with the exception of hyperlipidemia and raise the issue of whether these are harbingers of an epidemic to come. It appears that the Soweto population is standing at the crossroads of new and historically prevalent heart disease and provides an epidemiological laboratory for the study of the impact of migration and a changing socio-economic environment upon the cardiovascular health of a community in transition.

Another innovative component of this study is to develop an African cardiovascular risk score. The Framingham study has been an unqualified success by identifying the common risk factors underlying the development of coronary heart disease and stroke and the benefits have been worldwide. Nonetheless, traditional risk scores which are developed in populations such as Framingham may not be directly applicable to other environments from a quantitative standpoint, although the INTERHEART study has taught us that the traditional risk factors are certainly the predominant cause of premature cardiovascular disease globally. Nonetheless, developing countries face additional challenges from novel risk factors and their interaction with the established risk factors may be critically important.⁽¹⁾

Simon Stewart, who is part of the Heart of Soweto international collaboration, discusses the barriers and challenges of the primary and secondary prevention of disease in sub-Saharan Africa. Here again lessons learned may be applicable to other parts of the developing world. Although the challenges are enormous there is also great potential since the epidemic of coronary heart disease, although projected, has not arrived. Risk factors can be modified and there is the possibility that an apparently exorable trend can be halted. In many other parts of the world the epidemic of cardiovascular disease is already rampant and the time for modifying the epidemiologic transition has already passed. Nonetheless, and in regard to southern Africa although the barriers are not insurmountable, current trends in cardiovascular risk factors are not encouraging.⁽⁹⁾

**Guest editor,
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Prevention in sub-Saharan Africa will take many forms including population-based as opposed to individual interventions in high-risk populations. In this respect the “polypill” is intriguing and one suspects that if the polypill turns out to be successful in a South Asian population, this approach may be translated into other parts of the world. A key to this is an understanding that the contribution of risk factors may vary among regions and perhaps developing a polypill specific to a particular region.⁽¹⁰⁾ Developing solutions to the global epidemic of cardiovascular disease will require research into many other aspects including agricultural and food policies, smoking cessation programmes, urban design, air pollution, social and cultural values, and economic changes. The Heart of Soweto Study can play an invaluable role in identifying and monitoring trends in risk factors for cardiovascular disease and in developing preventive strategies in a complex and changing socio-economic milieu.

The paper by Terblanche and Burgess on cardiovascular clinical trials and clinical research in general in Africa focuses upon a critically important area – namely, clinical trials in African patients with both African diseases and the emergence of cardiovascular risk factors in the same population. The need for health research including trials in LMIC is indisputable, but the African continent’s research output is small and in a state of crisis. South Africa is currently leading the way as it should given its GDP and its current scientific infrastructure and traditions in comparison to other African countries but the road ahead is long and strewn with obstacles.

Marli Terblanche and Lesley Burgess highlight the difficulties in performing health research in the African and South African environment. They emphasise the lack of funding but also stress other issues that are pivotal to well carried out and ethical clinical trials, such as the protection of patient rights, informed consent, the language barrier, cultural difficulties, and attitudes, and essential impact of clinical trials on a global scale is that the trials in developing countries must fall under the ethical guidelines existing in developed countries. A landmark paper by Glickman, et al. addresses social issues raised by clinical trials in vulnerable patient populations in the LMIC.⁽¹¹⁾

Nonetheless, clinical trials need to be performed to answer research problems of importance in the African context, but it is undeniable that they are difficult to accomplish. This is another area, however, which is ripe for international collaboration with clinical trial groups that have the respect of the requisite experience and infrastructure and, hopefully the interest in making a contribution to research in Africa and other parts of the developing world.

In summary, from the perspective of cardiovascular medicine and other diseases, Southern Africa can be viewed as a fascinating epidemiological research laboratory given the mesh of races, changing environments, and socio-economic status. There is no shortage of topics to study but developing the research infrastructure and collaborative networks is a huge challenge. The other side of the coin is characterised by the burden of care that needs to be delivered under difficult circumstances and the equally complex challenges of primary and secondary prevention. This issue of the South African Heart Association Journal does not shy away from pointing out the obstacles, but a sense of optimism can also be gleaned from all the authors. Lessons learned in South Africa will be important from a global perspective as the world begins to focus more on non-communicable diseases.

TABLE 1: Four stages of the epidemiologic transition (reprinted from reference number 1 with permissions).

Description	Life expectancy	Proportion of death due to CVD (%)	Dominant form of CVD death
Stage 1: Pestilence and famine			
Malnutrition	35 yr	<10	Infectious (RHD)
Infectious diseases			Nutritional
Stage 2: Receding pandemics			
Improved nutrition and public health	50 yr	10 - 35	Infectious (RHD)
Chronic disease			Stroke - Haemorrhagic
Hypertension			
Stage 3: Degenerative and man-made diseases			
Increased fat and caloric intake	>60 yr	35 - 65	IHD*
Tobacco use			
Chronic disease deaths >Infections, malnutrition			Stroke - Haemorrhagic - Ischaemic
Stage 4: Delayed degenerative diseases			
Leading causes of mortality CV and cancer deaths	>70 yr	40 - 50	IHD**
Prevention and Tx delays onset			Stroke - Ischaemic
Age-adjusted CV death reduced			CHF

* Greater in high socioeconomic groups. ** Younger pt - lower socio-economic status. Elderly - higher socio-economic status

REFERENCES

- Gersh BJ, Sliwa K, Mayosi BM, et al. Novel therapeutic concepts: The epidemic of cardiovascular disease in the developing world: Global implications. *Eur Heart J*. 2010;31:642-648.
- Gaziano TA. Cardiovascular disease in the developing world and its cost-effective management. *Circulation*. 2005;112:3547-3553.
- Yusuf S, Reddy S, Ounpuu S, et al. Global burden of cardiovascular diseases: Part ii: Variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. *Circulation*. 2001;104:2855-2864.
- Ford ES, Ajani UA, Croft JB, et al. Explaining the decrease in U.S. Deaths from coronary disease, 1980-2000. *N Engl J Med*. 2007;356:2388-2398.
- Ford ES, Capewell S. Coronary heart disease mortality among young adults in the U.S. From 1980 through 2002: Concealed leveling of mortality rates. *J Am Coll Cardiol*. 2007;50:2128-2132.
- Notzon FC, Komarov YM, Ermakov SP, et al. Causes of declining life expectancy in Russia. *JAMA*. 1998;279:793-800.
- Chopra M, Lawn JE, Sanders D, et al. Achieving the health millennium development goals for South Africa: Challenges and priorities. *Lancet*. 2009;374:1023-1031.
- Sliwa K, Wilkinson D, Hansen C, et al. Spectrum of heart disease and risk factors in a black urban population in South Africa (The Heart of Soweto Study): A cohort study. *Lancet*. 2008;371:915-922.
- Stewart S, Carrington MJ, Pretorius S, et al. Elevated risk factors but low burden of heart disease in urban African primary care patients: A fundamental role for primary prevention. *Int J Cardiol*. 2011.
- Lonn E, Bosch J, Teo KK, et al. The polypill in the prevention of cardiovascular diseases: Key concepts, current status, challenges, and future directions. *Circulation*. 2010;122:2078-2088.
- Glickman SW, McHutchison JG, Peterson ED, et al. Ethical and scientific implications of the globalisation of clinical research. *N Engl J Med*. 2009;360:816-823.