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Silent Crisis: Epidemic Hypertension in Rural West Africa

Emmanuel Ato Williams[1]*, Daniel Ansong[1], Stephen Alder[2], Lowell Scott Benson[2], Stephen James Campbell[2], Katherine MacDonald[2], Tadashi R Miya[2], Isaac Boakye[1], Joseph Marfo Boaheng[1], Evans Xorse Amuzu[1], Osei Asibey Owusu[1], Isaac Nyanor[1], Bernard Arhin[1] and Ty Triston Dickerson[3]

[1]*Komfo Anokye Teaching Hospital, Ghana*
[2]*Division of Public Health, University of Utah School of Medicine, USA*
[3]*Department of Inpatient Pediatrics, University of Utah School of Medicine, USA*

Abstract

Background: Hypertension is the commonest modifiable risk factor of cardiovascular diseases and a major preventable cause of premature mortality. The worldwide prevalence of hypertension will increase by more than half by 2025; almost three-quarters of people with hypertension will be living in developing countries by 2025. We set out to evaluate the burden and correlates of adult hypertension in a rural Ghanaian community.

Methods: A cross-sectional survey was conducted on 438 adults aged ≥35 in the Barekese sub-district (estimated population 18,510). Socio-demographic characteristics, modifiable and non-modifiable risk factors, blood pressure (BP) and anthropometric measurements were collected using standardized protocols.

Results: The proportion of hypertension and isolated systolic hypertension in the study population is 50.9% and 16.0% respectively. Only 21.2% were previously diagnosed as hypertensive; 25.8% of whom were not being treated. The proportion of the people with hypertension whose BPs were controlled (<140/90mmHg) was 13.5%. The mean systolic and diastolic BPs were 134.75 mmHg (SD: 24.68) and 83.01 mmHg (SD: 13.58). Obesity (Body Mass Index, BMI>30 kg/m^2) was found in 13.24% of the population, with 6.7% being extremely obese (BMI>40 kg/m^2). Factors such as increasing age and BMI positively correlated with BP.

Conclusion: There appears to be a high burden of hypertension in rural Ghana; the low detection, and poor management and control should make this a high priority. These findings indicate the need for urgent measures to promote health education that would facilitate prevention, early detection, and management of hypertension.

Keywords: Hypertension; Cardiovascular; Epidemic; Rural; Ghana; West Africa; Developing countries

Introduction

Systemic Arterial Hypertension (hereafter referred to as 'hypertension') is defined as blood pressure (BP) ≥140/90 mmHg [1]. It is a major preventable cause of premature mortality through its association with Cardiovascular Disease (CVD) and renal disease. Hypertension-related CVD primarily includes stroke and Ischaemic Heart Disease (IHD). Isolated Systolic Hypertension (ISH) is more common in the elderly because the Diastolic Blood Pressure (DBP) plateaus in the 5th and 6th decades and, subsequently, gradually declines, unlike the Systolic Blood Pressure (SBP), which continues to increase with age [2]. Annually, approximately 8 million deaths worldwide are attributable to elevated SBP, accounting for about 14% of all deaths [3]. This includes 54% and 47% of hypertension-attributable deaths due to stroke and IHD, respectively [3]. The risk of death from such cardiovascular events (CE) increases in a 'log-linear' fashion for BP ≥115/75 mmHg, even in individuals with no known underlying vascular disease [4]. For instance, the probability of dying from CE such as IHD and stroke is doubled for every 20 mmHg increase in SBP or 10 mmHg rise in DBP in middle-aged and elderly persons [4]. The worldwide prevalence of hypertension is projected to increase by more than 50% by 2025 [3], implying an expected increase in global mortality from hypertension. Additionally, it is estimated that three-quarters of people with hypertension live in developing countries [5,6] where complicating factors such as poor detection and awareness [5-7], inadequate treatment and control [7,8], and increased risk [9,10] and severity [11] of end-organ damage contribute to a relatively earlier age for hypertension-related mortality (e.g., more than 52% compared to 23% under age 70) than in high-income countries [12,13]. Moreover, about 80% of the hypertension-attributable disease burden occurs in low- and middle-income countries with more than one-half occurring in individuals aged 45 to 69 years [3].

It had been previously suggested that hypertension is not a significant health problem in rural Ghana and that large-scale hypertension case-finding and intervention programmes should be confined to urban populations [14]. This assertion is no longer tenable, as studies increasingly indicate a rising number of persons with hypertension in not only urban, but also, rural communities in developing countries such as Ghana [15-18]. While historically, morbidity and mortality in Ghana were largely due to the significant infectious disease burden, it is rapidly being augmented by the rising incidence of noninfectious diseases, including hypertension. This epidemiologic transition has led to a 'double-burden' of disease phenomenon [19]. Consequently, efficiency in addressing the public health problems of developing nations such as Ghana is contingent on measures that address this dual burden of disease in their approach.

The Barekese sub-district of Ghana is a rural community near Kumasi, Ghana's second largest city, where investigators have previously identified a high burden of hypertension along with poor

***Corresponding author:** Emmanuel Ato Williams, Resident Physician, Komfo Anokye Teaching Hospital, Directorate of Internal Medicine, Kumasi, Ghana, Tel: +393421491215; E-mail: williams_ato@yahoo.com

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detection, treatment and control as part of the Barekuma Collaborative Community Development Project (BCCDP) [17]. The current study was carried out to confirm the previous findings [17] in an attempt to identify and flag a potentially imminent crisis of hypertension in this rural community where data have been scarcely available.

Methods

Study area and setting

Ghana, located in West Africa, is bordered by the Ivory Coast (West), Burkina Faso (North), Togo (East) and the Gulf of Guinea and Atlantic Ocean (South). It consists of 10 regions and 216 districts and has a population of about 25 million [20]. The name 'Ghana' originates from a medieval Ghana Empire kingly title meaning 'Warrior King' [21]. Ghana, formerly Gold Coast and now reputed as 'the Switzerland of Africa' [22], is regarded as a model nation in Africa with democratic and peaceful political transitions for over 2 decades, as well as being one of the continent's fastest growing economies (producing gold, cocoa, and crude oil). It is classified as a Lower-Middle Income Economy by the World Bank [23] and ranked 135 out of 187 on the human development index in 2012 [24]. The country has a universal health care system titled the National Health Insurance Scheme (NHIS) [25].

The BCCDP study area is located in the Barekese sub-district, one of the eight sub-districts of the Atwima Nwabiagya District in the Ashanti Region of Ghana. The BCCDP is a collaborative partnership between 20 rural Ghanaian communities near Kumasi and researchers from the Komfo Anokye Teaching Hospital (Kumasi, Ghana), the Kwame Nkrumah University of Science and Technology, KNUST (Kumasi, Ghana), and the University of Utah (Salt Lake City, Utah, USA). Focus is placed on community development efforts using Community-Based Participatory Research methodologies and primarily involves medical, health, education and economic development in the context of the social environment and infrastructure. The Barekese sub district has a population of approximately 18,510, with a female-to-male ratio of 1.1:1.

Study design and recruitment of participants

This study employed a modified-questionnaire based on the World Health Organization (WHO) Study on Global Ageing and Adult Health (SAGE) [26] to document both modifiable and non-modifiable risk factors of hypertension for 438 adults aged ≥35 years sampled through a cross-sectional community-stratified survey. Written informed consent was sought from study participants. Interviewed participants subsequently had their BP, weight and height checked using standardised protocols. Women who were pregnant or those less than 6 months postpartum were excluded from the study.

Interviews and examinations

Six teams of health professionals who underwent a two-day orientation on the study protocols collected information in the local or English languages (based on subject preference) on socio-demographic characteristics, familial CVD risk factors, educational level, activity level, social habits including current and previous cigarette smoking status and current and previous alcohol consumption, personal history of hypertension and current anti-hypertensive medication use.

Blood pressure was measured using a calibrated aneroid mercury sphygmomanometer (Omron M5-I monitor, Woodley Equipment Company Ltd, Bolton, United Kingdom). Two readings were taken for each participant and the mean values for SBP and DBP were used in data analysis. Appropriate measures such as allowing participants to rest for a minimum of 5 minutes before BP measurements and the use of appropriate cuff sizes relative to a participant's arm circumference were adhered to.

Weight was measured to the nearest kilogram using calibrated weighing scales (Healthometer, Jaden Consumer Solutions Boca Raton, FL 33431, China); participants were allowed to wear ordinary light clothing without holding onto any support.

Measurement of height was taken to the nearest centimeter using a nonstretchable tailor's measuring tape to mark off measurements against a straight wall while standing on a flat surface. The Body Mass Index (BMI) for each participant was calculated as the ratio of weight in kilogrammes to the square of height in metres (kg/m2). As with SBP and DBP, height and weight values were taken twice from each participant to reduce measurement error.

Study participants found to have high BP were referred for management at the local health facility. Those with stage I hypertension were referred within one week, whereas, those with stage II hypertension were referred within one day.

Definition of terms

This study defined [1] hypertension as SBP ≥140 mm Hg and/or DBP ≥90 mm Hg or being on drug therapy for hypertension or previous diagnosis of hypertension by a medical practitioner irrespective of the BP at the time of interview. Stage 1 hypertension was defined as SBP 140-159 mmHg, or DBP 90-99 mmHg. Stage II hypertension was defined as SBP ≥160 mmHg, or the DBP ≥100 mmHg. BMI was categorized [27] as underweight (<18.5 kg/m^2); normal weight (18.5-24.9 kg/m^2); overweight (25–29.9 kg/m^2), obese (≥30 kg/m^2), or extremely/ morbidly obese (>40 kg/m^2).

Data analysis

Data were coded and entered on a daily basis into Epi-Info (TM) 3.5.1 software (Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA). The data were analysed using STATA/SE 11.1 (StataCorp 4905 Lakeway Drive College Station, Texas 77845, USA). Data from individuals who did not complete all sections of the interview were excluded from the analysis for that particular component. Basic summary statistics of participants' socio-demographic characteristics, risk factors, SBP and DBP, weight and height as well as BMI were calculated. The mean SBP and DBP were calculated for age and gender, as well as the mean BMI by gender. Multiple regression analyses of independent variables associated with SBP and DBP were assessed according to gender. P-values less than or equal to 0.05 were considered statistically significant.

Ethical approval

The study protocol was approved by the Kwame Nkrumah University of Science and Technology-School of Medical Sciences and the Komfo Anokye Teaching Hospital (KNUST-SMS/KATH) Committee on Human Research, Publications and Ethics, Kumasi, Ghana

Results

Baseline characteristics

The study interviewed 438 adults aged 35 years or above with a ratio of 1.9:1 females-to-males. At least 423 participants completed all sections of the interview, giving a complete response rate of 96.6%. The median age of the study participants was 53 years (excluding

9 participants who could not confirm their ages). Most of the study participants were Christian (85.4%) and literate (75.3%), whereas more than half (50.7%) were married. Of the literate respondents, 47.3% had up to Junior High School education, and the median total number of years of schooling was 9 years. About one-quarter of respondents reported no schooling [Table 1].

Blood Pressure and BMI according to age categories

Although this study identified 50.9% of the study participants as hypertensive, only 21.2% had been previously diagnosed. This proportion of study participants identified as hypertensive included 30 participants with a previous diagnosis of hypertension and/or on drug treatment for hypertension but who had an average BP ≤ 140/90 mmHg at the time of the study. Nearly one-quarter (25.8%) of those diagnosed previously were not on treatment for hypertension. The SBP was either normal or pre-hypertensive in 61.42% of the cohort, and the mean SBP was 134.75 mmHg (SD: 24.68). Elevated SBP in Stage 1 and 2 was 23.52% and 15.07% respectively [Table 2]. The ratio of participants with controlled-to-uncontrolled SBP was approximately 1.6:1. The proportion of participants who recorded DBP in the Stage 1 and 2 ranges was 15.3% and 12.56% respectively. The mean diastolic BP recorded was 83.01 mmHg (SD: 13.58) for both males and females [Table 3]. The mean SBP was 135.25 mmHg > 133.82 mmHg (for females > males) and the DBP 84.21 mmHg > 82.37 mmHg (for males > females). Female participants recorded a mean SBP that was slightly higher than their male counterparts across all age-categories interviewed, whereas the male participants recorded a mean DBP that was higher than for the females across all the age-categories except age 55 to 64 years [Table 4]. The ratio of participants with controlled-to-uncontrolled DBP was approximately 2.6:1. The total proportion of individuals found to be obese (i.e. either BMI >30 kg/m² or >40kg/m²) in the population was 60 (14.2%), out of whom 4 (6.7%) were extremely obese [Table 2]. The mean BMI identified was higher for females than males: 24.94 kg/m² compared to 21.92 kg/m², respectively. The mean BMI for the cohort was 23.90 kg/m² [Table 3]. The mean age for males (55.99; SD 15.2 years) was higher than for females (54.37; SD 16.1 years) [Table 3].

Variables	Frequency (%)	Median (IQR)
Age (n: 429)		53 years(41-66)
Sex (n: 438)		
Male	152(34.70)	
Female	286(65.30)	
Marital Status (n:438)		
Single	16(3.65)	
Cohabiting	44(10.05)	
Married	222(50.68)	
Separated/Divorced	73(16.67)	
Widowed	83(18.95)	
Religion (n:438)		
Christian	374(85.39)	
Moslem	39(8.90)	
Traditional	1(0.23)	
Other	24(5.48)	
Ever been to school (n:438)		
Yes	330(75.34)	
No	108(24.66)	
Highest level of education (n:330)		
Less than Primary school	48(14.55)	
Primary school	83(25.15)	
Secondary school	156(47.27)	
High School or equivalent	33(10.00)	
College/University	9(2.73)	
Postgraduate Degree	1(0.30)	
Total years of schooling (n:330)		9 years (6 to 10)

IQR: inter-quartile range; %: percent; n: number

Table 1: Socio-demographic characteristics of study sample.

Characteristics	Standard	Frequency (%)
BMI (kg/m²) categories	Underweight (<18.5 Kg/m²)	52(12.29)
	Normal (18.5-24.9 Kg/m²)	221(52.25)
	Overweight (25-29.9 Kg/m²)	90(21.28)
	Obese (≥30 Kg/m²)	56(13.24)
	Extremely obese (>40 Kg/m²)	4(0.95)
SBP measurement categories	Normal (<120mmHg)	127(29.00)
	Pre-HTN (120-139 mmHg)	142(32.42)
	Stage I HTN (140-159 mmHg)	103(23.52)
	Stage II HTN (≥160 mmHg)	66(15.07)
	Controlled (<140 mmHg)	269(61.42)
	Uncontrolled (≥140 mmHg)	169(38.58)
DBP measurement categories	Normal (<80mmHg)	195(44.52)
	Pre-HTN (80-89 mmHg)	121(27.63)
	Stage I HTN (90-99 mmHg)	67(15.30)
	Stage II HTN (≥100 mmHg)	55(12.56)
	Controlled (<90 mmHg)	316(72.15)
	Uncontrolled (≥90 mmHg)	122(27.85)

HTN: hypertension; %: percent; BMI: Body Mass Index; SBP: systolic blood pressure; DBP: diastolic blood pressure

Table 2: SBMI, systolic BP (SBP) and diastolic BP (DBP) characteristics.

Variables	Sex Mean (SEM)		Total Mean (SEM)
	Male	Female	
Age (years)	55.99 (0.73)	54.37 (0.78)	54.94 (0.76)
BMI (kg/m²)	21.92 (0.23)	24.94 (0.26)	23.90 (0.26)
Systolic BP (mmHg)	133.82 (1.14)	135.25 (1.20)	134.75 (1.18)
Diastolic BP (mmHg)	84.21 (0.68)	82.37 (0.63)	83.01 (0.65)

BMI: Body Mass Index; BP: blood pressure; SEM: Standard Error of Mean

Table 3: Anthropometrics and mean BP by sex.

Age group (years)	Mean (SD)	Blood pressure				
	Systolic (mmHg)			Diastolic (mmHg)		
	Male	Female	All	Male	Female	All
35-44	124.94 (14.84)	125.98 (17.77)	125.67 (16.90)	82.48 (11.65)	81.76 (12.99)	81.97 (12.57)
45-54	132.68 (23.68)	132.73 (24.05)	132.71 (23.80)	88.08 (15.18)	84.99 (14.13)	86.11 (14.52)
55-64	136.43 (25.01)	140.41 (24.32)	138.62 (27.93)	83.10 (13.52)	84.11 (15.73)	83.66 (14.68)
≥65	141.93 (28.31)	144.47 (27.87)	143.58 (27.93)	83.55 (16.01)	79.62 (11.06)	82.95 (13.63)

SD: standard deviation

Table 4: Age and sex-specific systolic and diastolic blood pressures.

Multivariate associations with blood pressure

A multiple regression analysis of independent variables (according to sex) were assessed for their association with either SBP or DBP [Table 5]. Age and BMI were consistently positively correlated with increased SBP and DBP for both males and females. But other factors including

Factor, according to sex	Blood pressure					
	Systolic			Diastolic		
	Beta (β)	SEM	p-value	Beta (β)	SEM	p-value
Men:						
Age	0.78	0.13	**<0.01**	0.27	0.10	**<0.01**
Level of education	1.98	2.11	0.35	0.75	1.58	0.64
Family history of hypertension	-1.06	4.58	0.82	0.09	3.44	0.98
Family history of diabetes	5.27	5.23	0.32	1.80	3.93	0.65
Does vigorous physical activities besides usual activities	8.94	3.69	**0.02**	4.38	2.77	0.12
Salt consumption in meals	-2.84	2.93	0.33	1.24	2.20	0.57
Consumption of saturated fats	3.44	2.12	0.11	3.98	1.59	**0.01**
Consumed an alcoholic drink	10.76	4.68	**0.02**	6.66	3.51	0.06
Ever smoked	9.81	4.07	**0.02**	3.95	3.05	0.20
BMI	1.53	0.37	**<0.01**	1.27	0.28	**<0.01**
Women:						
Age	0.71	0.13	**<0.01**	0.18	0.09	**0.04**
Level of education	1.69	1.57	0.28	1.66	1.03	0.11
Family history of hypertension	-2.72	2.92	0.35	-1.57	1.92	0.42
Family history of diabetes	9.11	3.51	**0.01**	2.96	2.31	0.20
Does vigorous physical activities besides usual activities	2.38	3.07	0.44	1.43	2.02	0.48
Salt consumption in meals	3.38	2.32	0.15	3.82	1.53	0.01
Consumption of saturated fats	1.49	1.73	0.39	0.60	1.14	0.60
Consumed an alcoholic drink	5.54	3.14	0.08	3.70	2.06	0.07
Ever smoked	11.43	7.10	0.11	15.57	4.66	**<0.01**
BMI	1.26	0.29	**<0.01**	0.61	0.19	**<0.01**

Source: Field Data (2013)
SEM: Standard Error of Mean; BMI: Body Mass Index. **p-values <0.05 indicated in bold are significant**

Table 5: Multiple regression analysis of factors associated with systolic and diastolic BP by sex.

saturated fat (DBP), alcohol consumption (SBP) and smoking (SBP) were associated with either DBP or SBP for males; whereas others, including a family history of diabetes (SBP), salt consumption (DBP) and smoking (DBP) were associated with DBP or SBP for females. These latter associations and, even an unexpected association of physical exercise with SBP in males, were not consistently found for both sexes across the BP categories.

Discussion

Using a structured questionnaire, we interviewed individuals aged ≥35 years in the Barekese sub-district of Ghana and measured their blood pressure and anthropometric indices. The median age of the sampled population was 53 years, which is marginally higher than the expected increase in median age from a prior cohort (50 years) [17]. We recognize age as an important criterion for our comparison with last year's findings on account of the well-known association between age and elevated BP [28,29]. Secondly, it is noteworthy that the cohort for the present study is closer to age 55 than last year's – an age at or above which the majority (96%) of deaths from stroke or Coronary Heart Disease events (such as myocardial infarction and sudden cardiac death) occur [30]. Thirdly, with the plateauing in the 5th and 6th decades of life, and subsequent decline in DBP, the incidence of ISH rises with increasing SBP and age. This trend is found in our study population as the age-specific all-mean SBP increases with age whereas the DBP falls after an initial rise. The proportion of ISH in this population was found to be 16.0%. ISH has been associated with an increased risk of stroke, CHD and, renal disease [31], as well as being difficult to control [30]. These data highlight the need to urgently evaluate and implement measures aimed at promoting healthy aging in this population.

This study found a high proportion (50.9%) of hypertensive adults aged at least 35 years in this rural community. This is even higher than recent estimates; in 2012, Cook-Huynh et al [16] reported a prevalence of hypertension of 35% in the rural Adankwame sub-district, a community that is also part of the BCCDP with very similar characteristics to the Barekese sub-district. In 2013, Williams et al [17] reported a proportion of hypertension of 44.7% among adults 35 years and above in this same Barekese sub-district. These findings suggest a rapidly increasing burden of hypertension in this rural community. Alongside other estimates [16-19], the findings of this study imply a significant problem of elevated BP in rural Ghana. This will lead to substantial health and economic costs that must be considered in healthcare policy. For instance, the global prevalence of elevated BP in adults aged 25 or above was 40% in 2008, but the highest (46%) was reported in the WHO African Region compared with 35% in the Americas [33]. This means that the prevalence of elevated BP in Africa already exceeds those of other WHO regions, and the further increases suggested by this and other studies represent a serious but overlooked public health emergency on the continent. It is important to acknowledge that more than 50% of the estimated costs of low economic output due to noncommunicable diseases (NCD) are secondary to CVD, exceeding that of diabetes, cancer and respiratory disease combined, and that the costs of NCD are projected to outpace public spending on health [34]. This obviously implies the profound economic implications of a high prevalence of hypertension. However, in spite of the economic cost of hypertension being greater than that of either diabetes or respiratory illnesses in low-, middle- and high-income countries alike, diabetes and respiratory illnesses have much more public visibility than hypertension [35].

The mean SBP (standard error of mean, SEM) of 134.75 mmHg (1.18) found in this study is higher than estimates from other recent studies including Kunutsor and Powles [36], 122.86 mmHg (0.87);

Addo et al. [37], 127.5 mmHg (1.36); Cook-Huynh et al [16], 131 mmHg (1.47) and Williams et al [17], 134.38 mmHg (1.04). Similarly, the mean DBP (SEM) of 83.01 mmHg (0.65) found in this study is higher than estimates from Kunutsor and Powles [36], 71.32 mmHg (0.51); Addo et al [37], 74.0 mmHg (0.75); Cook-Huynh et al [16], 78 mmHg (0.84) and Williams et al. [17], 84.32 mmHg (0.60). The obvious trend is increasing mean SBP and DBP across these studies. Indeed, both SBP and DBP have been associated with an increasing risk of cardiovascular death (although the former has a greater impact, particularly in the elderly [38]). Because this risk of cardiovascular deaths exists even without a pre-existing history of cardiovascular disease [4], this upward trajectory in mean BP is alarming. Moreover, the Framingham Study [38] implies a need to change perspective from 'usual' BP to 'optimal' BP conducive to avoid hypertension-related CVD, since 45% of CVD events in men occur at SBP < 140 mmHg, and individuals aged ≥ 65 years have 4-year rate of progression to hypertension of 50% (if they have a BP of 130-139/85-89 mmHg) or 26% (if they have a BP 120-129/80-84 mmHg) [38]. Similar to other studies [7,17], we also identified poor levels of detection, treatment and control of hypertension in this population which complicate the already poor prognosis. The low level of detection in adults in this population represents a serious concern that needs to be addressed. This is obviously because of the subtle presentation of high BP that exists in spite of its potential catastrophic complications when not controlled. Hopefully, the results of this study, along with other data will decrease the threshold of suspicion for diagnosis among health professionals, and improve management.

Although the mean BMI was 23.9 kg/m^2, the proportion of obese individuals was 13.24% of the population, with 6.7% being extremely obese. A survey [39] to determine the prevalence of obesity in 4733 Ghanaian adults aged 25 and above identified a crude prevalence of 14.1% of obesity and a mean BMI of 24.4 kg/m^2, which were both slightly higher compared with the findings from this study. A 5% increase in obesity and weight gain is associated with 20% to 30% increase in odds of developing hypertension [38], although it has also been found that a higher baseline BMI increases future incident risk for hypertension even when there has been no major weight increase [40]. Central obesity is a stronger cardiometabolic risk factor than lower-body obesity [41] but these were not specifically assessed by this study.

Finally the study assessed the effects of various risk factors on SBP and DBP in this population through a multiple regression analysis. Increasing age and BMI were the most consistently positively correlated with SBP and DBP in both males and females. However, other factors such as saturated fat, alcohol and salt intake as well as smoking and a family history of diabetes also correlated with BP in this study. All these factors have been shown to influence blood pressure [38,42].

Limitations of the Study

Inherent in its design as a cross-sectional study, this survey assessed participants' 'casual' BPs which may be different from their 'usual' BPs followed up over a period of time. The use of the average of two measurements was to help minimize this effect. We assumed the mean 'casual' BPs are unbiased estimates of mean 'usual' BPs for the population. An individual diagnosis of high BP cannot be made based on casual BP alone without following up with repeated measurements. Furthermore, women were represented disproportionately compared to men.

Conclusion

The notion that hypertension is an insignificant problem in rural Ghana is misleading and inaccurate. It is critical to address the health care needs of developing countries, particularly, rural dwellers with the perspective of a 'double-burden' of disease in order to achieve optimal health targets in this population. Healthcare providers need to educate, encourage, and model life-style modifications such as the Dietary Approaches to Stop Hypertension (DASH) [43] diet and regular exercise. The DASH diet recommendations should include reducing salt and saturated fat intake, increasing potassium and fruit and vegetables intake, weight loss, and moderation of alcohol consumption. As well as encouraging physical activity and the DASH diet, preventive strategies should include tobacco control programmes and regular periodic health assessments for adults. Although the evidence [38] indicates that 'normotensive' or pre-hypertensive individuals are not exempt from CE and mortality, there is as yet no available high-level evidence to recommend routine screening with electrocardiography for asymptomatic individuals [44,45]. Nonetheless, it is crucial that healthcare providers and policy makers adopt educational measures that will promote a culture of monitoring one's cardiovascular health, especially in the setting of prevailing risk factors, and complying with recommendations and medications.

Healthcare policy should include more efforts to strengthen primary level healthcare at the sub-district and district levels through education and sensitization of the general population as well as continuous professional development courses for healthcare providers. These educational measures should address preventive and treatment methods of hypertension and the cardiometabolic risk factors. The provision of free antihypertensive medications through the National Health Insurance Scheme [25] is an important strategy that ought to be sustained and expanded to include more efficacious and safe medications. Strengthening of the referral systems from the primary level up to the tertiary centers will allow for the continued management of cases that are difficult to manage at the rural centers. Appropriate feedback and regular refresher courses or seminars organized by the tertiary centers on referred cases would serve to improve the subsequent quality of management of cases at the referring centers.

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