Examining risk factors for hypertension in Ghana: Evidence from the Global Ageing and Adult Survey

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Running Head: Risk factors for hypertension in Ghana

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Abstract

Background: Like most countries in sub-Saharan Africa, hypertension contributes substantially to morbidity and mortality in Ghana, yet nationally representative studies that examine the risks of becoming hypertensive in Ghana are conspicuously missing. We fill this void in the literature.

Method: Data used came from the first wave of the Study on Global Ageing and Adult Survey (SAGE) collected in Ghana from January 2007 to December 2008 by the World Health Organization. A total of 5573 respondents were sampled for the study. Random-effects C-log log models were employed in examining socio-economic, lifestyle and psychosocial factors on the risks of becoming hypertensive in Ghana. Separate models were run for male and females.

Results: Results indicate strong significant associations between socio-economic, lifestyle and psychosocial factors on the likelihood of becoming hypertensive among Ghanaian men and women. Compared with the poorest, wealthy Ghanaians are significantly more likely to be hypertensive. Educated women, compared with the uneducated are also more likely to be hypertensive. Ghanaians who engage in vigorous-intensive activities for at least 10 minutes continuously are significantly less likely to be hypertensive compared to those who do not. While happier men had reduced risks of becoming hypertensive, depressed women had increased risks of reporting they were hypertensive.

Conclusion: This study highlights the need for policy makers to adopt a holistic policy towards curbing the rates of hypertension in Ghana-one that considers lifestyle changes among the wealthy and promotes the psycho-social health of the Ghanaian people in general.

Keywords: Ghana, hypertension, non-communicable diseases, wealth, risk factors.

Introduction

Globally, Non-Communicable Diseases (NCDs) are the leading causes of morbidity and mortality within and across populations[1]. The World Health Organization estimated that 36 million people die of NCDs each year with approximately 80% of such deaths reported in low-and-middle –income countries[2]. Countries in Africa, south of the Sahara are on the brink of such diseases given that 35% of deaths in these parts of the world are attributable to NCDs and this is projected to increase to 65% in 2020[3,4]. With improvement in the economy and rapid urbanization, Ghana's share of the burden of these diseases continues to increase and has widely been acknowledged as disturbing by both researchers and policy makers[5-7]. Hypertension or increased blood pressure is one of such NCDs reported to have claimed the lives of many in sub-Saharan Africa including Ghana. For instance, a press statement released by the Ghana Health Service identified hypertension as the number one killer in Ghana with almost 70% of all deaths attributed to it[8]. Even more deadly is the fact that hypertension or increased blood pressure is linked to other NCDs such as stroke, diabetes and some cardiovascular diseases.

While the causes of hypertension are generally unknown, several risk factors have been associated with the condition. These risk factors are often explained in terms of how the disease, including other non-communicable diseases have been theorized especially for countries in sub-Saharan Africa including Ghana. For instance, in his seminal work on the epidemiological transition in industrialized countries, Abdel Omran had argued that structural changes in both the economy and demography of advanced westernized societies marked the completion of the epidemiological transition where degenerative or non-communicable diseases replaced infectious or communicable diseases[9]. Although different from the experiences of western industrialized

countries, the epidemiologic transition model as described by Omran partially explains Ghana's ongoing health transition. With a relatively stable democracy over the past two decades, the Ghanaian economy has seen much improvement. Ghana's GDP growth was estimated at 13.7% in 2011; the economy was rated the second largest in West Africa after Nigeria and one of Africa's twelve largest[10]. More recently, Ghana was classified a lower-middle income country and the discovery of oil and petroleum have only added to improving its economic prospects. The economic transformation of the Ghanaian society reflects in her health and mortality profile. For instance, albeit slowly, infant and child mortality continue to decline, while life expectancy continues to increase. The increasing life expectancy has meant a fundamental shift in the age structure especially as people are surviving longer than before. Thus, the prevalence of diseases such as hypertension may be a natural consequence of the beginning of an aging process within the Ghanaian population. It is important to also mention the lifestyle changes that accompany these rapid economic transformations in Ghana. Increasing education, rapid urbanization and improved technology both at home and the workplace have led to increased sedentary lifestyles which most studies have linked with non-communicable diseases such as hypertension[11-13]. However, the persistence of poverty, in the midst of economic expansion and growth has meant that diseases like malaria, cholera, and diphtheria among others which are communicable continue to be common. Thus, Ghanaian public policy makers and health professionals are faced with a double burden of disease. In particular, the upsurge of non-communicable diseases including hypertension poses serious threats to both the economic and health gains achieved in the past. Yet, population-based studies that examine non-communicable diseases such as hypertension in Ghana are limited[5, 7, 14]. Bosu corroborates this as he mentioned that PubMed and Google Scholar databases search of adult hypertension in Ghana between 1970 and 2009 yielded

only fifteen population-based articles[13]. Also although useful, majority of these studies have been systematic reviews of the literature[13-15]; have only examined the risks of hypertension using data from specific Ghanaian communities[7] and have provided a very limited analysis of the risks of becoming hypertensive in Ghana — one that does not make reference to class, culture and gender differences. This study fills an important research gap as one of the few if not the foremost that utilizes nationally representative data to examine the risks of hypertension in the Ghanaian population. It also adopts what Setel described as 'a holistic approach' to understanding such risks by examining how individual psychosocial, socio-economic, lifestyle and cultural factors influence the risks of becoming hypertensive in Ghana[12].

Data and Methods

Data

We use Wave 1 of the Study on Global Ageing and Adult Health (SAGE) collected in Ghana from January 2007 to December 2008 by the World Health Organization. The SAGE is a nationally representative multi-country study conducted as part of an ongoing process by the WHO to monitor the health and well-being of adult populations aged 50 years and above in six countries (China, Ghana, India, Mexico, Russian Federation and South Africa). For comparative purposes however, the SAGE also included a smaller sample of younger adults aged 18-49 years. For the survey in Ghana, a stratified multi-stage cluster design was employed to select respondents. The sample was first stratified by administrative region (using all the 10 regions in Ghana) and type of locality (urban/rural) resulting in 20 strata[16]. Approximately 235 Enumeration Areas were selected as primary sampling units from these localities out of which 5259 households were surveyed. A total of 5573 (Male=2799 and Females=2764) respondents were then sampled from these households. Response rates at both household and individual

levels were 86% and 80% respectively. Ethical clearance was obtained from the WHO and the local ethical authorities for each participating country including Ghana.

Measures

The dependent variable used for analysis is self-reported and asked respondents if they have ever been diagnosed with high blood pressure (hypertension). Independent variables are grouped into *socio-economic*, *psycho-social* and *lifestyle* factors. Socioeconomic predictors include respondents' education coded (0=no education, 1=primary education, 2=secondary education, 3=university education); a derived income variable created from a series of questions tapping the wealth status of respondents coded (0=poorest, 1=poorer, 2=middle, 3=richer, 4=richest); and the employment status of participants coded (0=not employed, 1=employed). Two psycho-social predictors are included; respondents' level of happiness coded (0=very happy, 1=happy, 2=neither happy nor unhappy, 3=unhappy, 4=very unhappy) and whether they have ever been diagnosed of depression coded (0=no, 1=yes). Lifestyle variables include a question that asked respondents if they walk or use a bicycle (pedal cycle) for at least 10 minutes to get to and from places (coded 0=no, 1=yes); whether respondents' work involve vigorous-intensive activity that causes large increases in breathing or heart rate such as heavy lifting, digging or chopping wood for at least 10 minutes continuously in the last 30 days (coded 0=no, 1=yes); and the frequency of consuming drinks that contains alcohol such as beer, wine, spirits etc. (coded 0=don't drink, 1=not at all, 2=less than once a month, 3=more than once a month). Some socio-demographic and cultural variables are used as controls. These include age of respondents (0=18 to 39, 1=40 to 64, 2=65 and above); ethnicity (0=Akan, 1=Ewe, 2=Ga Adangbe, 3=Northern ethnic groups, 4=other ethnic groups); religious denomination (0=None, 1=Christian, 2=Islam, 3=Traditional, 4=other); marital status (0=married/cohabiting, 1=never married,

2=divorced/widowed/separated); place of residence (0=rural, 1=urban). Separate models are built for males and females.

Analytical strategy

The dependent variable used in this study is dichotomous, but, as shown in Table 1, cases are unevenly distributed, meaning that using a probit or logit link function that assumes a symmetrical distribution could produce biased parameter estimates[17, 18]. As a result, we chose the complementary log-log function, which is better suited for asymmetrical distributions. The standard complementary log-log models are built on the assumption of independence of observations but the SAGE has a hierarchical structure with participants nested within survey clusters, which could potentially bias the standard errors. To control for this dependence, we employed random effects models that enabled us to estimate the magnitude and significance of clustering. The extent of clustering in our models was measured using intra-class correlations. For standard complementary log-log models, this was calculated as the ratio of the variance at the cluster level to the sum of the variances at the individual and cluster levels. That is:

$\rho = \sigma_u^2 / \sigma_u^2 + \frac{\pi^2}{6}$ where σ_u^2 is the cluster level variance and $\frac{\pi^2}{6}$ the variance at level 1 (individual level) which is that of the standard logistic regression[17, 18]. The GLLAMM program available in STATA was used to build all models.

Results:

Table 1 shows the distribution of selected dependent and independent variables by gender and a description of the sample used for the study. The average age of respondents included in the study sample is approximately 45 years for men and 44 years for women. Majority of respondents are married, live in the rural areas, identify as Akans and are Christians. Results

indicate Ghanaian women as significantly more likely to be diagnosed with hypertension compared to Ghanaian men. Significant socioeconomic differences are also observed with men more likely to receive higher education, an employment and as result more likely to be wealthy. Also, compared to women, Ghanaian men are more likely to be physically active, rate themselves as happier but consume alcohol more frequently than their female counterparts.

Bivariate results are shown in Table 2. Socio-economic variables are significant predictors of being hypertensive in Ghana with highly educated and wealthier men and women more likely to be hypertensive, compared to uneducated and poorer women. Employed men and women are however less likely to be hypertensive compared with the unemployed. Lifestyle variables are significantly associated with the risks of becoming hypertensive in Ghana. Men and women who walk or bike continuously for 10 minutes daily are significantly less likely to be hypertensive compared to those who do not. Similarly, Ghanaians engaged in vigorous-intensive activity for 10 minutes continuously on a daily basis are significantly less likely to be hypertensive. Compared to those who did not consume alcohol at all, men who indicated they consumed alcohol in the last 12 months and those who consumed alcohol once in less than a month were significantly more likely to be hypertensive. Surprisingly, women who consume alcohol 'more than once a month' were significantly less likely to be hypertensive compared to those do not consume at all. Also being hypertensive is significantly associated with living in urban areas, being older, being divorced/widowed/separated for women and identifying as Christians.

Multivariate results are presented in Tables 3 and 4. Three separate models are built for males and females. Model 1 examines the effects of socio-economic predictors on the likelihood of becoming hypertensive in Ghana controlling for theoretically relevant demographic variables.

Model 2, adds lifestyle variables and Model 3, includes psychosocial factors. Results indicate that for Ghanaian men, socio-economic variables are significantly associated with the risks of becoming hypertensive with wealthier Ghanaian men more likely to be hypertensive than poorer men. Ghanaian men who are employed were significantly less likely to be hypertensive compared to those who were unemployed. When lifestyle factors are controlled, we observe significant attenuation in the risks of wealthy Ghanaian men becoming hypertensive. The magnitude of the risks for wealthy men widens and the coefficients become highly significant when psychosocial factors are controlled. Results show that Ghanaian men who do vigorous work and are happy are significantly less likely to be hypertensive. However, compared to those who do not consume alcohol at all, Ghanaian men who did not consume alcohol in the past 12 months and those who consume alcohol less than once a month were significantly more likely to be hypertensive.

For Ghanaian women, the effects of socio-economic predictors on the risks of becoming hypertensive is more evident as both educated and wealthy women report significantly higher risks of hypertension compared to uneducated and poorer women. Similar to their male counterparts, those who were employed are less likely to be hypertensive compared to the unemployed. Unlike wealthy Ghanaian men whose risks of becoming hypertensive were significantly attenuated by lifestyle factors, the risks for educated and wealthy women were rather accentuated when both lifestyle and psychosocial factors are controlled in models 2 and 3. Women who engage in vigorous work for at least 10 minutes are less likely to be hypertensive compared to those who do not. Those diagnosed of depression are significantly more likely to be hypertensive compared to women without such diagnosis. For both men and women, being older and living in urban areas are associated with higher risks of becoming hypertensive. While never

married women are less likely to be hypertensive, divorced/separated/widowed women are significantly more likely to be hypertensive compared to married women. Christians are more likely to be hypertensive compared to respondents without any religion. Also, compared to Akans, Ewe women report higher risks of hypertension.

Discussion:

In his editorial published in the *International Journal of Epidemiology*, Lloyd-Sherlock asked if hypertension had become the new HIV epidemic[19]. This is against the backdrop that both diseases share lots in common, and like HIV, hypertension continues to be a major cause of mortality in both rich and poor countries. For instance, Lloyd-Sherlock argued that both HIV and hypertension are asymptomatic but can lead to fatal illnesses within populations. Also, projections indicate that mortality resulting from hypertension will by far exceed that of HIV/AIDS in the next 20 years[19]. In all these, low-income countries, in particular, those in sub-Sahara Africa have not been spared. Available evidence shows that countries in sub-Sahara Africa contribute substantially to the burden of hypertensive conditions globally, and this is projected to increase by 27% in the next 10 years[19]. Yet in Ghana, few comprehensive studies have been conducted examining what predisposes the population to such risks. This study contributes to the literature in this regard, and has important practical implications for policy makers.

Overall, the results suggest that Ghanaians with higher socio-economic status (the highly educated and wealthy) are more likely to be hypertensive. This finding is consistent with others that show that in most sub-Saharan African populations the risks of hypertension increases with affluence[20,21]. While the mechanisms linking socio-economic status, such as education and income, and the risks of hypertension is unclear, some studies point to the lifestyle changes that

usually accompany the urbanization process. Van der Poel et al. argue for instance, that economies that are undergoing economic transformations such as those in sub-Saharan Africa are equally experiencing major shifts from occupations that are labour intensive and require manual work to those that are capital-intensive and require technology[22]. The transition from a labour to capital intensive economy has led to increased sedentary lifestyles with higher risks for non-communicable diseases, especially, among those with higher education and skills that may benefit from this transition. It was thus not surprising to find lifestyle factors significantly affect the risks of becoming hypertensive for both men and women in Ghana. For instance, the finding that men and women who do vigorous-intensive activities for more than 10 minutes are less likely to be hypertensive is instructive and consistent with other studies that show that moderate to vigorous physical activity could offer protection against the risks of becoming hypertensive[20, 23-25]. More interesting was the finding that when such lifestyle factors were controlled the risks of becoming hypertensive reduced significantly for wealthy Ghanaian men (see models 1 and 2 of Table 3). This confirms our earlier theoretical stance that the increased sedentary lifestyles that accompany economic success may be what expose the wealthy and educated to becoming hypertensive, in particular, male respondents. It is also observed that the risks of hypertension is significantly higher for educated and wealthy Ghanaian women, even more than what is estimated for men and that this disadvantage is magnified with lifestyle factors controlled. These results suggest a clear gender difference in the way lifestyle factors confound the relationship between socio-economic predictors and the risks of becoming hypertensive in Ghana. Unemployment appears to be a major risk factor for increased blood pressure among men and women in Ghana. This finding provides some evidence for the documented advantages that employment could confer on health for individuals within populations and on the contrary how

job insecurity could adversely affect health outcomes including the risks of becoming hypertensive[26-28.]

Psychosocial factors have differential effects for both men and women regarding the risk of becoming hypertensive in Ghana. Compared to the unhappy, Ghanaian men who indicated they are happy are significantly less likely to be hypertensive. More important, when such psychosocial factors are controlled the risks of wealthy Ghanaian men become even more profound. Further checks indicate that significantly the majority of wealthy men reported higher levels of depression compared to poorer men. For women, however, level of happiness does not significantly affect the risks of becoming hypertensive, but depression does, as women ever diagnosed with depression are more likely to be hypertensive. These findings demonstrate the long established links between psychological well-being and physical health[29-31].

While not the focus of this paper, the significance of some control variables are worth mentioning and discussing. For instance, the finding that urban dwellers are more likely to be hypertensive compared to rural dwellers is consistent with several other studies that point to urban living as more stressful and present lifestyle and dietary changes that increase the risks of contracting non-communicable diseases including hypertension[32-34] . It is intriguing to find that divorced/separated/widowed women are more likely to be hypertensive and that single women had a lower likelihood of being hypertensive compared to married women. The risks of divorced/separated/widowed women may point to the emotional challenges women face in the event of divorce or the loss of a husband, especially in a society that is patriarchal and has limited social safety nets for women. The fact that married women had increased risks of being hypertensive is inconsistent with evidence elsewhere[35], but may be indicative of Ghanaian women not happy within their matrimonial homes. A cross-classification analysis of marital

status and level of happiness indicated divorced/separated/widowed women as very unhappy, followed by married women. Also, the fact that Ewe women are significantly more likely to be hypertensive compared to the Akans needs mention. It is known that the Ewes are heavily concentrated in the Volta region where fishing, salt production and sodium in diet may be higher than found in the Akan-speaking areas where farming is the predominant activity and diets may have less sodium[36].

Despite the interesting findings, several limitations are worth-noting. First, the data used here are self-reported which is often subject to report bias. This is even more problematic as we know that quite a substantial proportion of Ghanaians live with hypertension but have not been diagnosed. In this regard, it is possible that the higher report rates among the wealthy, educated and urban residents may be due to access to health facilities that enable easy diagnosis of these diseases compared to the poorer, uneducated and rural dwellers. Second, we use only the first wave of the SAGE data and produce cross-sectional estimates meaning 'causal' connections cannot be drawn between dependent and independent variables. Notwithstanding, findings from this study have important policy implications. The findings suggest adopting a holistic approach towards dealing with hypertension within the Ghanaian population, one that emphasizes life-style change, especially among the wealthy and improves the psychosocial health of the Ghanaian people in general.

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Table 1:Distribution of dependent and independent variables by gender

Variables	Male(%)	Female(%)
Ever been diagnosed with hypertension?	N=2799	N=2764
No	89.8	85.7***
Yes	6.2	8.5
Socio-economic variables		
Educational background		
No Education	21.2	36.6***
Primary Education	32.2	34.3
Secondary Education	40.1	26.2
Higher Education	5.8	2.6
Income Quintile		
Poorest	13.4	16.9***
Poorer	17.7	18.7
Middle	19.3	18.7
Richer	21.6	23.2
Richest	27.9	22.5
Employment Status		
Unemployed	15.0	18.3***
Employed	85.0	81.7
Lifestyle variables		
Walk or bike for 10 mins continuously?		
No	18.8	27.1***
Yes	81.2	72.9
Vigorous-intensive activity for 10 mins continuously		
No	40.8	57.6***
Yes	59.2	42.4
Frequency of drinking alcohol in the last 12 months?		
Don't drink	37.9	52.5***
Not at all	8.8	12.0
Less than once a month	14.3	15.4
More than once a month	39.0	20.1
Psycho-social factors		
Level of Happiness		
Unhappy	11.0	8.3***
Neither	18.5	26.7
Happy	70.5	65.0
Ever been diagnosed with depression?		
No	99.1	99.4
Yes	0.9	0.6
Control variables		
Average age of respondents	45.12	43.89***

Marital status		
Married	84.3	58.8***
Never married	8.6	9.1
Divorced/Widowed/Separated	7.1	32.1
Place of residence		
rural	55.8	52.1***
urban	44.2	47.9
Ethnicity		
Akan	50.3	55.0***
Ewe	4.9	5.4
Ga Adangbe	11.3	12.1
Northern ethnic groups	14.0	11.8
Others	19.5	15.7
Religious denomination		
None	4.7	2.3***
Christians	69.0	81.0
Muslims	17.9	10.1
Traditionalists	7.5	5.5
Others	0.9	1.1

Note: *p<.1; **p<.05; ***p<.01

Table 2: A bivariate analysis of the risks of hypertension among male and females in Ghana

Socio-economic variables	**Male**	**Female**
Educational background	OR	OR
No Education	1.00	1.00
Primary Education	1.59 (.239)**	1.60 (.223)**
Secondary Education	3.42 (.208)***	2.54 (.384)***
Higher Education	5.10 (.359)***	9.39 (.778)***
Income Quintile		
Poorest	1.00	1.00
Poorer	1.15 (.389)	1.68 (.296)*
Middle	2.07 (.356)**	2.14 (.310)***
Richer	5.37 (.344)***	4.48 (.454)***
Richest	9.58 (.356)***	9.03 (.714)***
Employment Status		
Unemployed	1.00	1.00
Employed	.267 (.282)***	.307 (.378)***
Lifestyle variables		
Walk or bike for 10 mins continuously?		
No	1.00	1.00
Yes	.336 (.233)***	.582 (.213)***
Vigorous-intensive activity for 10 mins continuously		
No	1.00	1.00
Yes	.252 (.186)***	.323 (.278)***
Frequency of drinking alcohol in the last 12 months?		
Don't drink	1.00	1.00
Not at all	2.66 (.283)***	1.10 (.211)
Less than once month	2.29 (.261)***	1.12 (.201)
More than once month	.722 (.212)	.415 (.282)***
Psycho-social factors		
Level of Happiness		
Unhappy	1.00	1.00
Neither	.554 (.328)*	.361 (.252)
Happy	.364 (.296)***	1.03 (.224)
Ever been diagnosed with depression?		
No	1.00	1.00
Yes	1.55 (1.38)	2.77 (.576)*
Control variables		
Age of respondents	1.028 (.007)***	1.037 (.010)***
Marital status		
Married	1.00	1.00
Never married	.087 (1.18)**	.350 (.698)

Divorced/Widowed/Separated	.845 (.248)	1.94 (.270)***
Place of residence		
rural	1.00	1.00
urban	4.85 (.205)***	4.67 (.642)***
Ethnicity		
Akan	1.00	1.00
Ewe	1.03 (.325)	1.36 (.297)
Ga Adangbe	1.48 (.248)	1.24 (.246)
Northern ethnic groups	1.94 (.230)	1.10 (.246)
Others	.858 (.275)***	.426 (.301)
Religious denomination		
None	1.00	1.00
Christians	3.32 (.474)***	5.70 (.666)***
Muslims	1.41 (.512)	3.19 (.658)*
Traditionalists	.310 (.697)	1.11 (.707)
Others	2.83 (.869)	3.42 (1.11)

Note: *p<.1; **p<.05; ***p<.01; Odds ratios are reported and standard errors are in brackets

Table 3: Multivariate analysis of hypertension among men in Ghana, 2008/09			
Socio-economic variables	Model 1	Model 2	Model 3
Educational background	AOR	AOR	AOR
No Education	1.00	1.00	1.00
Primary Education	1.29 (.379)	1.16 (.268)	1.48 (.397)
Secondary Education	2.06 (.369)**	1.56 (.272)	2.10 (.389)*
Higher Education	1.64 (.540)	1.27 (.355)	1.75 (.551)
Income Quintile			
Poorest	1.00	1.00	1.00
Poorer	.508 (.570)	.596 (.498)	.554 (.582)
Middle	1.08 (.499)	1.06 (.399)	1.17 (.517)
Richer	2.75 (.473)**	2.10 (.402)	3.10 (.503)**
Richest	3.94(.488)***	2.66(.445)**	4.62(.525)***
Employment Status			
Unemployed	1.00	1.00	1.00
Employed	.336(.306)***	.544 (.318)*	.524 (.310)**
Lifestyle variables			
Walk or bike for 10 mins continuously?			
No		1.00	1.00
Yes		.687 (.247)	.607 (.300)*
Vigorous-intensive activity for 10 mins continuously			
No		1.00	1.00
Yes		.579(.247)**	.485(.281)***
Frequency of drinking Alcohol in the last 12 months?			
Don't drink		1.00	1.00
Not at all		1.93 (.386)	2.43 (.415)**
Less than once a month		2.03 (.395)	2.54 (.406)**
More than once a month		.971 (.249)	.933 (.336)
Psycho-social factors			
Level of Happiness			
Unhappy			1.00
Neither			.478 (.421)
Happy			.248(.418)***
Ever been diagnosed with depression?			
No			1.00
Yes			1.25 (1.32)
Control variables			
Age of respondents	1.05(.012)***	1.03(.014)**	1.04(.012)***
Marital status			
Married	1.00	1.00	1.00
Never married	.125 (1.51)	.351 (1.11)	.129 (1.68)
Divorced/Widowed/Separated	.607 (.367)	.695 (.268)	.526 (.382)
Place of residence			

rural	1.00	1.00	1.00
urban	3.42(.280)***	2.27(.355)**	3.03(.303)***
Ethnicity			
Akan	1.00	1.00	1.00
Ewe	1.07 (.469)	.990 (.318)	.790 (.488)
Ga Adangbe	1.37 (.390)	1.17 (.246)	1.13 (.395)
Northern ethnic groups	1.81 (.385)	1.47 (.253)	1.60 (.403)
Others	.414 (.441)**	.541 (.334)	.395 (.461)**
Religious denomination			
None	1.00	1.00	1.00
Christians	1.91 (.638)	1.47 (.454)	1.83 (.641)
Muslims	1.11 (.722)	1.26 (.526)	1.62 (.755)
Traditionalists	.442 (.916)	.512 (.651)	.485 (.925)
Others	2.42 (1.27)	1.66 (.876)	2.51 (1.68)
Log-likelihood	-654.131	-642.444	-612.809
Level 2 Variance	8.50(3.09)***	2.59 (3.76)	8.59(3.30)***

Note: *p<.1; **p<.05; ***p<.01; Adjusted odds ratios are reported and standard errors are in brackets

Table 4: Multivariate analysis of hypertension among women in Ghana, 2008/09			
Socio-economic variables	Model 1	Model 2	Model 3
Educational background	AOR	AOR	AOR
No Education	1.00	1.00	1.00
Primary Education	1.76 (.234)***	1.87 (.241)***	1.84(.247)***
Secondary Education	1.93 (.297)**	2.08 (.350)***	2.09(.295)***
Higher Education	4.18 (.572)***	7.54 (.577)***	4.06(.584)***
Income Quintile			
Poorest	1.00	1.00	1.00
Poorer	1.74 (.325)	1.79 (.341)	1.75 (.355)
Middle	2.11 (.327)**	2.23 (.337)**	2.32 (.347)**
Richer	4.39 (.419)***	4.81 (.348)***	5.42(.359)***
Richest	6.36 (.476)***	7.77 (.283)***	7.85(.392)***
Employment Status			
Unemployed	1.00	1.00	1.00
Employed	.402 (.275)***	.379 (.224)***	.393(.229)***
Lifestyle variables			
Walk or bike for 10 mins continuously?			
No		1.00	1.00
Yes		1.10 (.193)	1.01 (.202)
Vigorous-intensive activity for 10 mins continuously			
No		1.00	1.00
Yes		.578 (.219)***	.582(.299)***
Frequency of drinking Alcohol in the last 12 months?			
Don't drink		1.00	1.00
Not at all		.884 (.265)	.853 (.275)
Less than once a month		1.02 (.251)	1.03 (.258)
More than once a month		.567 (.291)**	.590 (.299)
Psycho-social factors			
Level of Happiness			
Unhappy			1.00
Neither			1.06 (.299)
Happy			1.15 (.271)
Ever been diagnosed with depression?			
No			1.00
Yes			3.13 (.555)**
Control variables			
Age of respondents	1.03 (.010)***	1.03 (.010)***	1.03(.010)***
Marital status			
Married	1.00	1.00	1.00
Never married	.289 (.776)	.214 (.782)**	.221 (.785)**
Divorced/Widowed/Separated	1.68 (.219)***	1.76 (.223)***	1.79(.233)***
Place of residence			

rural	1.00	1.00	1.00
urban	2.19 (.239)***	2.19 (.206)***	1.97(.210)***
Ethnicity			
Akan	1.00	1.00	1.00
Ewe	1.81 (.327)*	1.98 (.340)**	1.96 (.347)**
Ga Adangbe	1.32 (.264)	1.41 (.290)	1.54 (.298)
Northern ethnic groups	1.25 (.276)	1.33 (.3030	1.28 (.320)
Others	.891 (.324)	.928 (.357)	.815 (.367)
Religious denomination			
None	1.00	1.00	1.00
Christians	1.46 (.715)**	5.05 (.721)**	4.66 (.722)**
Muslims	3.78 (.737)*	3.97 (.791)*	4.22 (.799)*
Traditionalists	1.98 (.784)	2.39 (.852)	2.20 (.854)
Others	7.31 (1.24)	7.84 (1.28)	8.08 (1.28)
Log-likelihood	-869.342	-863.676	-821.350
Level 2 Variance	3.26 (2.45)	5.06 (1.55)***	5.12(1.59)***

Note: *p<.1; **p<.05; ***p<.01; Adjusted odds ratios are reported and standard errors are in brackets