ORIGINAL REPORTS: CARDIOVASCULAR DISEASE

Hypertension in Ghana: A Cross-Sectional Community Prevalence Study in Greater Accra

Objectives: To determine the prevalence of hypertension, and the extent to which it is treated and controlled, among adult Ghanaians.

Design: 6300 adults, aged 25 years and older, were selected by random cluster sampling, using electoral enumeration areas and listings of adults.

Setting: Three communities in the greater Accra region of Ghana.

Subjects and Methods: A total of 4733 subjects (male to female ratio=1:1.5) participated, representing a response rate of 75%. The analysis used the mean of 2 blood pressure readings, taken with a mercury sphygmomanometer after a 10-minute rest. Hypertension was defined as having blood pressure \geq 140/90 mm Hg, or currently undergoing anti-hypertensive treatment.

Results: The mean ages for males and females were 44.9 \pm 14.7 years, and 44.0 \pm 14.6 years, respectively. The crude prevalence of hypertension was 28.3%. The age-standardized prevalence, to the new standard world population, was 28.4%. Mean systolic and diastolic blood pressures increased with age. Of 1337 subjects with hypertension, 34% were aware of their condition, 18% were treated, and 4% were controlled (blood pressure <140/90 mm Hg).

Conclusion: Hypertension is a major public health problem, and is associated with relatively low levels of awareness, drug treatment, and blood pressure control. Population-based prevention strategies, such as reduction in salt intake and integration of hypertension care into primary care, may prove beneficial; however, the determinants of hypertension remain to be ascertained. (*Ethn Dis.* 2003;13:310–315)

Key Words: Hypertension, Prevalence, Community, Ghana, Sub-Saharan Africa, Treatment, Control

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INTRODUCTION

Hypertension is a major global public health problem,¹ and a primary cause of hemorrhagic stroke, hypertensive heart disease, and hypertensive kidney failure, even before coronary artery disease and atherothrombotic stroke became major causes of mortality.2 Hypertension end organ damage is a major source of morbidity and mortality in sub-Saharan Africa.3 A recent study from urban and rural Tanzania reported rates of stroke mortality higher than those of England and Wales, and suggested that untreated hypertension is an important etiological risk factor.⁴ Until recently, hypertension was generally considered to be rare in rural African communities.^{5,6} Studies have revealed that urbanization is associated with elevation of blood pressure in Africans,7-9 and that hypertension is now likely to be the most common cardiovascular problem in Africa.10 In sub-Saharan Africa, hypertensive patients accounted for 40%-60% of adult cardiology practices.8

In 1973, using the criteria for hypertension of blood pressure $\geq 160/95$ mm Hg, Pobee et al¹¹ found a hypertension prevalence rate of 2%–5% in rural Ghanaians aged 16–54 years. In a 1976 urban population sample from Accra with a similar age structure, the

prevalence of hypertension (blood pressure $\geq 160/95$ mm Hg) was 11%.¹² In general, the prevalence of hypertension ranged from 8%-13% in urban dwellers, compared to 4.5% in rural subjects.8 The prevalence of hypertensive heart disease was 4.8% in urban Accra in 1976.12 In 1990, hypertension was the most common cause of end stage renal failure presenting to the Korle Bu Teaching Hospital, Accra,13 as well as being the most common cause of heart failure in Ghanaian heart failure patients at a national cardiovascular referral center in Accra.¹⁴ Further, mortality studies in Ghana reveal that hypertensive disorders were responsible for 63% of all cardiovascular deaths.8 Stroke-related deaths associated with hypertension alone accounted for 15% of all deaths.8 In a recent study in the second largest tertiary hospital in Ghana, stroke, heart failure, and renal disease, accounted for 23% of acute medical admissions, and for 29% of deaths.15

Ghana is a tropical country in West Africa with a surface area of 238,533 km². The 2000 population was 18.9 million, with a gross domestic product (GDP) of USD 7.4 billion, and a per capita GDP of USD 412. Ghana's capital city, Accra, in which most of the earlier studies on hypertension were conducted, has since undergone considerable demographic changes, and is now the most urbanized and densely populated area in the country, with an urban population of 1.6 million.¹⁶ The earlier (1970s) epidemiologic studies on arterial hypertension in Ghana^{6,8,11,12} utilized different sampling frames and definitions of high blood pressure ($\geq 160/$ 95 mm Hg), thereby making it difficult

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to compare them with recent studies that used current diagnostic criteria for high blood pressure (140/90 mm Hg). In 1998, a non-communicable diseases survey (NCDS 98) was performed to determine the prevalence rates of diabetes, hypertension, obesity, ischemic heart disease, and cardiovascular risk factors, in selected communities in this area. In this article, we provide current information on the prevalence of hypertension (defined as having blood pressure $\geq 140/90$ mm Hg, or currently undergoing anti-hypertensive treatment), and the extent to which it is detected, treated, and controlled, in Accra.

Materials and Methods

Target Population and Sample Design

Two urban communities (Labone/ Cantoments and Teshie) were deliberately selected from the Accra metropolis, to be compared to the rural communities of Danfa/Abokobi with 20 villages. A stratified 2-stage cluster sampling technique was used. The first stage units consisted of census enumeration areas (urban) or villages (rural) while the second stage units were adults aged 25 years and older.

Sample Size Determination

The Statcalc function of Epi Info, Version 6 (Centers for Disease Control and Prevention, Altanta, Georgia, and the World Health Organization, Geneva, Switzerland) was used to determine the sample size, as described elsewhere.¹⁷ As the study was originally designed to ascertain the prevalence of diabetes mellitus, a sample of 2100 provided precise estimates of the prevalence rate of diabetes for each community.

Sampling Frame and Sample Allocation

The Ghana Statistical Service randomly selected 14 census enumeration zones from each of the 2 urban communities (Labone/Cantoments and Teshie). A household census was subsequently taken of all adults, aged 25 years and older, in each of the 14 enumeration zones in the urban communities. Following the household census, 2100 (150 subjects in each of the 14 enumeration areas) eligible subjects were selected from the urban communities (Labone/Cantoments and Teshie) to participate in the study by systematic random sampling. In the rural area (20 villages), all eligible adults were listed, and 2100 subjects were selected by systematic random sampling. Ninety-five (2%) survey subjects were aged 80 years and older. Inclusion of these older subjects did not significantly affect the crude prevalence rates of hypertension (28.3% vs 27.4%).

Measurement of Blood Pressure

Three nurses with certification in blood pressure measurement (Accurate Blood Pressure Measurement: A Video-Tutored Course-Shared Care, Torrance, California), determined the subjects' blood pressure. A quiet area at the survey site was chosen for blood pressure measurement. Blood pressure readings were taken from 7:00 AM-11:00 AM. The subjects rested quietly for at least 10 minutes, and were not permitted to smoke. With the right arm of the subject held at the level of the heart, the maximum inflation level was determined with a mercury sphygmomanometer, using a 15 cm stethoscope and an appropriately sized cuff. The first and fifth Korotkoff sounds were employed to determine systolic and diastolic pressures, respectively. For sounds that continued to 0 mm Hg, the fourth Korotkoff sound was used for diastolic pressure. Blood pressure was measured to the nearest 2 mm Hg on 2 occasions, with a one-minute interval between. The mean of the 2 measurements was used in analysis. The heart rate was measured during the one-minute interval. Demographic data and hypertension status/treatment were subsequently determined with the aid of a structured questionnaire.

Participants were informed of the results of their blood pressure readings. Subjects found to be hypertensive were counseled, and given pre-printed letters referring them to the investigator's hospital for confirmation of hypertension and management strategies. Subjects with severe hypertension (grade 3 hypertension—blood pressure $\geq 180/$ 110)¹⁸ were given a supply of bendrofluazide for 2 weeks, in addition to being referred to the hospital.

Data Analysis

In this article, the data from the 3 communities have been pooled for analysis. Hypertension was defined as having a blood pressure of \geq 140/90 mm Hg, or currently undergoing anti-hypertensive treatment.¹⁸ Hypertensive subjects were further categorized using the World Health Organization's former criteria of \geq 160/95 mm Hg.¹⁹ Prevalence of hypertension was age-standardized²⁰ to the New World Standard Population²¹ by the direct method.²²

The statistical package SPSS 10.0 for Windows (SPSS Inc, Chicago, Illinois), and Epinfo version 6 (Centers for Disease Control and Prevention, Atlanta, Georgia, and the World Health Organization, Geneva, Switzerland), were used for data analysis. Data are expressed as the mean with standard deviation, unless otherwise stated. Unpaired, two-sided *t* tests were used to compare means between 2 groups for variables with normal distribution. Confidence intervals (Fleiss quadratic

44.0 ± 14.6*	44.2 + 14.7
	44.3 - 14./
78.2 ± 11.3*	77.8 ± 11.1
$128.9 \pm 26.7 \pm$	128.9 ± 25.0
74.7 ± 14.1†	74.9 ± 13.7
-	128.9 ± 26.7+ 74.7 ± 14.1+

95% confidence interval) are reported for percentages.

Quality Assurance

Personnel measuring blood pressure were re-certified every 3 weeks during the 12-week survey period, using the video from Shared Care (Torrance, California). Last digit with respect to blood pressure measurement was monitored during the study. The percentages with 95% confidence intervals for the digits 0, 2, 4, 6, and 8, were 20.5% (19.4%– 21.7%), 21.3% (20.1%–22.5%), 18.3% (17.2%–19.5%), 18.9% (17.7%–20.0%), and 21.1% (20.0%– 22.3%), respectively.

Ethics

The study was approved by the Ethical Review Committee of the University of Ghana Medical School, and complied with the 1975 (revised in 1983) Helsinki declaration on human experimentation. Informed consent was obtained from all subjects. The objectives of the survey and survey procedures were explained to all subjects. Potential subjects were also made aware of the potential dangers of blood sampling, and the inconvenience of spending long hours at the survey site. In addition, prospective subjects were made aware that participation was entirely voluntary, and that they had the right to refuse to participate, or to withdraw from the survey at anytime. Of 6300 subjects selected, 1567 did not take part in the study.

RESULTS

A total of 4733 subjects, ranging in age from 25 to 102 years, took part in the study, representing a response rate of 75%. Male to female ratio was 1:1.5. Table 1a shows the mean characteristics of the study population. The crude prevalence rate of hypertension (blood pressure ≥140/90 mm Hg, and/or treatment) was 28.4% (confidence interval, 26.5%-30.1%). The crude prevalence rate of hypertension using the former World Health Organization criteria (≥160/95 mm Hg, and/or treatment) was 16.2% (CI 15.8%-16.5%). Table 1b shows the age-adjusted hypertension prevalence rates for males and females, using the 2 sets of criteria. Lit-

Table 1b. Age adjusted prevalence of hypertension with 95% confidence intervals (CI) of males and females

	Male	Female	All Subjects
Hypertension %*	27.6	29.5	28.4
(≥140/90 mm Hg)	(27.0-28.2)	(28.9-30.0)	(27.8-29.0)
Hypertension %*	14.7	17.4	16.2
(≥160/95 mm Hg)	(14.3-15.2)	(16.9–17.8)	(15.8–16.5)

* Standardized to the New Standard World Population.

tle difference was observed between the overall crude prevalence rate of hypertension, and the age-adjusted rate using the criteria of blood pressure \geq 140/90 mm Hg, and/or treatment.

Table 2 shows the mean \pm standard deviation of systolic and diastolic blood pressures in subjects who were not on anti-hypertensive treatment. Mean systolic blood pressure increased with age in both sexes. Diastolic blood pressure also increased with age, peaking at ages 45–54 years in males, and 55–64 years in females.

Of 598 subjects with self-reported high blood pressure before the study, 543 had received drug treatment for high blood pressure at one time or another. One hundred forty subjects who self-reported high blood pressure were not on drug treatment for hypertension at the time of the study, but had normal systolic and diastolic pressures. Levels of hypertension awareness, treatment, and control, are presented in Table 3. Approximately one third of subjects with high blood pressure were aware that they had the condition.

DISCUSSION

This community-based cross-sectional study demonstrates that hypertension is a major cardiovascular disease in Ghanaians. Of 4733 subjects, 28.3% had high blood pressure, according to current diagnostic criteria.¹⁸ Adjusting the prevalence to the new Standard World population²¹ resulted in a hypertension prevalence rate (28.4%) similar to the crude rate.

In 1997, investigators using diagnostic criteria for high blood pressure of \geq 140/90 mm Hg, reported a consistent gradient of hypertension prevalence, rising from the relatively less urbanized West African subjects (16%), to the more urbanized Caribbean subjects (26%), and African Americans (33%) in the United States.²³ We report a much higher rate of hypertension than did the

Table 2.	Mean systolic and o	diastolic blood p	ressure (mm Hg)	in subjects ($N = 4490$)
on no ar	ntihypertensive treat	tment by age an	d sex	

Fox and Ago		Mean Blood Pressure (mm Hg)		
Categories	No. of Subjects	Systolic	Diastolic	
Men (years)				
25-34	549	120.7 ± 13.5	70.0 ± 9.7	
35-44	428	123.1 ± 16.7	74.5 ± 12.5	
45-54	369	131.7 ± 23.0	79.2 ± 13.9	
55-64	222	135.8 ± 24.7	77.7 ± 13.1	
≥65	197	144.0 ± 29.4	75.5 ± 13.3	
All men	1765	128.1 ± 21.6	74.6 ± 12.7	
Women (years)				
25–34	890	115.3 ± 15.3	68.2 ± 10.2	
35–44	740	122.6 ± 20.0	74.3 ± 13.0	
45-54	522	133.9 ± 26.3	78.7 ± 13.7	
55-64	284	143.9 ± 28.2	79.8 ± 15.0	
≥65	289	151.5 ± 31.7	79.2 ± 15.6	
All women	2725	127.7 ± 25.7	74.2 ± 13.8	

above study from West Africa. It would appear that the greater Accra area from which our sample was taken is further advanced in the epidemiologic transition, compared to the other area of study in West Africa. This assertion must be confirmed by future studies; however, hypertension is already a major cause of morbidity and mortality in Ghana. Hypertension was the most common cause of end stage renal failure in patients presenting to the Korle Bu Teaching Hospital, Accra.¹³ The disease was also the most common cause of heart failure in Ghanaian patients presenting with heart failure to a national cardiovascular referral center in Accra.14 Further, mortality studies in Ghana reveal that hypertensive disorders were responsible for 63% of all cardiovascular deaths.8 In a recent study from Kumasi, the second largest city in Ghana, hypertension-related deaths accounted for 28.5% of deaths among medical in-patients.¹⁵ Interestingly, the overall prevalence rate of hypertension in our subjects was similar to that of Caribbean subjects (26%), but was lower than that of African Americans (33%).²³ It must be noted that West Africans share ethnogenetic links with African Americans.²³ Therefore, as demonstrated among African Americans,²³ Ghanaians are clearly at risk for higher rates of hypertension, in conjunction with further urbanization and cultural transition.

Hypertension awareness, treatment, and control, are lower in developing economies compared to those already developed.^{2,4,8,24–26} Among an inner-city African-American population with hypertension, 73% were aware of their condition, 64% were on treatment, and 28% were controlled (blood pressure <140/90 mm Hg).²⁷ In contrast, a recent study from South Korea reported

Table 3. Hypertension awareness, treatment, and col

	N (%)
All subjects with hypertension (≥140/90 or on current treatment)	1337 (28)
Subjects with hypertension who were aware they had hypertension	458 (34)
Subjects with hypertension who were on treatment	243 (18)
Subjects with hypertension who were controlled (<140/90 mm Hg)	49 (4)

... Ghanaians are clearly at risk for higher rates of hypertension, in conjunction with further urbanization and cultural transition.

awareness of 25%, treatment of 16%, and control of 5% (blood pressure <140/90 mm Hg).²⁸ Our data are comparable to those from South Korea, with 34% aware, 18% treated, and 4% controlled. There are several possible reasons for the low levels of hypertension detection and management in our subjects. First, Ghana has no national policy on the prevention and control of hypertension, cardiovascular, and other chronic diseases. In addition, the facilities and resources (including trained healthcare personnel) available for the management of chronic diseases such as diabetes and hypertension are woefully inadequate. In addition, when care is provided, it is usually far from satisfactory.^{29,30} Further, the relatively high rates of previously undiagnosed hypertension revealed in our study reflect a lack of hypertension awareness among the general population, which could result in late diagnosis, as well as complications caused by the condition. Often, Ghanaian patients with hypertension present late to secondary and tertiary health facilities, with complications such as heart failure, stroke, and chronic renal failure (Amoah AGB, personal observation).

Our study has revealed that hypertension is under-diagnosed in Ghana, and that the management of the condition is far from optimal. In the context of inadequate resources, population-based interventions to reduce blood pressure could have significant impact on the morbidity and mortality associated with hypertension in Ghanaians. In a pilot study, Cappuccio and colleagues demonstrated the feasibility of reducing blood pressure by reducing salt intake in 20 farmers in a village in Ghana.³¹ Implementation of such community-based strategies may prove cost effective in reducing the disease burden associated with hypertension.

In Ghana, both detection and management of hypertension are usually initiated at the secondary and tertiary levels of care. Along with other non-communicable and chronic diseases, hypertension is not given adequate attention at the primary healthcare level (health posts and health centers), where the bulk of the population receives health care. The high prevalence of hypertension, the large number of undiagnosed cases, and the low rates of control, should persuade health policymakers to initiate a cardiovascular disease (CVD) control program integrating cardiovascular care into primary health care. Non-physician primary healthcare providers, such as physician assistants, can be re-trained to detect and treat hypertension, with low cost drugs, in primary healthcare settings. Creating awareness among healthcare professionals at all care levels, and among the lay public, by encouraging regular blood pressure checks, may assist in reducing the level of undiagnosed hypertension and its attendant morbidity. Provision of appropriate guidelines for the treatment of high blood pressure for primary, secondary, and tertiary levels of care may also facilitate the care of subjects with hypertension in Ghana. Channels of referral may then be established from the primary to the secondary and tertiary levels of care for the more complicated and/or resistant cases.

The present study had certain limitations. First, the sample was not nationally representative. In addition, only 2 readings of blood pressure, taken on the same day, were used as the basis for diagnosing hypertension. Nevertheless, the study provides useful information that may assist in informing health policy on the prevention and control of hypertension in Ghana. The determinants and natural history of hypertension in Ghanaians remain to be ascertained by future studies.

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AUTHOR CONTRIBUTIONS

Design and concept of study: Amoah Acquisition of data: Amoah Data analysis and interpretation: Amoah Manuscript draft: Amoah Statistical expertise: Amoah Acquisition of funding: Amoah Administrative, technical, or material assistance: Amoah Supervision: Amoah