Hypertension In Sub-Saharan Africa
A Systematic Review

Juliet Addo, Liam Smeeth, David A. Leon

Abstract—Hypertension is an important public health challenge worldwide. Information on the burden of disease from hypertension is essential in developing effective prevention and control strategies. An up-to-date and comprehensive assessment of the evidence concerning hypertension in sub-Saharan Africa is lacking. A literature search of the PUBMED database was conducted and supplemented by a manual search of bibliographies of retrieved articles. The search was restricted to population based studies on hypertension in sub-Saharan Africa published between January 1975 and May 2006. Data were extracted after a standard protocol and using standard data collection forms. Thirty-seven publications met the inclusion criteria. The prevalence of hypertension varied extensively between and within studies. Prevalence of hypertension was higher in urban than rural studies in all studies that covered both types of area, and also increased with increasing age in most studies. In most studies less than 40% of people with blood pressure above the defined normal range had been previously detected as hypertensive. Of people with previously diagnosed hypertension, less than 30% were on drug treatment in most studies, and less than 20% had blood pressure within the defined normal range. Hypertension is of public health importance in sub-Saharan Africa, particularly in urban areas, with evidence of considerable under-diagnosis, treatment, and control. There is an urgent need to develop strategies to prevent, detect, treat, and control hypertension effectively in the African region. (Hypertension. 2007; 50:1-2.)

Key Words: blood pressure ■ hypertension ■ prevalence ■ sub-Saharan Africa ■ population

Hypertension is an increasingly important medical and public health issue worldwide. High blood pressure is estimated to have caused 7.6 million premature deaths (13.5% of the total) and contributed 92 million disability-adjusted life years (DALYs) worldwide in 2001.1 In the year 2000, nonoptimal blood pressure was estimated to have caused approximately 7.1 million deaths (12.8% of the total) and contributed 64.3 million DALYs.2 It has been suggested that the prevalence of cardiovascular disease and hypertension is increasing rapidly in sub-Saharan Africa (SSA).3 The current prevalence in many developing countries, particularly in urban societies, is said to be already as high as those seen in developed countries.4,5 SSA is currently battling with communicable diseases such as malaria and HIV, and most governments in the region have limited resources and health budgets. An increasing burden of hypertension in this region is therefore likely to be of grave consequence because very few people will get treated and control is likely to be low. This in turn would result in high morbidity and mortality from potentially preventable complications such as stroke, myocardial infarction, and renal failure.

Epidemiological studies on hypertension in Africa have been conducted over the years in an attempt to estimate the burden of hypertension in this region, and these have reported variable rates within and between different population groups. The purpose of this review is to establish what reliable and comparable evidence is available on hypertension in black adults in SSA. Its aim is to assemble evidence on the prevalence and distribution of hypertension in SSA and the corresponding levels of awareness, treatment, and control.

Methods
A literature search of the PUBMED database, using the Medical subject headings “hypertension,” “blood pressure,” “Africa,” and “Africa South of the Sahara” was conducted. The search was restricted to studies in human beings published between January 1975 and May 2006. A manual search for additional studies was performed using references cited in original study articles and reviews. Additionally, studies were retrieved by searches of the World Health Organization Global Cardiovascular Infobase.6 No language restrictions were applied and publications in other languages were translated to English. Articles were incorporated into an Endnote database. Titles and abstracts were screened, and potentially relevant articles acquired. When copies of papers could not be obtained, attempts to get copies directly from the authors were made.

The eligibility criteria for inclusion were: population based studies that included 400 or more participants aged 15 years and above; random sampling of a defined population or studies involving entire populations; response rate greater than 70%; involving...
black participants living in sub-Saharan Africa; standard methods of measuring blood pressure described; defined hypertension as blood pressure ≥160/95mmHg (WHO criteria) or ≥140/90mmHg or self-reported use of antihypertensive medication (Joint National Committee on Prevention, Detection, Evaluation, and Treatment’s report (JNC 7 criteria)); When information needed to consider eligibility was missing the study was excluded.

Hypertension detection was defined as any prior diagnosis of hypertension made by a health professional among the population defined as having hypertension. Treatment of hypertension was defined as use of recognized antihypertensive medication among the population defined as having hypertension, whereas control of hypertension was defined as blood pressure of <140/90mmHg among the population defined as having hypertension. Comparisons were made only between studies that had used the same definitions. Using the “Statcalc” function of EPI INFO (Version 6, Center for Disease Control, USA), it was determined that a sample size of 400 was adequate to detect prevalence of hypertension between 10% to 50% with 5% precision and 95% confidence. Data were extracted after a standard protocol and using standard data collection forms and checklist by a single reviewer (J.A.) with uncertainties resolved by discussion with the other authors. Data on year of survey, country of study, age of participants, sampling methods, response rate, sample size, methods for preparation, and measurement of blood pressure, definition(s) used for hypertension, and type of measuring device used were extracted. Prevalence of hypertension (unadjusted and age adjusted if stated), percentage of those with hypertension who had been previously diagnosed, on treatment, and those controlled were also obtained. We described the population used for the standardization of hypertension prevalence where this information was available. Where information was available, the prevalence was obtained by age, gender, socio-economic status, and rural-urban residence. Multiple papers from a study were included if these were found and consistency of results checked for the same study.

A formal meta-analysis was not conducted because of the heterogeneity in methods used and participants involved.

Results

The initial search identified 1037 references. An additional 28 references were found from reference lists of articles and 5 more from the World Health Organization database. Figure 1 summarizes the selection process for the total of 1070 publications. In all 37 publications describing 25 studies from 10 countries in SSA satisfied the criteria for inclusion. The list of excluded articles and reasons for exclusion are in the data supplement available online at http://hyper.ahajournals.org.

Papers identified from the same study were grouped together and compared for consistency. The number of participants involved in the studies ranged from 446 to 13,802. The mercury sphygmomanometer was used for measurement of blood pressure in 14 studies and an electronic monitor used in 9 studies. The majority of studies used blood pressure measured on a single visit. With the exception of 2 studies, blood pressure was measured at least twice per visit and an average value determined in most cases. Three studies that sampled from whole national populations were identified with one reporting results for urban and rural areas separately. Apart from the national studies, 10 studies included both rural and urban participants with 5 of those reporting age-standardized prevalence of hypertension for rural and urban populations separately. Urban and rural communities had been defined in the studies by each country’s prior enumeration of areas. Where nomadic participants were included this was stated. In studies reporting age-standardized prevalence of hypertension, prevalence had been adjusted to the age distribution of the entire study sample, the national population, or the new WHO Standard World Population. A summary of the characteristics of the studies and methods used in blood pressure measurements are presented in the data supplement.

Prevalence of Hypertension

The Table shows crude and age-adjusted prevalence of hypertension defined by both WHO and JNC 7 criteria for each study. The prevalence of hypertension varied extensively between and within studies. The difference in the prevalence of hypertension between males and females was minimal for almost all communities. When studies with both urban and rural populations were examined,
### Table. Prevalence of Hypertension in Sub-Saharan Africa

<table>
<thead>
<tr>
<th>Study Identifier</th>
<th>Country, Year of Field Work, and Reference</th>
<th>Prevalence of Hypertension by JNC 7 Criteria</th>
<th>Prevalence of Hypertension by WHO Criteria</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>1</td>
<td>Nigeria 1992&lt;sup&gt;13,20,25&lt;/sup&gt;</td>
<td>(21.6)</td>
<td>(12.5)</td>
</tr>
<tr>
<td>2</td>
<td>Nigeria&lt;sup&gt;14&lt;/sup&gt;</td>
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<td>3&lt;sup&gt;*&lt;/sup&gt;</td>
<td>Nigeria&lt;sup&gt;22&lt;/sup&gt;</td>
<td>(22.2)</td>
<td>(14.2)</td>
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<td>4</td>
<td>Nigeria&lt;sup&gt;35&lt;/sup&gt;</td>
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<tr>
<td>5</td>
<td>Tanzania&lt;sup&gt;40&lt;/sup&gt;</td>
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<td></td>
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<tr>
<td>6</td>
<td>Tanzania urban 1987/1998&lt;sup&gt;30,31&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Aged 47–57</td>
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<tr>
<td>7.2†</td>
<td>Tanzania rural Morogoro 1993&lt;sup&gt;39&lt;/sup&gt;</td>
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<tr>
<td>7.3†</td>
<td>Tanzania rural Mara 1993&lt;sup&gt;39&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8‡</td>
<td>Tanzania 1996/97&lt;sup&gt;17&lt;/sup&gt; urban</td>
<td>37.3</td>
<td>(30)</td>
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<tr>
<td>8‡</td>
<td>Tanzania rural 1996/97&lt;sup&gt;17&lt;/sup&gt;</td>
<td>26.3</td>
<td>(32.2)</td>
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<tr>
<td>9‡§</td>
<td>South Africa 1989/90&lt;sup&gt;9,28&lt;/sup&gt;</td>
<td>23.2</td>
<td>23.3</td>
</tr>
<tr>
<td>10‡</td>
<td>South Africa 1998&lt;sup&gt;16&lt;/sup&gt;</td>
<td>23.5</td>
<td>(20.2)</td>
</tr>
<tr>
<td>11‡</td>
<td>Ghana 1998&lt;sup&gt;11&lt;/sup&gt;</td>
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<td>29.5</td>
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<tr>
<td>12</td>
<td>Ghana 2004&lt;sup&gt;4,10&lt;/sup&gt; Urban</td>
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<td>(28.9)</td>
</tr>
<tr>
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<td>Ghana rural 2004&lt;sup&gt;4,10&lt;/sup&gt;</td>
<td>(27.0)</td>
<td>(27.0)</td>
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<tr>
<td>13</td>
<td>Sudan 1990&lt;sup&gt;19&lt;/sup&gt;</td>
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<td>14</td>
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<td></td>
<td>Rural Nigeria 1991–95&lt;sup&gt;4,13–34&lt;/sup&gt;</td>
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<td>14</td>
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<td>Urban Cameroon 1991–95&lt;sup&gt;14,13–34&lt;/sup&gt;</td>
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<td>Rural Cameroon 1991–95&lt;sup&gt;14,13–34&lt;/sup&gt;</td>
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<td>Cameroon&lt;sup&gt;27&lt;/sup&gt; Urban</td>
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<td></td>
<td>Cameroon rural&lt;sup&gt;26&lt;/sup&gt;</td>
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<td>16</td>
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<td></td>
<td>Cameroon urban&lt;sup&gt;15,27&lt;/sup&gt;</td>
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<td>17.5</td>
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<tr>
<td>17†</td>
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<td>6.6</td>
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<tr>
<td>18‡</td>
<td>Cameroon 2003&lt;sup&gt;23&lt;/sup&gt;</td>
<td>25.6</td>
<td>23.1</td>
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<td>19</td>
<td>Liberia 1998&lt;sup&gt;21&lt;/sup&gt;</td>
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<tr>
<td>20</td>
<td>Eritrea 2004&lt;sup&gt;29&lt;/sup&gt;</td>
<td>(16.9)</td>
<td>(15.3)</td>
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<td>20</td>
<td>Urban Eritrea 2004&lt;sup&gt;29&lt;/sup&gt;</td>
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<td>20</td>
<td>Rural Eritrea 2004&lt;sup&gt;29&lt;/sup&gt;</td>
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<tr>
<td>21</td>
<td>Senegal&lt;sup&gt;24&lt;/sup&gt;</td>
<td>(22.2)</td>
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<td>24</td>
<td>Gambia 1996/97&lt;sup&gt;41,42,44&lt;/sup&gt; Urban</td>
<td>(22.0)</td>
<td>(16.9)</td>
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<tr>
<td>24</td>
<td>Gambia 1996/97&lt;sup&gt;41,42,44&lt;/sup&gt; Rural</td>
<td>(20.6)</td>
<td>(16.0)</td>
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<tr>
<td>25</td>
<td>Gambia 1998&lt;sup&gt;43&lt;/sup&gt;</td>
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Values in brackets represent non–age standardized prevalence of hypertension.

*Adjusted readings said to have been obtained by MANOVA technique.

†Not stated.

‡Age adjusted to the WHO New World Population.
§Age adjusted to the population of the country.
∥Age adjusted to the entire study population.

††Age adjusted to WHO old world standard population.
prevalence of hypertension was observed to be higher in the urban compared with the rural population as shown in Figure 2. A study from rural Tanzania that had sampled from 3 rural regions and reported prevalence separately showed prevalence to be lowest for both females and males in the rural region described as least advantaged, and highest in that described as the most socially and economically advantaged.39

Figures 3 and 4 show the age- and sex-specific prevalence of hypertension defined by both WHO and JNC 7 criteria. The prevalence of hypertension defined by both criteria was observed to increase steadily from the youngest to the highest age groups. This was generally similar for males and females and in rural and urban studies. In a study from rural Tanzania involving 3 rural populations, however, there was an increase in only the population described as advantaged with virtually no increase with age in the other 2.39

Temporal trends in blood pressure prevalence could not be established conclusively from the data available because few studies had been done in which serial surveys using the same methodology had been conducted. One exception was a study from Tanzania involving urban, rural, and seminomadic participants aged 47 to 57 years. An initial survey was conducted in 1987 and a resurvey in 1998 in the same areas using similar methods. There was a marked increase over the period with overall prevalence increasing from 25.4% in men to 41.1% and from 27.2% to 38.7% in women. The increase was observed for rural and urban as well as seminomadic participants.30,31

With hypertension defined as BP ≥140/90 mm Hg, the level of hypertension detection ranged between 11% in all participants in rural Cameroon26 and 47% in females in South Africa,38 treatment between 10% in urban Cameroon17 and 32% in Ghana,10 and control between 0.4% and 16.8%.17,38 Females were more likely to have been detected, be on treatment, and have hypertension controlled compared with males. A one-year follow-up of newly diagnosed hypertensive in 1 study showed that despite referral, 62.9% had uncontrolled hypertension and 26.8% claimed to be unaware of their hypertension.16,28

Discussion
There have been a surprisingly large number of studies that provide data about hypertension in SSA, but very few of these provide age-standardized data which allow comparability between studies. The individual studies show a generally high prevalence of hypertension. Urban populations consistently had higher prevalence of hypertension compared with their rural counterparts in almost all studies that covered both types of area. The prevalence of hypertension increased with age. For most studies hypertension was defined on the basis of blood pressure taken on one visit only and thus may have overestimated the prevalence. There was very little information on temporal trends in the prevalence of hypertension because studies undertaken at different time periods were among different populations or did not use similar methods. There were generally low levels of detection, treatment, and control of hypertension.

This review used a wide ranging search strategy and a standard protocol to determine which studies to include and to extract data making conclusions more reliable and limiting bias.47 There were great variations in the studies reviewed,
partly because of the criteria used in selecting participants and also methods applied in measurement and classification of blood pressure. Variations in the age structure of the different populations included in our review limited the ability to compare results directly. Different standard populations had also been used in most studies that reported age-standardized values, and data available did not allow us to restandardize using the same reference population thus limiting comparability between studies greatly. Studies were included based on the extent to which the methods used were likely to give results which were representative of the population from which samples were drawn. To achieve this, studies were included only if the response rate had been mentioned and was at least 70% and sample size was reasonably large (400 participants). Studies were limited to those involving blacks only, to allow comparison among the same racial group because hypertension and its sequelae have been suggested to occur differently in blacks compared with whites living elsewhere. We included only studies that had used and documented standard blood pressure measuring protocol. Urban and rural contrasts involved age standardized prevalence that used the same approach within a single study. The various differences between the studies meant that meta-analysis was not appropriate.

The higher prevalence of hypertension in urban areas compared with rural areas strongly implicates differences in lifestyle as an explanatory factor. Higher levels of obesity and increased salt and fat intake from consuming more processed foods and engaging in jobs with minimal physical activity are likely explanations for higher hypertension in urban populations.

The prevalence of hypertension in SSA, particularly in urban areas, was as high as that from most countries in income settings. Specific issues include the possible role of migration and the characteristics of the urban lifestyle or environment that most strongly predict hypertension. There is also a need to identify barriers to treatment and good control of hypertension and how these could be improved. There is an urgent need to put in place mechanisms of gathering accurate and complete data about blood pressure among populations in SSA, particularly on time-trends. In the absence of such information, projections on the burden of hypertension in SSA will be limited, reliant on predicted demographic patterns with little or no account of the many other major drivers of health at a time when many communities in SSA are undergoing major changes.

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None.

References
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on Evidence for Health Policy Discussion Paper Series: no. 31. World
47. Oxman AD, Guyatt GH. Guidelines for reading literature reviews. Cmaj.
1988;138:697–703.
49. Wolf-Maier K, Cooper RS, Kramer H, Banegas JR, Giampaoli S, Joffres
MR, Poultner N, Primastesta P, Stegmyr B, Thamm M. Hypertension
treatment and control in five European countries, Canada, and the United
50. Banegas JR, Rodriguez-Artalejo F, de la Cruz Troca JJ, Guallar-Castillon
P, del Rey Calero J. Blood pressure in Spain: distribution, awareness,
control, and benefits of a reduction in average pressure. Hypertension.
51. Joyce Fan Z, Lackland DT, Lipsitz SR, Nicholas JS, Egan BM, Tim
Garvey W, Hutchison FN. Geographical patterns of end-stage renal
disease incidence and risk factors in rural and urban areas of South
52. Psaltopoulou T, Orfanos P, Naska A, Lenas D, Trichopoulos D, Trichopo-
oulou A. Prevalence, awareness, treatment and control of hypertension
in a general population sample of 26,913 adults in the Greek EPIC study.
53. Mainous AG 3rd, King DE, Garr DR, Pearson WS. Race, rural residence,
and control of diabetes and hypertension. Ann Fam Med. 2004:2:
563–568.
54. Oyediran ABCR, Bademos O, Olatunde IA. Community control of hyper-
55. Pobee JO. Community-based high blood pressure programs in sub-
56. Pobee JOM. Epidemiological report from West Africa. In Gross F,
Strasser T, ed. Mild Hypertension: Recent Advances. New York, Raven
57. Uwais N, Mugusi F, Aspray T, Whiting D, Edwards R, Mbanya JC,
Sobngwi E, Rashid S, Alberti KG. Tackling the emerging pandemic of
non-communicable diseases in sub-Saharan Africa: the essential NCD
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