

## ORIGINAL ARTICLES

## A REVIEW OF POPULATION-BASED STUDIES ON HYPERTENSION IN GHANA

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## SUMMARY

**Background:** Hypertension is becoming a common health problem worldwide with increasing life expectancy and increasing prevalence of risk factors. Epidemiological data on hypertension in Ghana is necessary to guide policy and develop effective interventions.

**Methods:** A review of population-based studies on hypertension in Ghana was conducted by a search of the PUBMED database, supplemented by a manual search of bibliographies of the identified articles and through the Ghana Medical Journal. A single reviewer extracted data using standard data collection forms.

**Results:** Eleven studies published on hypertension with surveys conducted between 1973 and 2009 were identified. The prevalence of hypertension was higher in urban than rural areas in studies that covered both types of area and increased with increasing age (prevalence ranging from 19.3% in rural to 54.6% in urban areas). Factors associated with high blood pressure included increasing body mass index, increased salt consumption, family history of hypertension and excessive alcohol intake. The levels of hypertension detection, treatment and control were generally low (control rates ranged from 1.7% to 12.7%).

**Conclusion:** An increased burden of hypertension should be expected in Ghana as life expectancy increases and with rapid urbanisation. Without adequate detection and control, this will translate into a higher incidence of stroke and other adverse health outcomes for which hypertension is an established risk factor. Prevention and control of hypertension in Ghana is thus imperative and any delays in instituting preventive measures would most likely pose a greater challenge on the already overburdened health system.

**Keywords:** hypertension, salt consumption, alcohol intake, urbanization, Ghana

## INTRODUCTION

Hypertension is an important public health challenge in both economically developing and developed countries.<sup>1</sup> It is becoming an increasingly common health problem because of increasing longevity and prevalence of contributing factors such as obesity, physical inactivity and an unhealthy diet.<sup>2-4</sup> The current prevalence of hypertension in many developing countries, particularly in urban societies, is reported to be already as high as is seen in developed countries.<sup>5-7</sup> The prevalence of hypertension is expected to increase even further in the absence of broad and effective preventive measures.<sup>8</sup>

This is especially true for Ghana where hypertension was reported to be the second leading cause of outpatient morbidity in adults older than 45 years in Ghana.<sup>9</sup> At the leading teaching hospital in Ghana between 1990 and 1997, non-communicable diseases and their complications accounted for more than two-thirds of all medical admissions and more than 50% of all deaths.<sup>9</sup> An increase in morbidity associated with hypertension does not only reflect a high prevalence of hypertension, but is also an indication of inadequate rates of detection, treatment and control. In an examination of post-mortem records in the teaching hospital in Accra between 1994 and 1998, 11 % of deaths in adults aged 20 years or more were due to stroke, most of which were haemorrhagic.<sup>10</sup> Hypertension was a predominant factor in these strokes.

Most of the hypertension research to date has been undertaken among white participants in developed country settings. Both health service factors relating to the detection and control of hypertension and environmental determinants of blood pressure -such as diet and physical activity - differ markedly between Africa and most western settings. In addition, there is some evidence that compared to white people, people of black African origin have higher risks of developing hypertension, the blood pressure elevation is often more marked and more rapid and that achieving blood pressure control is more difficult.<sup>11</sup> Reliable information about the prevalence of hypertension in different world regions is essential to the development of health policies for prevention and control of this condition.<sup>12</sup> The absence of reliable data on the prevalence of major cardiovascular risk factors in sub-Saharan Africa (SSA), let alone the trends over time, has been identified as a major impediment to developing appropriate policies and interventions to prevent and treat cardiovascular disease (CVD) in the region.<sup>13-17</sup> Current estimates and projections around non-communicable diseases for most of SSA are largely based on assumptions and extrapolations.<sup>18, 19</sup>

The purpose of this review was to identify population based studies of hypertension in Ghana; to determine the prevalence, detection, treatment and control rates reported in these studies; examine the sex and urban-rural differences if any, in these rates; examine temporal trends in the prevalence, detection, treatment and control of hypertension and to examine the factors associated with hypertension and its control.

## METHODS

A literature search of the PUBMED database was conducted from 1970 to 2009 using the medical subject headings "hypertension", "blood pressure" and "Ghana". A manual search for additional studies was performed using references cited in the original articles. Additionally, we contacted some key researchers working on hypertension in Ghana for studies known to them, which might have been missed. The review was limited to population-based studies involving Ghanaians aged 15 years and above.

Data were extracted following a standard protocol and using standard data collection forms and a checklist by a single reviewer. Variables extracted included year of survey, 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. The mean systolic (SBP) and diastolic blood pressure (DBP), prevalence of hypertension (unadjusted and age adjusted), percentage of participants with previously

diagnosed hypertension, those on treatment and those whose blood pressure was controlled (BP<140/90 mmHg) were also obtained. Where information was available we described the population used for the standardization of hypertension prevalence, and categorized the prevalence of hypertension by gender and rural-urban residence. Multiple papers from a study were included if these were found and consistency of results checked for the same study.

## RESULTS

We identified 11 population-based studies that had been conducted on hypertension in Ghana between 1973 and 2007. Table 1 shows a summary of the characteristics of the studies and participants as well as methods used for blood pressure measurement.

The sample size for individual studies ranged from 287 to 6900 with a response rate between 53% and 97%. Mercury sphygmomanometer was used to assess blood pressure in six studies; aneroid sphygmomanometer was used in one study; while electronic monitors were used in four studies. The blood pressure was measured on a single visit in the majority of studies, but blood pressure had been recorded at least twice during the visit in almost all studies and an average value determined. There were four studies involving only rural participants, four studies involving only urban participants and three studies that included both rural and urban or semi-urban participants. The age range of participants varied extensively as shown in Table 1.

Table 2 shows the mean blood pressure levels reported from the included studies. The mean SBP ranged between 122.0 and 139.4 mmHg in women and 123.8 mmHg and 132.9 mmHg in men, while mean DBP ranged between 68.8 and 86.4 mmHg in women and 69.2 and 78.4 mmHg in men. In studies with both urban and rural populations, the mean SBP and DBP was higher in the urban compared to rural populations.

Table 3 shows the prevalence of hypertension from the individual studies, standardization of hypertension prevalence by age, and the criteria for definition of hypertension. Where available, we reported the levels of detection, treatment and control of hypertension. Based on the definition of hypertension with a BP >160/95 mmHg, the prevalence of hypertension ranged from 4.5% to 16.2% whereas using a threshold of BP > 140/90 mmHg, the prevalence of hypertension ranged from 19.3% to 54.6%. For most studies, the prevalence of hypertension was lower in women. The prevalence of hypertension was generally lower in rural compared to urban populations. The prevalence of hypertension

reported from Northern Ghana was considerably lower than that reported from other rural populations from more southern parts of Ghana.<sup>20</sup> Hypertension treatment rates ranged from 11.3% to 52.5% with blood pressure control rates between 1.7% and 12.7%. The rates of awareness, treatment and control of hypertension were reported to be low in both rural and urban populations. Cappuccio et al reported the detection, treatment and control rates to be higher in the semi-urban compared to rural population.<sup>21</sup>

Although higher awareness and treatment rates were reported for older adults, the rates of BP control remained low.<sup>22</sup> There were marked differences in the mean blood pressure values when repeat measurements were taken two weeks after the baseline measurements.<sup>20</sup> The prevalence of hypertension changed from 37.1% to 30.3% in a study of urban civil servants when repeat measurements taken two weeks after the baseline measurements were considered.<sup>23</sup>

**Table 1** Characteristics of studies

Author	Year of field work	Study population	Age range	Sample size	Males/females	Response rate	Preparation	Device	Measures/visits
Pobee <sup>24</sup>	1973	20 rural villages	≥16	1670	809/861	97.5	Seated for 5 to 10 minutes	Mercury sphygmomanometer	3/1
Pobee <sup>28,50</sup>	1975-76	Urban community	15-64	3745	1635/2100	73	NR	Mercury sphygmomanometer	NR
Pobee <sup>28,51</sup>	1973	Urban public servants	15-64	6900	5520/1380	91	Seated for 10 minutes	Mercury sphygmomanometer	2/2
Amoah <sup>26</sup>	1998	Urban and rural communities	25-102 (44.3)	4733	1860/2873	75	Rested for 10 minutes	Mercury sphygmomanometer	2/1
Addo <sup>25</sup>	2001	4 rural communities	≥18 (42.4)	362	107/255	60-80%	Rested for 10 minutes	Mercury sphygmomanometer	2/1
Cappuccio <sup>21</sup>	2001-2002	6 semi-urban and 6 rural communities	40-75 (54.7)	1013	385/628	53.4	5 minutes rest	Electronic	3/1
Burket <sup>52</sup>	2002	Rural	≥17 (41.8)	287	NR	NR	NR	Mercury sphygmomanometer	2/1
Agyemang <sup>22,27,53</sup>	2004	Urban and rural	(35.9)	1431	644/787	82-95	Rested for 5 minutes	Electronic	2/1
Duda <sup>30</sup>	NR	Urban	18-100	1328	NR	NR	NR	Aneuroid sphygmomanometer	NR
Addo <sup>23</sup>	2006	Urban civil servants	25-68	1015	615/400	82.7	Ten minutes rest	Electronic	3/2
Kunutsor <sup>20</sup>	2007	Rural	18-65 (37.8)	574	207/367	95.7	NR	Electronic	2/2

NR not reported

Temporal trends in mean BP and prevalence of hypertension could not be established conclusively from the available data because of the absence of studies that had conducted serial surveys using the same methodology and population. However, the rural population studied by Addo et al in 2001 was in the same district as that previously studied by Pobee in 1973 and showed an increase in the prevalence of hypertension over the period.<sup>24,25</sup>

The mean BP increased with age in almost all studies where age was reported. The increasing trend in BP

with age was less apparent in an earlier study of a rural population.<sup>24</sup> Blood pressure was reported to be positively associated with urban dwelling, body mass index, waist circumference, heart rate and a family history of hypertension, parity, and chronic alcohol use.<sup>20,25-28</sup> A significant and positive relationship was reported between the level of salt intake and both systolic and diastolic blood pressure.<sup>29</sup> No significant association was reported between the level of physical activity and hypertension.<sup>25,30</sup>

**Table 2** Mean blood pressure levels

Author and year of fieldwork	Study population	Mean SBP (mmHg)			Mean DBP (mmHg)		
		Men	Women	All	Men	Women	All
Pobee, (1973) <sup>24</sup>	Rural	123.8 (19.7)	122.0 (21.0)		69.2 (13.5)	68.8 (12.7)	
Amoah (1998) <sup>26</sup>	Rural and urban	129.0 (22.2)	128.9 (26.7)	128.9 (26.7)	75.1 (13.0)	74.7 (14.1)	74.9 (13.7)
Addo (2001) <sup>25</sup>	Rural	125.4 (20.9)	128.5 (27.6)	127.5 (25.8)	74.5 (14.2)	73.9 (14.4)	74.0 (14.3)
Cappuccio (2001-2002) <sup>21</sup>	Rural and semi-urban	126.3 (24.4)	125.1 (27.0)	125.5 (26.1)	75.8 (13.7)	73.5 (13.5)	74.4 (13.6)
Cappuccio (2001-2002) <sup>21</sup>	Rural			121.5 (25.1)			72.3 (13.2)
Cappuccio (2001-2002) <sup>21</sup>	Semi-urban			129.2 (26.4)			76.2 (13.8)
Agyemang (2004) <sup>22, 27</sup>	Rural and urban			130.1 (129.0-131.1)			77.8 (77.1-78.4)
Agyemang (2004) <sup>22, 27</sup>	Rural	129.2 (127.1-131.2)	126.3 (124.3-128.3)		75.2 (74.1-76.9)	75.5 (74.3-76.7)	
Agyemang (2004) <sup>22, 27</sup>	Urban	132.9 (131.3-134.5)	130.8 (129.1-132.6)		78.4 (77.3-79.5)	80.2 (79.1-81.2)	
Duda <sup>30</sup>	Urban		139.4 (27.5)			86.4 (15.1)	
*Addo, 2006 <sup>23</sup>	Urban	131.5 (122.0-144.0)	121.5 (111.3-135.0)	128.5 (117.0-140.5)	80.0 (72.5-89.5)	77.0 (69.0-85.3)	79.0 (71.0-87.5)
Kunutsor, 2007 <sup>20</sup>	Rural	124.25 (18.67)	122.07 (22.01)	122.86 (20.88)	69.92 (12.09)	72.11 (12.35)	71.32 (12.29)

\*reported median values

**Table 3** Prevalence of hypertension

Author	Study population	Prevalence of hypertension			Detection	Treatment	Control
		All	Men	Women			
Pobee <sup>24</sup>	Rural	4.5 <sup>a</sup>					
Pobee <sup>28</sup>	Urban community	13 <sup>a</sup>					
Pobee <sup>28, 51</sup>	Urban public servants	7.8 <sup>a</sup>	8.9 <sup>a</sup>	3.5 <sup>a</sup>	24		
Amoah <sup>26</sup>	Rural and urban	28.4 <sup>b</sup> (16.2) <sup>a</sup>	27.6 <sup>b</sup> (14.7) <sup>a</sup>	29.5 <sup>b</sup> (17.4) <sup>a</sup>	34	18	4
Cappuccio <sup>21</sup>	Rural and semi-urban	28.7	29.9	28.0	22	11.3	2.8
Cappuccio <sup>21</sup>	Rural	24.1			16.4	6.9	1.7
Cappuccio <sup>21</sup>	Semi-urban	32.9			25.7	14.3	4.4
Addo <sup>25</sup>	Rural	25.4 (15.2) <sup>a</sup>			32.3	12.9	2.1
Agyemang <sup>22, 27</sup>	Rural and urban	29.4			34	28	6.2
Agyemang <sup>22, 27</sup>	Rural		27.0	27.0	26.6 (34.8) <sup>d</sup>	23.4 (29.3) <sup>d</sup>	4.7 (7.6) <sup>d</sup>
Agyemang <sup>22, 27</sup>	Urban		33.4	28.9	27.2 (44.2) <sup>d</sup>	22.8 (34.9) <sup>d</sup>	5.1 (7.0) <sup>d</sup>
Duda <sup>30</sup>				54.6		52.5	4.4
Addo <sup>23</sup>		37.1 (30.3) <sup>c</sup> (27.4) <sup>b</sup>	31.7 <sup>c</sup>	28.0 <sup>c</sup>	54.1	31.3	12.7
Burket <sup>52</sup>		32.8	39.4	30.7			
Kunutsor		19.3					

<sup>a</sup> hypertension defined by WHO criteria (160/95)<sup>b</sup> prevalence age-standardised to new world standard population<sup>c</sup> prevalence defined by readings from two visits two weeks apart<sup>d</sup> values in brackets are the rates for women

Examination of the relationship between hypertension and socioeconomic status measured by level of education, income or employment grade was inconclusive. In a study of urban women, there was an inverse relationship between hypertension and education, but there was no demonstrated association with income.<sup>30</sup> The prevalence of hypertension was however higher in civil servants of higher socioeconomic position.<sup>31</sup>

## DISCUSSION

This review of population-based studies conducted on hypertension in Ghana identified a number of studies conducted since 1973 involving rural as well as urban adults. There were variations in the criteria used in selecting participants and methods applied in blood pressure measurements in the studies. The age structure of the different populations also varied extensively and very few studies provided age-standardised data, thus limiting the ability to directly compare the results between studies. Almost all studies had based the classification of hypertension on blood pressure readings taken at a single visit with the possibility of overestimating the prevalence of hypertension and there was very little information on temporal trends in the prevalence of hypertension. Despite these limitations, there was clear evidence of differences in prevalence, with urban areas consistently having a higher prevalence of hypertension. The prevalence of hypertension among urban populations in Ghana was comparable to that reported from Europe and North America.<sup>1,32</sup>

The prevalence of hypertension in the recent rural studies was lowest in a study from a rural area in Northern Ghana which is more economically disadvantaged compared to the other rural areas studied. The prevalence of hypertension increased with age in almost all studies contrary to earlier reports from some rural African studies where little or no rise in blood pressure with age had been observed among nomads, rural agricultural males and indigenous people.<sup>33-36</sup> Hypertension was positively associated with body mass index, waist circumference, pulse rate, excessive alcohol consumption, salt intake and a positive family history of hypertension. Most of the studies did not report the association between hypertension and physical activity, and the relationship with socioeconomic status was inconclusive. The rates of detection, treatment and control were low in all studies that had reported these and were reported to be even lower in rural areas compared to urban areas.

The findings of this review have important public health implications. Firstly, an increased burden of hypertension should be expected in Ghana in the absence of effective hypertension prevention programmes.

This is especially true given the rapid rate of urbanisation, and increased life expectancy with an increased access to health care. Secondly, complications such as strokes, heart failure and renal failure are undoubtedly going to become more apparent if the current low levels of detection, treatment and control of hypertension persists, and this would certainly place a great toll on the already overburdened health infrastructure. Prevention and control of hypertension in Ghana is thus imperative.

Primary prevention of hypertension provides a good opportunity to interrupt and prevent the continuing costly management of hypertension and its complications.<sup>37</sup> This can be accomplished by the complementary application of strategies targeting the general population with the objective of achieving a downward shift in the distribution of blood pressure, as well as targeting of individuals and groups at higher risk of developing hypertension.<sup>37-39</sup> It has been suggested that prevention strategies applied early in life, provide the greatest long-term potential for avoiding the precursors that lead to hypertension and for reducing the overall burden of blood pressure-related complications in the community.<sup>39</sup> Engaging in regular aerobic physical activity, maintaining a normal body mass index, reduction of dietary salt intake to no more than 100mmol/day, moderation in alcohol intake, maintaining adequate intake of dietary potassium, and consumption of a diet rich in fruits and vegetables and in low-fat dairy products, but with a reduced content of saturated and total fat have been shown to be beneficial in the prevention of hypertension.<sup>39-41</sup>

A community programme in the Ashanti region to establish the feasibility of salt reduction as a way of reducing blood pressure showed that a reduction in average salt intake led to a small but important reduction in blood pressure.<sup>29</sup> It is important for lifestyle and dietary habits that promote the primary prevention of hypertension and cardiovascular disease to be encouraged among the entire Ghanaian population, including the youth and children. The maintenance of ideal body weight through reduced fat and total calorie intake and increase in physical activity as well as a reduction in dietary sodium intake should be emphasised. Information on hypertension should be disseminated through the appropriate media. These could be achieved through mass media campaigns, engagement of the lay public and non-governmental organisations in dissemination of information on hypertension and production of simple and easy to read booklets on hypertension.

The information should address what hypertension is, how it is diagnosed and managed, and the potential complications that could occur when left uncontrolled. It is important to emphasise in educating people, the usual absence of symptoms, need for long term therapy and monitoring, and the importance of lifestyle and diet in the primary prevention of hypertension. School and work based health education programs could be beneficial. The population strategy should be complemented by additionally targeting preventive efforts at those considered to be at high risk of developing hypertension. This should importantly include early detection through screening programs as well as appropriate treatment and control of hypertension when detected. Limited resources, poor delivery of care at community health centres, unreliable drug supply and unreliable equipment to measure blood pressure in some health facilities, unavailability of basic investigations, lack of assessment of target organ damage, risk stratification and global cardiovascular risk reduction are reported to be major obstacles to providing better detection and treatment of hypertension in sub Saharan Africa.<sup>42-44</sup> These hurdles could possibly be surmounted in Ghana if the government has hypertension prevention high on the agenda and allocates adequate resources to achieving this. It is necessary to develop guidelines for hypertension management in Ghana, targeted at all health professionals in both public and private sectors. These guidelines should reflect realistic objectives that can be applied widely in the Ghanaian context.

Despite very effective antihypertensive therapies and data from clinical trials demonstrating that lowering blood pressure reduces cardiovascular and renal complications, a significant proportion of people with known hypertension from both developed and developing countries have blood pressure exceeding recommended levels.<sup>45</sup> There could be various possible explanations for the low treatment and poor control of hypertension in SSA. These include scarce resources, lack of patient education, and poor organization of the health care systems. Unaffordable drug prices have been reported to be the major cause of non-compliance with hypertension medication in Ghana.<sup>46</sup> It is however reported that even in healthcare systems with generous resources, control of blood pressure is often unsatisfactory.<sup>47</sup>

This suggests that although hypertension control is probably dependent on the availability and affordability of medication, there are other factors that play a role and these need to be investigated and appropriate measures taken to address them. Although rural Ghanaians rarely buy ready-made and processed foods, urban populations continue to face a rapid influx of restaurants and fast food joints, most of which serve foods

heavily laden with salt and fat. Processed canned foods with high salt content are also more readily available and increasingly becoming more affordable. It is important for the health sector to liaise with the food sector to address the issue of hidden salts and fats in processed foods and determine how these could be effectively regulated.

It may require voluntary agreements with food industry or policies from central government mandating reductions in salt and fat in these foods. Recommendations by health professionals to modify diets or to increase physical activity will be hampered by lack of healthier and affordable food choices, and by lack of safe, attractive places to be physically active.<sup>48</sup> Environmental and legislative interventions that facilitate widespread adoption of healthy lifestyles, and the development of policies to strengthen primary healthcare systems will be crucial for the prevention and control of high blood pressure and stroke.<sup>49</sup>

## CONCLUSIONS

The limited number of population-based studies with age-standardised data that allow direct comparison between studies, the heterogeneity of the methods and the absence of data on temporal trends underscores the importance of obtaining more data using rigorous methods to inform policy and practice on hypertension and cardiovascular disease in Ghana. The relatively limited evidence available however, suggests an increasing prevalence of hypertension in both urban and rural populations but more so in urban groups associated with increasing body mass index, salt intake and other risk factors as well as poor detection, treatment and control rates. These findings certainly raise important concerns. Cardiovascular disease and its major risk factors such as hypertension would undoubtedly compete with other conditions such as malaria, HIV/AIDs, maternal and infant mortality for the limited resources. However uncontrolled hypertension potentially increases the risk of developing complications of hypertension with grave consequences on the individual, family and the entire society. Ignoring the need to institute effective prevention strategies now, would certainly result in a greater burden with increased challenges in the near future.

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