HYPERTENSION IN BO, SIERRA LEONE

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Objective: To identify the prevalence of hypertension among adults in Bo, Sierra Leone.

Design: Hypertension data were extracted from outpatient clinic records.

Setting: Mercy Hospital in urban Bo, Sierra Leone.

Patients: All nonpregnant outpatients aged ≥15 years seen at the outpatient clinic in 2009.

Main Outcome Measures: Prevalence of hypertension, defined as a systolic blood pressure ≥140 mm Hg and/or a diastolic blood pressure ≥90 mm Hg.

Results: Data from 3944 individuals were analyzed (mean age 38.7 years). The overall prevalence of hypertension among those aged ≥15 years was 25.2%, with an age-adjusted prevalence of 19.6%. The prevalence of hypertension for participants aged ≥20 years was 27.1%, with an age-adjusted prevalence of 23.6%. There were no significant differences in blood pressure by sex. The prevalence of hypertension increased significantly with age for both males and females ($P<.001$).

Conclusions: The prevalence of hypertension in Sierra Leone is consistent with the rates of hypertension observed in other parts of West Africa. (*Ethn Dis*. 2011;21(2):237–242)

Key Words: Hypertension, Blood Pressure, Sierra Leone, West Africa

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INTRODUCTION

This study examines the prevalence of hypertension among nearly 4000 adults in Bo, Sierra Leone, and compares the results to other studies of hypertension from Sierra Leone and across West Africa. Sierra Leone, which is located on the Atlantic coast between Guinea and Liberia, was severely affected by a civil conflict that lasted from 1991 to 2002. Previous studies of hypertension in Sierra Leone found a high prevalence of hypertension,[1–5] but no studies have been conducted since the resolution of the war.

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African and African diaspora populations are consistently reported to have concerning rates of hypertension.[6–9] Hypertension is the leading risk factor for both ischemic and hemorrhagic stroke,[10] and elevated blood pressure is also associated with an increased risk of many other health problems, including chronic kidney disease, coronary artery disease, congestive heart failure, and heart arrhythmias.[11] Individuals with other cardiovascular diseases, diabetes, and kidney disease are particularly vulnerable to hypertension and the complications associated with hypertension,[11] so management of hypertension is an important component of managing the other chronic diseases that are now recognized as significant and increasingly common problems in Sub-Saharan Africa.[12]

Early identification and treatment of hypertension is effective in saving lives and reducing costs to families and health systems,[13,14] but diagnosis of and treatment for hypertension are often unavailable or under-available in low-income populations.[6,8,10] The lack of health infrastructure is severe in Sierra Leone, where there are fewer than 500 hospitals and clinics, fewer than 200 physicians, and fewer than 1500 nurses serving a national population of about 5 million.[15] In fact, these may be significant overestimates of the number of health professionals since a 2007 Ministry of Health workshop identified only 67 medical officers and 225 nurses working in the republic.[16] The extreme shortage of physicians means that clinics are often staffed entirely by clinicians with less advanced training, and the limited number of total clinicians means that all of them must typically focus their attention on acute and critical care rather than on management of chronic diseases.

However, even with the inadequacy of health infrastructure in much of West Africa, effective interventions and policies for hypertension prevention and control have been successfully implemented in some areas within the region.[14] Identifying the prevalence of hypertension in Sierra Leone, and in

other countries, is a first step toward the development and prioritization of policies and practices that will reduce the morbidity and mortality associated with high blood pressure.

METHODS

Mercy Hospital is a private medical facility located on the northern side of Bo, a city in south-central Sierra Leone. The hospital, which is affiliated with the United Methodist Church, operates an outpatient clinic that provides basic preventive, diagnostic, and therapeutic services for both acute and chronic conditions in adults and children. Additionally, the hospital has a maternity clinic for antenatal and delivery services as well as a 25-bed inpatient facility. Approximately two-thirds of the hospital's patients live within one km of the hospital.[17]

Prior to being examined by a physician, each outpatient's weight, temperature, pulse, oxygenation level, and blood pressure are taken by a nurse or clinical officer and recorded on a hospital enrollment card along with the patient's sex and age. Pulse rate and oxygenation levels are taken using a Medtronic LifePack 20 defibrillator/monitor. Blood pressure measurements are made manually by trained staff using a UNESCO blood pressure cuff machine.

After the analysis plan was approved by both the Bo District Medical Board of the United Methodist Church (Bo, Sierra Leone) and the Institutional Review Board of George Mason University (Fairfax, Virginia, USA), the medical records of all individuals aged ≥15 years who were seen at the outpatient clinic at Mercy Hospital in 2009 were screened for eligibility. A total of 4000 records remained after eliminating any outpatient who was subsequently admitted to the hospital as an inpatient and removing the records of all pregnant women, since pregnancy is associated with an increased risk of hypertension.[18] Of these 4000 outpatients, 56 were missing blood pressure information, which left a final study population of 3944.

SPSS 16.0 was used to analyze the data, and significance was set as $\alpha = .05$. In agreement with the standard definition used by the World Health Organization[19] and Joint National Commission on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure,[20] hypertension was defined as having a systolic blood pressure (SBP) ≥140 mm Hg and/or a diastolic blood pressure (DBP) ≥90 mm Hg. Independent samples *t* tests were used to compare means for SBP, DBP, weight, pulse, oxygenation level, and temperature in hypertensive vs normative individuals. Chi-square tests and ANOVA tests of trend were used to examine differences in blood pressure by sex and age. Multiple regression was used to examine the independent effects of variables on blood pressure.

RESULTS

The characteristics of the study population are summarized in Table 1. Out of the 3944 outpatients included in the analysis, 57.8% were women and 42.2% were men. One patient file was missing information about sex and 162 were missing age information. The mean age of the study population was 38.7 years (SD: 17.0). The mean (SD) SBP at the first clinic visit of the year was 120.0 mm Hg (26.2) and the mean DBP was 72.7 mm Hg (13.7). Both the mean SBP and DBP increased significantly with age ($P < .01$). There were no significant differences in mean SBP ($P = .84$) or DBP ($P = .07$) by sex. The mean pulse rate was 84.7 beats per minute (19.3). Blood oxygenation level and temperature means were approximately 99.0% (2.9) and 37.0°C (2.2), respectively.

Table 2 shows the prevalence of hypertension by sex and age. In total, 25.2% of the 3944 patients aged ≥15 years had hypertension. The prevalence of hypertension was 27.1%

Table 1. Participant characteristics

Characteristic		*n (% of total)*	SBP in mm Hg					SBP in mm Hg, mean (SD)	DBP in mm Hg, mean (SD)	Pulse in beats per minute, mean (SD)
			<120	120–129	130–139	140–159	≥160			
Total		3944 (100.0%)	2084 (52.8%)	571 (14.5%)	426 (10.8%)	451 (11.4%)	412 (10.4%)	120.0 (26.2)	72.7 (13.7)	84.7 (19.3)
Sex	Female	2279 (57.8%)	1229 (53.9%)	293 (12.9%)	240 (10.5%)	263 (11.5%)	254 (11.1%)	120.0 (26.6)	73.1 (13.9)	86.0 (16.5)
	Male	1664 (42.2%)	854 (51.3%)	278 (16.7%)	186 (11.2%)	188 (11.3%)	158 (9.5%)	120.1 (25.6)	72.3 (13.5)	82.9 (22.4)
Age, years	15–19	407 (10.3%)	332 (81.6%)	59 (14.5%)	11 (2.7%)	4 (1.0%)	1 (.2%)	104.2 (12.3)	64.3 (8.4)	88.3 (18.5)
	20–29	983 (24.9%)	728 (74.1%)	159 (16.2%)	54 (5.5%)	31 (3.2%)	11 (1.1%)	107.8 (15.3)	67.2 (10.0)	86.4 (26.1)
	30–39	815 (20.7%)	512 (62.8%)	148 (18.2%)	69 (8.5%)	60 (7.4%)	26 (3.2%)	112.9 (18.5)	70.9 (11.5)	84.4 (15.7)
	40–49	601 (15.2%)	251 (41.8%)	99 (16.5%)	93 (15.5%)	96 (16.0%)	62 (10.3%)	124.0 (25.1)	76.8 (14.9)	83.8 (16.5)
	50–59	417 (10.6%)	114 (27.3%)	50 (12.0%)	79 (18.9%)	93 (22.3%)	81 (19.4%)	134.0 (28.0)	79.2 (14.2)	82.3 (15.9)
	≥60	559 (14.2%)	97 (17.4%)	38 (6.8%)	95 (17.0%)	138 (24.7%)	191 (34.2%)	145.0 (30.9)	79.9 (15.3)	82.8 (15.4)

Table 2. Prevalence of hypertension (SBP ≥140 and/or DBP ≥90 mm Hg) by age and sex

Age (years)	Total	Females	Males	*P* for chi-square test for differences between males and females
15–19	1.2%	.0%	2.9%	.013
20–29	6.9%	5.6%	9.0%	.041
30–39	14.5%	15.0%	13.9%	.690
40–49	31.1%	33.1%	28.6%	.250
50–59	47.0%	51.3%	41.9%	.061
≥60	61.5%	64.0%	57.9%	.157
All ages	25.2%	26.0%	24.2%	.207
P for chi-square test for trend by age	<.001*	<.001*	<.001*	

* statistically significant trend.

in those aged ≥20 years. After using direct age-adjustment to standardize our study population to the age distribution of adults in Sierra Leone as a whole (Table 3), the age-adjusted prevalence of hypertension was 19.6% for those aged ≥15 years and 23.6% for those aged ≥20 years. The mean SBP in persons with hypertension was 155.2 mm Hg, compared to a mean of 108.2 mm Hg in normotensive individuals. The mean DBP in persons with hypertension was 89.2 mm Hg, compared to a mean of 67.2 mm Hg for normotensive individuals (data not shown). There were no significant differences in the overall prevalence of hypertension in males and females (24.2% vs. 26.0%, $P=.21$), but several age-specific differences were noted, with younger males having higher rates of hypertension than younger females but older females having a higher prevalence than older males. The prevalence of hypertension increased significantly with age ($P<.01$), and this was true for both males ($P<.01$) and females ($P<.01$). Compared to normotensive individuals, hypertensive individuals had a higher mean weight (65.7kg vs. 58.3kg, $P<.01$). There were no significant differences in pulse rate ($P=.38$), oxygenation level ($P=.36$), and temperature ($P=.32$).

In total, 981 (24.9%) of the 3944 participants made two or more visits to the outpatient clinic in 2009. Of the patients with multiple visits, 86.5% did not have a change in their blood pressure status from their first visit to their second visit, 8.8% were normotensive at the first visit and hypertensive at the subsequent visit, and only 4.7% were hypertensive at their first visit and normotensive at the subsequent visit. The consistency of blood pressure readings over multiple visits supports the precision of the blood pressure readings. The average length of time between visits was more than one month (mean: 60 days; median: 31 days), which indicates that hypertension in this population tends to be a chronic condition. The sustained hypertension in repeat clients suggests a lack of hypertension management in the patient population despite the availability of antihypertensive medication at the hospital pharmacy and the routine prescription of medications and monthly blood pressure checks to hypertensive patients.

DISCUSSION

Our study found an age-adjusted prevalence of hypertension of 23.6% in those 20 years of age and older. This prevalence does not adjust for outpatients who were normotensive as a result of taking antihypertensive medications. Adding patients with medication-controlled blood pressure to the prevalence rate would cause it to be higher than 23.6%, which would result in a rate closer to that found by previous studies from both urban and rural Sierra Leone that used the same definition for hypertension as our study and found rates exceeding 40%.[3]

Table 3. Age-adjustment to the national population of Sierra Leone (with national demographics from Thomas et al 2006[45])

	Females			Males			Total
Age group	% of those ages 15+ in the study population	% of those ages 15+ in each age group in Sierra Leone	Age- and sex-specific hypertension rate in the study population	% of those ages 15+ in the study population	% of those ages 15+ in each age group in Sierra Leone	Age- and sex-specific hypertension rate in the study population	Total prevalence of hypertension
15–19	6.2%	9.6%	.0%	4.5%	9.1%	2.9%	1.4%
20–29	15.7%	15.6%	5.6%	10.3%	12.9%	9.0%	7.1%
30–39	11.8%	11.7%	15.0%	9.7%	9.6%	13.9%	14.5%
40–49	8.8%	6.7%	33.1%	7.1%	6.9%	28.6%	30.85
50–59	6.0%	3.6%	51.3%	5.1%	3.8%	41.9%	45.6%
≥60	8.8%	5.7%	64.0%	6.0%	5.0%	57.9%	61.1%
total	57.3%	52.8%	26.0%	42.7%	47.2%	24.2%	25.2%
					Age-adjusted total prevalence (ages ≥15)		19.6%
					Age-adjusted total prevalence (ages ≥20)		23.6%

Table 4. Prevalence of hypertension from population-based studies in West Africa

Country	Study year(s)	Sample size	Definition of hypertension	Prevalence, %	Average age, years	Age range	Population	Reference
Sierra Leone	–	558	†	47.8	–	15+	urban	Lisk 1999
Guinea	2000–01	188	†	45.2	–	16–100	rural	N'Gouin-Claih 2003[46]
Guinea	2003	886	*	43.6	–	35+	urban	Baldé 2006
Sierra Leone	–	606	†	41.1	–	15+	rural	Lisk 1999
Burkina Faso	2004	2087	†	40.2	–	35+	urban	Niakara 2007
Ghana	2001	532	†	32.9	54.9	40–75	semi-urban	Cappuccio 2004
Ghana	2002	284	*	32.8	41.8	17+	rural	Burket 2006
Cameroon	–	641	†	32.5	–	25–88	urban	Sobngwi 2004
Ghana	2004	853	†	31.0	33.7	16+	urban	Agyemang 2006
Ghana	2006	1015	†	30.2	44.0	25+	urban	Addo 2009[47]
Ghana	2001–02	1135	†	30.0	48.0	18+	urban	Spencer 2005
Côte d'Ivoire	1995	202	*	29.7	46.0	30–55	urban	Koffi 2001
Ghana	1998	4733	†	28.4	44.5	25–102	urban	Amoah 2003
Sierra Leone	**2009**	**3375**	*	**27.1**	**41.3**	**20–97**	**urban**	**current study**
Ghana	2004	578	†	27.0	37.8	16+	rural	Agyemang 2006
Ghana	–	362	*	25.4	42.4	18–99	rural	Addo 2006
Sierra Leone	**2009**	**3944**	*	**25.2**	**38.7**	**15–97**	**urban**	**current study**
Cameroon	2003	10,011	†	24.6	31.6	15–65	urban	Kamadjeu 2006
Gambia	–	6021	*	24.2	–	16+	nationwide	van der Sande 1997
Ghana	2001	481	†	24.1	54.5	40–75	rural	Cappuccio 2004
Ghana	2000	1328	*	23.7	46.8	18–100	urban women	Duda 2007
Sierra Leone	**2009**	**3375**	*	**23.6§**	**41.3**	**20–97**	**urban**	**current study**
Senegal	–	2300	‡	23.6	31.5	15+	urban men	Astagneau 1992
Benin	–	200	*	23.0	38.9	25–60	urban	Sodjinou 2008
Burkina Faso	–	3441	†	23.0	33.1	18–99	urban	Niakara 2003
Cameroon	–	1085	†	22.1	–	25–88	rural	Sobngwi 2004
Senegal	–	1862	†	21.6	37.4	16–64	urban	Lang 1988
Cameroon	2004	2559	†	20.8	–	15–99	urban	Kengne 2007
Gambia	1996–97	2152	†	20.3	35.4	15+	urban	van der Sande 2000
Sierra Leone	**2009**	**3944**	*	**19.6§**	**38.7**	**15–97**	**urban**	**current study**
Ghana	2007	574	*	19.3	37.8	18–65	rural	Kunutsor 2009
Cameroon	1995	1361	†	19.1§	–	25–74	urban	Cooper 1997
Gambia	1996–97	3320	†	17.8	35.4	15+	rural	van der Sande 2000
Cameroon	–	1052	‡	15.8	–	34–58	urban	Mbanya 1998[48]
Cameroon	1995	1467	†	15.4§	–	25–74	rural	Cooper 1997
Guinea	2003	651	*	14.9	–	35+	rural	Baldé 2006
Liberia	1989	3588	*	12.5	–	20+	rural	Giles 1994
Cameroon	–	746	‡	11.7	–	34–58	rural	Mbanya 1998

* Hypertension defined as SBP≥140 and/or DBP≥90 mm Hg.
† Hypertension defined as SBP≥140 and/or DBP≥90 mm Hg and/or being on antihypertensive drug therapy.
‡ Hypertension defined as SBP>140 and/or DBP>90 mm Hg and/or being on antihypertensive drug therapy.
§ Age-adjusted.

All other published studies from Sierra Leone used older definitions for hypertension and, as a result, reported lower prevalence rates. A 1961–1962 study of hospital patients found that 15% had a DBP≥100 mm Hg.[4] A 1977 study found that 14% of adults in eastern Sierra Leone had SBP>140 mm Hg and/or DBP>95 mm Hg.[1] A 1994 study found that more than 20% of urban residents had SBP>160 mm Hg and/or DBP>95 mm Hg.[2] A study published in the late 1990s found that more than 20% of rural residents had SBP≥160 mm Hg and/or DBP≥95 mm Hg.[5]

Table 4 summarizes other studies of hypertension from West African countries in close proximity to Sierra Leone, listing them in order from highest to lowest prevalence. All of the studies in this table were conducted in or after 1980 and used a definition for hypertension similar to the one we used, SBP≥140 mm Hg and/or a DBP≥90 mm Hg. Studies that used an alternate definition, such as cut-offs of 160 mm Hg SBP and 95 mm Hg DBP, are not shown on the table. Our study results fall in the middle of the prevalence rates found by these comparison studies. Age-adjusted studies such as ours tend to have a lower prevalence rate.

Our finding of an increased risk of hypertension with increasing age is supported by previous literature on hypertension in West Africa,[2,3,8,21–40] as is our finding that an increased prevalence with increasing age is

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observed in both males and females.[2,3,22,24,27,30,31,33–40] Our study found no difference in the overall prevalence of hypertension in males and females, as did many of the other studies from West Africa.[5,21,23,25–27,36,38,41] Some of these studies also similarly noted that among younger adults there was either no difference by sex or males had higher blood pressures than females, but among older adults females had higher blood pressures than males, even if there was no overall difference by sex.[21,26,29,30]

The primary limitation of our study was the use of a patient population rather than a randomly-selected sample of the general population. To increase the representativeness of our sample we excluded individuals who were so sick that they were admitted as inpatients for treatment and those who were pregnant. We also confirmed that there were no significant differences in blood pressure readings in those with different temperatures and oxygenation levels, which suggests that our outpatient population is reasonably similar to the general healthy adult population. A second limitation was the use of existing patient records that contained a limited amount of information about each patient and were missing some potentially important data. For example, since patient heights were not recorded on the patient charts, the association between height and hypertension – which may be an important diagnostic consideration, especially for adolescents[42] – and the association between body mass index and hypertension could not be examined or adjusted for in our analysis. A third limitation is that the prevalence of hypertension reported for adolescents in the study population may be underestimated due to our use of a 140/90 definition for hypertension in all age groups. Hypertension may be diagnosed at lower pressures in adolescents and young adults. A final concern common to all studies of hypertension is white coat syndrome, in which individuals in clinical settings may become anxious and experience elevated blood pressures. However, the stress of being in a clinical setting is unlikely to be significantly greater than other stressors experienced in daily life, and individuals whose blood pressures increase in a clinical setting are likely to have elevated blood pressure on a regular basis in other settings.

Our study of hypertension in Sierra Leone – the first one to be conducted since the end of the civil conflict – raises concerns about the high prevalence of hypertension in the adult population in Sierra Leone and further confirms the prevalence of high blood pressure in West African populations. There is a need for expanded access to diagnosis and treatment of hypertension in this region of the world. Studies of hypertension medication use in West Africa have found very low compliance with drug therapy, in large part attributed to cost barriers.[43,44] Access to appropriate therapies may become increasingly important with continued urbanization, since urban populations tend to have higher hypertension prevalence rates (Table 4). Additional research to identify modifiable risk factors for high blood pressure that can be addressed through preventive measures will be important for individual and public health in the years to come.

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