Cardiovascular Disease in Sub-Saharan Africa

Lionel H. Opie, MD, DPhil, FRCP; Bongani M. Mayosi, DPhil, FCP(SA), FESC

"I speak of Africa and golden joys."
—Shakespeare, Henry IV part 2

"The wind of change is blowing through this continent."
—Harold McMillan, former Prime Minister of the United Kingdom

Open your eyes to Africa. It is big, complex and confounding,” says the British Medical Journal of October 1, 2005.1 It has some of the world’s richest natural resources in minerals and oil. Yet 34 of the world’s 41 indebted poor countries are in Africa, and only 37% of Africa’s children attend secondary school. Africa, with one sixth of the world’s population, accounts for one fiftieth of the global trade. We also read of wars, civil disturbances, and devastating chronic diseases such as malnutrition, HIV/AIDS, tuberculosis, and malaria. The problems seem insuperable. “Who takes responsibility for Zimbabwe?” asked The Lancet in despair in a recent editorial.2

Sub-Saharan Africa, the Cradle of Humankind

Why is the focus of the present series of articles on Africa in this issue of Circulation on sub-Saharan Africa? Linguistic maps of Africa show that the Sahara divides northern peri-Mediterranean Africa and some adjoining areas from sub-Saharan Africa. The language of the north is Hamito-Semitic and Arab, whereas the sub-Saharan is covered almost entirely by the Niger-Congo Bantu languages, with 2 exceptions: the Khoisan language in the Kalahari desert, lying in what is now Namibia and Botswana, and parts of South Africa in which the Indo-European languages are prominent. Thus, sub-Saharan Africa differs linguistically and culturally from Northern Africa. Sub-Saharan Africa is also the putative cradle of humankind (Figure).

In 1871, Charles Darwin predicted that human ancestors would be found in Africa.3 “Both the genetic antiquity and impact of the African contribution to the modern Homo sapiens are so great as to view Africa as a central place of human evolution.”4 Many researchers now support the “out-of-Africa” model,5 whence came “Eve,” the postulated common ancestor to all modern humans. But, from where in Africa? The “out-of-Ethiopia” hypothesis gives an estimated age of ancestors more human than ape (Homo sapiens) in Ethiopia about 160 000 years ago,6 on the basis of mitochondrial footprints.6 There are also some ancient Homo sapiens remains in South Africa, although not quite as old. “But all that refers only to the recent stages in human evolution” (P.V. Tobias, DSc, FRS, e-mail communication, on human evolution, October 25, 2005). With regard to the origin of the hominids, which occurred at an even earlier stage of evolution, the oldest South African sites at Sterkfontein, west of Johannesburg, contain fossils that go back about 3.3 million years (ibid). There are even older remains of these early hominids from Kenya, Ethiopia, and especially the Chad Republic (ibid). Flat-faced fossils between 3.2 and 3.5 million years old were found in the Olduvai Gorge in Kenya.7 Overall, we can safely say that “out of Africa” is the cradle of humankind without being able to pinpoint the exact area. Multiple sites of origin cannot be excluded.

What about subsequent expansion? How did the population escape from the cradle(s) to become “Pan-African” and sub-Saharan, which is the scope of this focused issue of Circulation? Within Africa, the oldest detectable major migrations occurred about 60 000 to 77 000 years ago,6 expanding to Southern Africa, becoming the Khoisan people (and more about them later), and into Eastern, Central, and Western Africa.6 There might even have been earlier “upstream” flows into central Africa from the Khoisan about 150 000 years ago.6 Similar techniques, with DNA patterns, have been used to trace the expansion from Africa to all parts of the globe, presumably spreading upward along the great lakes and Nile River to Egypt, and thence into Asia about 60 000 years ago (Figure). Spread from Africa to Europe occurred about 45 000 years ago. Further emigration from Asia to America occurred via Alaska about 7000 to 35 000 years ago.

The First Drawing of a Human Heart?

Now we take a big jump in time and briefly deviate via Egypt. The origins of the ancient Egyptians are not too well defined but could have occurred from those emigrants en route from Africa to Asia who saw their future in the rich waters of the Nile delta, or from Eurasians who had returned to Mediterranean Africa or from a separate origin in the near Middle East. In time, Egypt became the source of a thriving civilization where, among other things, they were obsessed with death and the afterlife. The Egyptian Book of the Dead was a collection of papyrus rolls placed in Egyptian tombs. The heart, the organ of conscience and understanding, had to be weighed against the feather, which symbolized order, truth, and justice. A heavy heart was a bad heart, and the heart had to be lighter than the feather for its previous bearer to pass
beneficially into the afterlife. The Book of the Dead, circa 1370 BC, illustrates these small hearts, probably among the first ever drawn. Those with overweight and functionally inadequate hearts failed the test. To put it simply in current terms: A big heart is a bad heart.

Early Tribal Life
At about the same time, the early tribesmen of sub-Saharan Africa were hunter-gatherers, living far from the complexity of current modern “civilization.” One of the oldest of these indigenous groups were the Khoisan nomadic hunters, peaceful tribes with a rich tradition and language but now barely surviving the onslaught of modern life and, alas, governments. “The last stand of the Kalahari Bushmen ends in dispossession, defeat and despair.”9 What of their cardiovascular health while they were still hunter-gatherers? An important article in Circulation describes the blood pressure (BP) patterns of this group in 1960.10 Quite differently from the pattern in most Western persons, the BP did not rise with age. This poses the repetitive problem, do the differences lie in the genes or the environment? A key phrase in the Methods section of the report by Kaminer and Lutz is, “Each nomadic group was a completely self-contained socioeconomic unit.” This description could probably also be applied to the early tribal groups of East Africa, as first recorded in Kenya by Donnison in 192911 and confirmed in Uganda by Williams in 1941.12 These tribesmen did not suffer from the steady rise in BP as in “the people of Europe and North America.”12 Is it a coincidence that another “self-contained socioeconomic group,” this time white and female, showed no BP increase over 30 years?13 What could be the common factor to these 3 very diverse groups? Clearly not external genetic similarities, nor diet, nor the level of physical exercise, nor lack of stress (imagine the daily lives of early tribesmen), but rather the socioeconomic independence from “Western civilization.” These observations show how lifestyle can affect BP and, hence, cardiovascular outcome. If we could pinpoint the secret of the flat BP in these 3 rather disparate groups, this could contribute to solving a major public health problem in Western societies in which even those who are normotensive at 55 years of age have a 90% lifetime risk of developing hypertension.14

Epidemiological Factors and Cardiovascular Risk
Currently, there are strong economic forces propelling previously isolated rural groups into the periurban and urban areas. Much of Africa is undergoing an epidemiological transition.15 Cardiovascular disease (CVD) is the leading worldwide cause of death in all developing regions with the exception of sub-Saharan Africa. There, the first phase of this transition, that is, the phase of pestilence and famine, is still dominant.16 However, in the next phase, that of receding pandemics, CVD becomes more prominent, and in the third phase of degenerative and man-made disease, CVD is the leading cause of death. As “civilization” spreads, so does CVD become an increasing health burden that requires skillful, cost-effective management.16 As shown in the INTERHEART study, hypertension is a strong contributor to the hazards of CVD in black Africans, with an OR of 7.0 versus 2.3 to 3.9 in other ethnic groups, with \( P < 0.0002.\)17 Hypertension is eminently treatable and to some extent preventable.18

Poverty and affluence may both bring disease. According to the “fetal” origins of adult disease, as put forward by Barker, environmental factors and particularly poor maternal nutrition during pregnancy may program risks for adverse health that appear only later in adult life.19 Specifically, there is an inverse relation between birth weight and CVD in later life, as shown in a longitudinal study from Scotland.20 Affluence, too, has its problems. Higher-income black Africans are more susceptible to myocardial infarction than high-income white or other nonblack Africans, hypothetically because different stages of the epidemiological transition are at work.17 Besides hypertension, another major cardiovascular disease susceptible to the changing environment in Africa is diabetes mellitus,21 also a prominent risk factor for myocardial infarction in black Africans.17 Other major cardiovascular diseases in Africa include the consequences of HIV/AIDS (often manifesting as tuberculous pericarditis), rheumatic valvular disease, and cardiomyopathy, each of which has at least some environmental component and each of which is discussed in different articles in this issue of Circulation.
Toward Practical Solutions

In a continent where poverty is rife, despite the burgeoning wealth of upper-income groups in countries such as Nigeria and South Africa, how can effective cardiovascular therapy be sustained financially? This question is tackled by Gaziano et al in an important article selected for the Editor’s pick of this week. The answer is that major improvements could be achieved with not much expenditure but much application of policy. Furthermore, by judicious selection of high-risk hypertensive patients, those who need more urgent treatment can be selected by risk factor calculation. Such scientific knowledge must be matched by the political will to apply these policies. This is where the nongovernmental organizations come in, a large number of which are active in sub-Saharan Africa (Table).

The ingredients for success in the struggle against cardiovascular diseases include governmental will-power, vigorous nongovernmental organizations, dedicated physicians, and fully trained nurses with technical support. An important issue is keeping trained personnel in Africa, as brought to the fore in ProCOR by Nobel Prize winner Bernard Lown, a renowned cardiologist. The “brain drain” deprives Africa of doctors, nurses, technicians, and others who, together, could help to fight the growing CVD epidemic. Dr Lown empha-

<table>
<thead>
<tr>
<th>Cardiovascular Health Organizations of Sub-Saharan Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country/Region</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Benin</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Congo</td>
</tr>
<tr>
<td>Ghana</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Kenya</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Mauritius</td>
</tr>
<tr>
<td>Mozambique</td>
</tr>
<tr>
<td>Nigeria</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
sizes that wealthy Western countries should only with reluctance permanently take on those from Africa. An exception would be refugees from those African regimes that make it impossible for such qualified people to continue to practice in their home country. Promoting a strong research base indirectly helps to keep “good brains” in their home countries, in addition to enhancing patient care. “Inequalities in health research contribute to inequalities in health.”24

On the positive side, a web of medical and cardiovascular societies is spreading across Africa, including active nongovernmental organizations such as the Heart Foundations (Table). For example, there is a very active Heart Foundation in Nigeria that strongly supports a World Health Organization report on preventing chronic diseases, released on October 5, 2005. Dr K. Akinroye, Vice President of the Nigerian Heart Foundation, reports that Nigerian President Olusegun Obasanjo has lent his support to the goal of reducing death from chronic disease as follows: “Governments have a responsibility to support their citizens in their pursuit of a healthy, long life. It is not enough to say, we have told them not to smoke, we have told them to eat fruit and vegetables, we have told them to take regular exercise. We must create communities, schools and workplaces and markets that make these healthy choices possible. We must tackle this problem step by step and we must start now.”25

Conclusions

In Africa, the dominant factors driving (or limiting) success are the will to deliver first-class cardiovascular care within the limits of cost-effectiveness and the need to build a suitable infrastructure, including those doctors, nurses, and others who should be kept in Africa. Many major cardiovascular drugs are no longer prohibitively expensive. The real challenge is how best to deliver the drugs to those who need them. We are deeply appreciative of the opportunity of presenting this group of articles in Circulation, a shining example of the application of first-world concepts and rigor of scientific method, including thorough review processes, to help heal the cardiovascular problems of sub-Saharan Africa.

Disclosures

None.

References

23. Lown B. The brain drain. ProCOR 26 July, 2005. procor@healthnet.org

**Key Words:** Editorials ■ diabetes mellitus ■ hypertension ■ myocardial infarction ■ Africa
Cardiovascular Disease in Sub-Saharan Africa
Lionel H. Opie and Bongani M. Mayosi

Circulation. 2005;112:3536-3540
doi: 10.1161/CIRCULATIONAHA.105.597765
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2005 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/112/23/3536

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/