High Blood Pressure: The Foundation for Epidemic Cardiovascular Disease in African Populations

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High blood pressure is a powerful independent risk factor for death from heart disease and stroke. It is also a common clinical condition affecting more than 600 million persons worldwide and seen in nearly all populations. Although reliable, large-scale, population-based data on high blood pressure in sub-Saharan Africa (SSA) are limited, recent studies provide important and worrisome findings in both epidemiology and clinical outcomes. Although overall hypertension prevalence is between 10%–15%, prevalence rates as high as 30%–32% have been reported in middle-income urban and some rural areas. Importantly, hypertension awareness, treatment, and control rates as low as 20%, 10%, and 1%, respectively have also been found. Stroke has been by far the most common clinical sequela. In most SSA settings, hypertension control assumes a relatively low priority and little experience exists in implementing sustainable and successful programs for drug treatment. Rapid urbanization and transition from agrarian life to the wage-earning economy of city life continue to fuel increases in average blood pressure levels and prevalence of hypertension. Although the true burden of high blood pressure in sub-Saharan Africa remains largely unmeasured, compelling preliminary evidence suggests that it is the foundation for epidemic cardiovascular disease in Africa and already contributes substantively to death and disability from stroke, heart failure, and kidney failure in this region. Success in limiting this epidemic in SSA will depend heavily on the implementation of sustainable and aggressive population-based programs for high blood pressure awareness, prevention, treatment, and control. It will be critical to obtain investments in improved surveillance and program-relevant research to provide the evidence base for policy development and effective hypertension prevention and control. (*Ethn Dis.* 2003;13[suppl2]:S2-48–S2-52)

Key Words: Hypertension, Sub-Saharan Africa, Stroke

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Introduction

High blood pressure is a health risk for all populations in the world, with the exception of very small isolated groups that continue to live a pre-industrial lifestyle. Although survey research on cardiovascular disease (CVD) has been limited in sub-Saharan Africa (SSA), over the last several years a number of important new studies have been reported. Given the range of social contexts in SSA, the risk patterns for CVD vary widely. This extreme heterogeneity demonstrates the importance of the changing pattern of causal exposures and underscores the need for population-wide preventive strategies. The clinical outcomes that result from high blood pressure have also been inadequately described, although it is now well documented that stroke is by far the most common major sequela.[1]

The wide range of the social conditions in contemporary SSA also means that control of hypertension presents challenges that vary from the rural areas to the cities, and from one country to the next. Given the low priority that hypertension control assumes in the health sector, however, little experience exists in implementing successful programs for drug treatment. Cardiovascular (CV) diseases will undoubtedly increase in frequency in SSA over the coming decades. Many countries are now undergoing a rapid transition, for example, approximately 35% of the population is now urbanized in Nigeria, the country with a population of 125 million.

The purpose of this brief review, therefore, will be to summarize new developments in research within the public health context of high blood pressure in Africa.

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Findings from Community Surveys

A great variation in blood pressure levels within SSA has been highlighted in previous studies, some of which employed carefully standardized measurement protocols.[2–4] The transition from agrarian life to the wage-earning economy of cities continues to provide an important underlying mechanism that results in increases in the level of mean blood pressure. Earlier surveys in Nigeria, for example, demonstrated substantial shifts in blood pressure over the course of this transition despite little change in obesity or dietary patterns (Figure 1).

Two recent large surveys, in Nigeria and nearby Ghana, highlight the accelerated pattern of this transition where further economic development has occurred. In Nigeria, a rural district of Igbo-Ora was surveyed between 1996–2001, while in Ghana community residents were enrolled in Accra and surrounding villages (Figure 2). While still at a low level of socioeconomic development, the population in Ghana has generally been more prosperous than Nigerians have been in recent years. Not only do the urban-rural contrasts persist within Ghana, there is a stepwise increase compared to Nigeria. It must be recognized that these studies did not

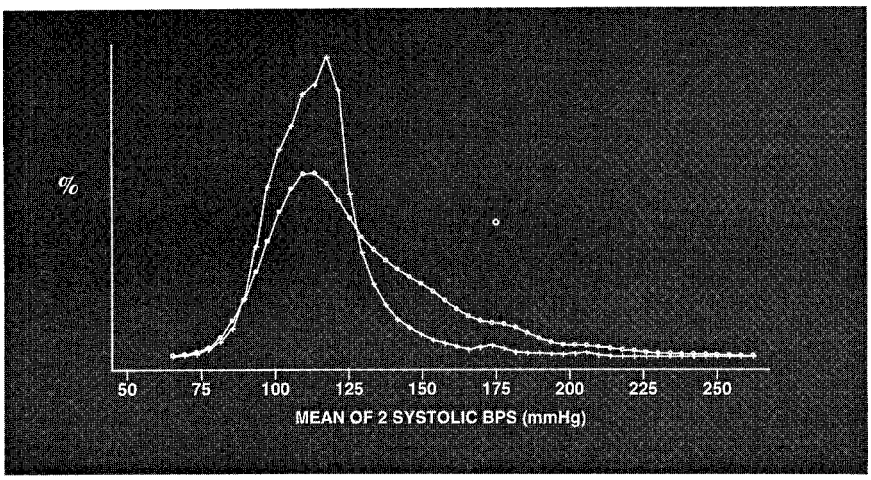

Fig 1. Systolic blood pressure in urban and rural Nigerians, ages 60+

[For SSA] the transition from agrarian life to the wage-earning economy of cities continues to provide an important underlying mechanism that results in increases in the level of mean blood pressure.

employ directly standardized protocols, although measurement procedures were very similar. The increased slope with age further suggests that the observation is valid and not a result of artifact. These data dramatically underscore predictions that hypertension is likely to become a major public health problem over the next decade. Similar predictions can be made in regard to diabetes, at least in urban areas.

CLINICAL CONSEQUENCES

As demonstrated above, while hypertension is less common in Africa than elsewhere, the burden is nonetheless substantial. The population attributable risk from hypertension for deaths from all causes was 5% in an earlier report of a Nigerian cohort study, compared to 10% in the United States.[5] Prevalences of hypertension are generally in the range of 10%–15%, yielding an estimated 10–20 million patients.[5,6] Effective treatment could forestall 250,000 deaths/year.[6] Stroke and heart failure are common occurrences in the virtual absence of treatment. The Adult Morbidity and Mortality Project in Tanzania reported stroke death rates 8–10 times higher than in the UK, an outcome attributed to the absence of hypertension treatment.[7]

The Igbo-Ora Adult Mortality Study in southwest Nigeria has been following 10,000 individuals over the age of 18 for a period of 5 years. There are no vital records systems in this region, as is true of virtually all of SSA, and deaths are classified using "verbal autopsy." With this method, information is collected from next of kin or other informants and a team of physicians assigns the most likely cause of death. The distribution of causes of death is presented in Table 1. The results of this study reconfirm the overwhelming importance of infection as a cause of death. Nonetheless, CVD, primarily stroke, accounted for 17% of deaths. Hypertension, defined as a blood pressure ≥140/90, was not associated with a significant increase in relative risk of death from all causes (hazard ratio = 1.15) in this cohort, however the risk of stroke was substantial and significant (hazard ratio = 2.47, 95% confidence intervals, 1.03–5.95).

TREATMENT

While considerable progress has been made toward hypertension control in most industrialized countries, very little has been accomplished in developing countries.[3–12] In the United States and Europe, treatment and control rates in the general population range from 15% to 35%.[13–16] A recent national survey of 14,000 persons in Mexico documented a treatment and control rate of 2%.[17] In Tanzania and Senegal, 10% of hypertensives were being treated and <1% controlled.[9] The control rates among clinic attenders are also very low in Africa. In South Africa, only 18% of hypertensive patients were still attending one year after their initial visit, and less than half of those were controlled.[18] By contrast, in a large Canadian cohort 78% of patients persisted in treatment after one year.[19] The single overriding theme in this literature is the need to develop strategies that take the social and cultural factors into account to boost adherence.

But should hypertension control be a priority for developing countries? Some authorities question its value in Africa in particular, when so many competing health emergencies exist. A World Bank document, for example, suggests that hypertension treatment is not cost effective in Africa, citing an expense of up to $1.5 million to prevent a fatal event.[20] Unfortunately, this recommendation is based on the cost to prevent a death in a middle-aged American, which is likely to be much higher

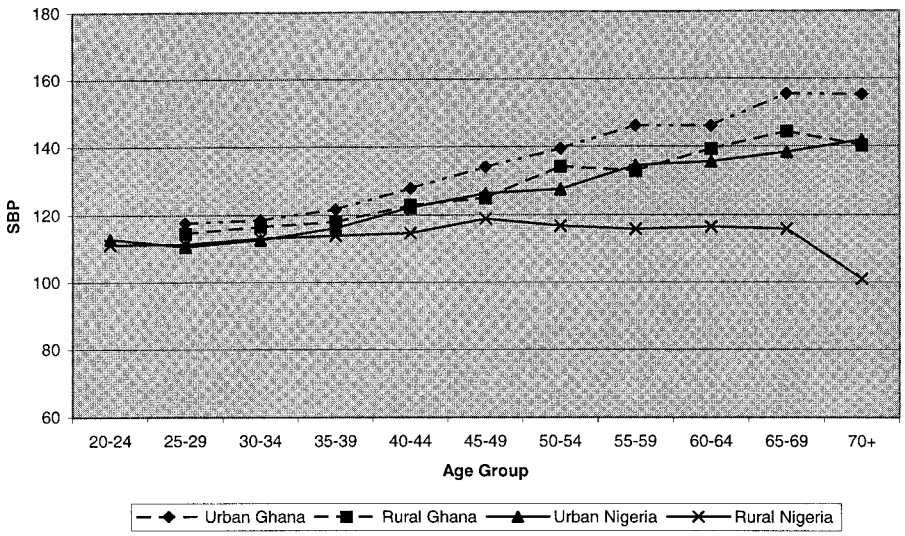

Fig 2. Systolic blood pressure in urban and rural communities in Nigeria and Ghana, by age group

Table 1. Cause of death in the Adult Mortality Study, Igbo-Ora, Nigeria

	Frequency	Percent	Cumulative Percent
Cancer	4	1.3	1.3
Diabetes	7	2.3	3.6
HIV/AIDS	2	0.6	4.2
Infection	121	39.2	43.4
CVD	53	17.2	60.5
Other	47	15.2	75.7
Stroke	29	9.4	85.1
Surgical	10	3.2	88.3
Trauma	16	5.2	93.5
Unknown	20	6.5	100.0
Total	309	100.0	

than in Africa given physician fees and ancillary costs, and used no empirical data on the effectiveness of programs in SSA.[6,21] It is certainly true that, under many circumstances in Africa, hypertension treatment may not qualify as a priority. However, in parts of SSA, hypertension is already a major cause of death and ill health. Data from Birth and Death Registry in Ghana showed that stroke caused death in 25% of females and 23% of males.[22] In another study, hypertension was responsible for 63% of cardiovascular deaths, 36% of heart failure deaths, and stroke-related deaths associated with hypertension alone accounted for 15% of all deaths.[23] Hypertension was the most common cause of end stage renal failure among Ghanaians.[24] Thus, the World Bank recommendation can hardly be universal as it must be grounded in data. Furthermore, the purpose of health research is to provide options for policy; understanding how to treat and control chronic disease in the long term is an essential health need in all countries, and if not now a priority will become one in the future.

Although primary prevention is an important long-term goal, programs must be developed to make drug treatment available in the interim. The challenge is to develop treatment methods that are effective in the African social setting, as was done with oral rehydration and directly observed therapy for tuberculosis. This recommendation has been made repeatedly in recent years: "Hypertension is ideally suited to be the initial component of a CVD control program . . . in developing countries[3]"; and "Low-cost hypertension control programs are needed in developing countries."[12] What is missing is an evidence base upon which to build these programs.

Recent dietary intervention trials conducted in a more rigorous manner have demonstrated a substantial effect of sodium reduction and increases in fruit, vegetables, and non-fat dairy products on blood pressure.[25] A pilot study in Nigeria has recently demonstrated good levels of adherence to sodium reduction and modest changes in blood pressure, despite low baseline levels (Table 2). Similar studies on a larger scale are urgently needed. While this approach has considerable appeal for low-resource settings since the cost of drugs is eliminated, implementation is still problematic. Of course, a strategy based on interventions at the individual level that requires one-on-one education will not be efficient; however, a body of evidence regarding efficacy could provide the basis for interventions to reduce sodium in the food chain.

GENETICS

Because Africa was the continent where our species underwent the majority of its evolutionary development, genetic diversity remains greater among contemporary populations.[26] Multiple studies have demonstrated that the vast majority of all genetic polymorphisms are present in Africa.[27,28] Studies in African populations are, therefore, extremely valuable, and can illuminate genetic patterns in greater detail than those among Europeans or Asians, where genetic diversity is somewhat more limited. In addition, large families and high levels of participation, provide additional advantages to the genetic epidemiologist in SSA. A recent report demonstrated association and linkage between polymorphisms in the angiotensin-converting enzyme gene among Nigerians.[29] Likewise, a genome-wide scan in the same population identified several other chromosomal regions that were linked to blood pressure.[30] While the contribution of molecular genetics to the control of CVD may not be felt for many years, it does appear that etiologic research on hypertension using

Table 2. Blood pressure changes during a sodium reduction trial in Igbo-Ora, Nigeria

	Mean Systolic BP					
	Visit 1	**Visit 4**	**Δ BP**	**Visit 6**	**Visit 9**	**Δ BP**
Intervention 1st	111.2	107.4	−3.8	111.4	111.7	+0.3
Control 1st	117.5	117.2	−0.4	118.1	111.1	−6.9
	Mean Diastolic BP					
	Visit 1	**Visit 4**	**Δ BP**	**Visit 6**	**Visit 9**	**Δ BP**
Intervention 1st	71.3	68.6	−2.9	71.2	71.8	+0.5
Control 1st	74.7	74.9	+0.2	77.8	73.3	−1.4

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this technology in SSA can be uniquely productive, underscoring the need to expand the scientific infrastructure in these countries.

RESEARCH

Although clinical and basic science research holds significant promise for understanding hypertension and in the prevention and control of its cardiovascular complications, the real priority must be in population science research. More specifically, emphasis must be placed on program-relevant research, beginning with basic epidemiological research to carefully and systematically document the true burden of hypertension. Next, answers for the following questions must be found: 1) What is the population distribution of the risk factors that predispose to hypertension? 2) How important and relevant are salt and dietary sodium intake, overweight, obesity, and physical inactivity? 3) What roles do they play in the development and maintenance of hypertension? 4) Is the lifetime risk of hypertension known and what are the best population-based practices for primordial prevention of hypertension?

In both primary and secondary prevention and control of hypertension, support for research to identify cost-effective and cost-beneficial strategies will be needed. Similarly, research on the best ways to integrate community participation and primary healthcare delivery must be supported. Assessment of the knowledge, attitudes, and practices of clinical and public health practitioners with respect to high blood pressure would be very useful for program planning. Finally, research on the role and relative priorities of other major established cardiovascular risk factors will be important.

PROSPECTS FOR THE FUTURE

The burden of CVD in Africa is largely unmeasured.[18] Data imputation projects, most notably the Global Burden of Disease Study, have published estimates for Africa, giving the impression that information exists.[31] In some regards, this impression is unfortunate as it implies that these countries have vital registration systems, which is universally untrue, or that public health policy can be effectively developed without surveillance systems, which is equally open to question. As noted, the only widespread risk factor for stroke or CHD in SSA is hypertension. Since the majority of Africans below the Sahara still live in rural areas and rely on subsistence agriculture, life is physically demanding and there is only a modest intrusion of mass produced consumer goods, including cigarettes and manufactured food based on animal products. Although current data are limited, the diet in SSA most likely provides more than 65% of calories from carbohydrate, compared to less than 50% in the United States, with 18%–20% and 35%–40% of calories from fat, respectively. The pattern of lipids and lipoproteins in populations of the African diaspora reflects the accompanying dietary change.[32]

The primary component of the global CVD epidemic has, of course, been coronary heart disease (CHD). Given the favorable lipid status and low smoking rates, CHD is exceedingly rare in SSA, except among the elite. On the other hand, with a hypertension prevalence around 15% and the absence of effective treatment, stroke is a serious threat to the health of older adults in Africa. Despite the low risk of atherosclerosis in these populations, concern remains for the future. Increases in average levels of LDL-cholesterol are unlikely to occur in the near term, although the intrusion of the multi-national food industry has wreaked havoc on other regions after only modest progress on the road to economic development. Poor countries have also been subjected to the scourges of tobacco and obesity in the immediate stages of release from abject poverty. Unfortunately, these countries have limited resources with which to resist these epidemics and treatment of established disease is virtually nonexistent. A sober prediction, therefore, based on the forces that are currently at play, includes a major epidemic of CVD in West Africa over the coming decades.

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