

# Psychosocial factors and hypertension prevalence among Ghanaians in Ghana and Ghanaian migrants in Europe: The RODAM study

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## Abstract

Despite progress made to prevent and control hypertension, its prevalence has persisted in many countries. This study examined the associations between psychosocial factors and hypertension among Ghanaian non-migrants and migrants. Data were drawn from the Research on Obesity and Diabetes among African Migrants (RODAM) project. Findings show that among migrant women, those who experienced periods of stress at home/work had higher odds of hypertension. Among non-migrants, women with depression symptoms were more likely to be hypertensive. Furthermore, there was a positive association between negative life events and hypertension among non-migrant men. The findings highlight the importance of psychosocial factors in addressing hypertension prevalence in Ghanaian populations.

## Keywords

depression symptoms, hypertension, Ghanaian migrants in Europe, Ghanaians in Ghana, negative life events, stress

## Introduction

Hypertension is an important global public health problem mainly because of its high frequency and its associated risk of cardiovascular diseases (CVDs) (Seedat et al., 2018). About 4 out of 10 adults aged 25 years and over have been diagnosed with hypertension globally (World Health Organization (WHO), 2011). Furthermore, global estimates show that hypertension is responsible for approximately 45 per cent of deaths due to heart disease and 50 per cent of deaths due to stroke (WHO, 2013).

The prevalence of hypertension is higher in low- and middle-income countries (LMICs) compared to high-income countries (40% compared to 35%) (WHO, 2013). In addition, LMICs, particularly those in sub-Saharan Africa (SSA), are confronted with a daunting challenge of addressing the burden of hypertension mainly due to weak health systems and the number of people living with the condition who are undiagnosed, untreated and uncontrolled

(Ataklte et al., 2015). In SSA, hypertension has been identified as a leading risk of death among adults, increasing by 67 per cent between 1990 and 2010 (Campbell et al., 2015).

In Ghana, a review of studies on hypertension showed that the prevalence of hypertension ranged between 25 per cent and 48 per cent, with higher rates observed in urban populations compared to rural populations (Addo et al.,

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2012; Awuah et al., 2014; Sanuade et al., 2018a, 2018b). In addition, there is evidence to show that the prevalence of hypertension is high among African (including Ghanaian) migrant populations residing in high-income countries compared to the host population (Agyemang et al., 2009, 2010, 2015; Gu et al., 2012; Modesti et al., 2016). Particularly, a study that assessed variations in hypertension prevalence, awareness, treatment and control among Ghanaian migrants showed that the prevalence of hypertension was higher among Ghanaian migrants compared to Ghanaian non-migrants or the host population (Agyemang et al., 2018).

Despite efforts to prevent, treat and effectively control hypertension, its prevalence has persisted or increased in many LMICs and in African populations in high-income countries. Advancement in hypertension research overtime has led to the recognition of factors such as low physical activity levels, smoking, over consumption of alcohol and unhealthy diets as major drivers of hypertension prevalence. However, these factors alone do not fully explain the increase in prevalence of hypertension. It has been suggested that psychosocial factors such as stress, depression (symptoms), negative life events and anxiety contribute to the prevalence of hypertension (Neylon et al., 2013). This association may be true for many LMICs as well as African (including Ghanaian) migrant populations.

A psychosocial factor is a measurement that associates psychological events to the social environment (Nilsson, 2010). This may lead to psychological and biological changes that may increase one's risk of diseases (Okereke and Manson, 2017). Ongoing exposure to stressors that may eventually lead to chronic or acute stress or depression is linked to sustained blood pressure (BP) elevations (Guimont et al., 2006; Heard et al., 2011; Markovitz et al., 2004). However, there is a paucity of evidence of this association among Ghanaian populations at home and those residing outside the country. Particularly, migrant populations face peculiar challenges which threaten or compromise their physical and mental well-being compared to non-migrants (Pikhart and Pikhartova, 2015), mainly because migrants are often confronted with a number of challenges especially as they learn and adjust to the norms and values of the host culture (Kuo, 2014). In addition, migrants are burdened with the pressure of remitting to family and close associates in their home country (Adepoju, 2008; Humphries et al., 2009).

The main objective of this study was to assess the association between psychosocial factors – specifically, stress, depression symptoms and negative life events – and hypertension prevalence among Ghanaians living in Ghana (non-migrant population) and Ghanaian migrants in Europe.

## Methods

### Data source

Data were drawn from the Research on Obesity and Diabetes among African Migrants (RODAM) study. The

RODAM study was a multi-centre research study with partners from Ghana and three European countries (Netherlands, United Kingdom and Germany), conducted between 2012 and 2015. A main feature of the RODAM project was that highly standardized protocols of quantitative and qualitative assessments were applied for participant recruitment and topic-related investigations at all the study locations. Additional details of the RODAM methodology have been published previously (Agyemang et al., 2014).

### Study design and recruitment

The RODAM study was cross-sectional in design involving participants living in Ghana and Europe. In Ghana, participants were recruited from urban and rural areas of the Ashanti region (hereafter referred to as urban Ghana and rural Ghana). Urban areas of the region where data were collected included Kumasi and Obuasi, and the rural communities included Denyase and Akwaaduo. In Europe, participants were recruited from Ghanaian dominated communities in Amsterdam, London and Berlin. The Ghanaian migrant population in Europe was comparable in ethnic composition to the Ghanaian population recruited in Ghana.

### Inclusion and exclusion criteria

Individuals between the ages of 25–70 years, and of Ghanaian heritage living in rural and urban Ghana, and the three cities in Europe were eligible to respond to a questionnaire and attend a physical examination process. Individuals who did not give an informed consent and pregnant women were excluded.

### Data collection

Individuals who agreed to participate in the study were scheduled for an interview which was administered by trained field personnel or self-administered. The interview provided information on demographic and socio-economic characteristics, psychosocial vulnerabilities and health status. Respondents who completed the questionnaire were invited for a physical examination in a local research clinic or a health centre where BP measurements as well as weight and height measurements were taken.

## Measurements

### Outcome variable

Participants had their BP measured three times with a validated semi-automated monitoring device (Microlife Watch BP home) with the appropriate cuff used. Participants were seated in a chair with a suitable support to enable the arm rest. The mean of the last two readings was used to determine the BP status of an individual. Hypertension was

defined as a systolic BP of  $\geq 140$  mmHg and/or a diastolic BP of  $\geq 90$  mmHg and/or receiving anti-hypertensive medications (World Health Organization, International Society of Hypertension Writing Group, 2003).

### *Explanatory variables*

Stress at home and/or work, depression symptoms and negative life events were used as the measures of psychosocial factors. Stress at home and/or work was assessed with the stress scale used in the INTERHEART study (Rosengren et al., 2004). Respondents were asked how often they felt irritable, anxious or had sleeping difficulties as a result of conditions at home or work. In this study, stress at home/work was categorized as 'no' (never experienced stress at home and/or work) or 'yes' (experienced periods of stress at home and/or work).

To assess depression symptoms, the nine-item Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001) was used. The PHQ-9 is a tool used for diagnosing depression or assessing the level or severity of depression symptoms. A sum score of the nine-item scale was computed, ranging from 0 to 27. This was categorized as 'no depressive symptoms' (sum score from 0 to 4) and 'presence of depressive symptoms', representing mild, moderate and severe depressive symptoms (sum score from 5 to 27). These categories were combined due to the small number of cases in each of them.

To assess negative life events, an adapted version of the 'List of Threatening Experiences' (LTE) measure was used (Ikram et al., 2015; Lewis et al., 2006). This enabled for an assessment of the presence of major negative life events that could cause acute stress to an individual. Respondents were asked whether they had experienced unpleasant events such as the experience of serious illness, injury or death of a close family member, abrupt end of a steady relationship or the experience of a major financial crisis. Responses were categorized as 'no' (no negative life event experienced) or 'yes' (experienced one or more negative life event(s)).

### *Covariates*

Covariates assessed in this study were age, level of formal education completed (no/primary education, lower secondary, higher secondary or tertiary), employment status (not working or has a paid job), physical activity (low, moderate or high), body mass index (BMI), family history of CVD and length of stay (for migrants only). These covariates have been shown to be associated with hypertension in previous studies (Ibekwe, 2015; Pilakkadavath and Shaffi, 2016; Wu et al., 2018).

### *Data analyses*

Characteristics of the study sample were expressed as counts and percentages for categorical variables or means

and standard deviations for continuous variables. Logistic regression models were ran to assess the association between psychosocial factors (stress, depression symptoms and negative life events) and hypertension, with adjustment for covariates.

Analyses of the associations between psychosocial factors and hypertension were assessed for both Ghanaians populations (non-migrants and migrants). Stepwise adjustments were made for the covariates. A  $p$ -value of  $< 0.05$  was considered statistically significant. Results are presented as odds ratios (ORs) with corresponding 95% confidence intervals (CIs) and denotations for  $p$ -values that were significant. All data were analysed using SPSS version 23.

### *Ethical approval and consent to participate*

Review and approval of the study protocol including procedures that were implemented for data collection, storage and protection were sought from the respective ethics committees in Ghana, Netherlands, England and Germany. Written informed consent was obtained from each participant prior to enrolment in the study.

## **Results**

### *Characteristics of the study participants*

Table 1 shows the characteristics of the respondents for the non-migrant and migrant populations. Approximately 68 per cent and 58 per cent of respondents in the non-migrant and migrant populations, respectively, were women. In both populations, the mean age was 47 years ( $\pm 11.9$ ) among men and 46 years ( $\pm 11.3$ ) among women. About two-thirds of the respondents had obtained lower secondary education in both populations. The non-migrant population had a lower proportion of respondents who had completed tertiary education (approximately 9% of men and 2% of women). In addition, the non-migrant population had a higher proportion of respondents who had a paid job (86% for both men and women).

A majority of the respondents (over 90%) reported that they were non-smokers. More than half of the male respondents in both populations were in the high physical activity category (62% and 53% of the male non-migrant and migrant populations, respectively). On the other hand, barely half of the female respondents were in the high physical activity category (47% and 46% of the female non-migrant and migrant populations, respectively). In addition, more than three-quarters of all respondents reported no family history of CVD.

More than two-thirds of the non-migrant population reported experiencing periods of stress at home/work compared to about a half in the migrant population. Furthermore, in the non-migrant population, approximately 25 per cent of

**Table 1.** Characteristics of the study participants stratified by migrant status and sex.

Variable	Male		Female	
	Non-migrants (n = 657)	Migrants (n = 1041)	Non-migrants (n = 1364)	Migrants (n = 1425)
Age (years)	47.4 ( $\pm$ 13.2)	47.4 ( $\pm$ 10.6)	46.3 ( $\pm$ 12.5)	45.6 ( $\pm$ 10.0)
Education				
No or primary education	211 (32.1)	138 (13.3)	795 (58.3)	393 (27.6)
Lower secondary	263 (40.0)	414 (39.8)	446 (32.7)	520 (36.5)
Higher secondary	125 (19.0)	272 (26.1)	94 (6.9)	335 (23.5)
Tertiary	58 (8.8)	217 (20.8)	29 (2.1)	177 (12.4)
Employment status				
Not working	91 (13.9)	254 (24.4)	193 (14.1)	530 (37.2)
Has a paid job	566 (86.1)	787 (75.6)	1171 (85.9)	895 (62.8)
Currently smoking				
No	632 (96.2)	959 (92.2)	1363 (99.9)	1401 (98.4)
Yes	25 (3.8)	82 (7.8)	1 (0.1)	24 (1.6)
Physical activity (PA)				
Low PA	125 (19.0)	283 (27.2)	483 (35.4)	430 (30.2)
Moderate PA	122 (18.6)	208 (20.0)	239 (17.5)	344 (24.1)
High PA	410 (62.4)	550 (52.8)	642 (47.1)	651 (45.7)
BMI (kg/m <sup>2</sup> )	22.8 ( $\pm$ 3.8)	27.1 ( $\pm$ 3.9)	26.5 ( $\pm$ 5.5)	30.2 ( $\pm$ 5.1)
Family history CVD				
Yes	33 (5.0)	55 (5.3)	84 (6.2)	83 (5.8)
No	574 (87.4)	814 (78.2)	1164 (85.3)	1170 (82.1)
Unsure	50 (7.6)	172 (16.5)	116 (8.5)	172 (12.1)
Length of stay in years (migrants only)		18.2 ( $\pm$ 9.9)		17.6 ( $\pm$ 9.6)
Stress at home/work				
No	200 (30.4)	516 (49.6)	371 (27.2)	687 (48.2)
Yes	457 (69.6)	525 (50.4)	993 (72.8)	738 (51.8)
Depressive symptoms (DS)				
No DS	491 (74.7)	821 (78.9)	929 (68.1)	1070 (75.1)
Presence of DS	166 (25.3)	220 (21.1)	435 (31.9)	355 (24.9)
Negative life events				
No	199 (30.3)	396 (38.0)	487 (35.7)	563 (39.5)
Yes	458 (69.7)	645 (62.0)	877 (64.3)	862 (60.5)
Hypertension				
No	427 (65.0)	422 (40.5)	883 (64.7)	648 (45.5)
Yes	230 (35.0)	619 (59.5)	481 (35.3)	777 (54.5)

BMI: body mass index; CVD: cardiovascular disease; SD: standard deviation.

men and 32 per cent of women had depression symptoms. On the other hand, depression symptoms were observed among 21 per cent of men and 25 per cent of women in the migrant population. Also, more than 60 per cent of respondents in both populations had experienced negative life events (see Table 1).

### *Hypertension prevalence by psychosocial factors*

The prevalence of hypertension was 35 per cent among non-migrant men and 59.5 per cent among migrant men. Among migrant women, the prevalence of hypertension

was higher than that observed among non-migrant women (54.5% and 35.3%, respectively) (Table 1).

In the non-migrant population, the prevalence of hypertension among women with depression symptoms was significantly higher compared to those with no depression symptoms (41.4% compared to 32.4%,  $p$ -value = 0.001). This finding was not observed among non-migrant men (see Table 2).

In the migrant population, the prevalence of hypertension among women who experienced negative life events was rather lower than those who did not experience negative life events (32.6% compared to 37.8%,  $p$ -value = 0.042). This finding was not observed among migrant men (Table 2).

**Table 2.** Prevalence of hypertension by stress, depression symptoms and negative life events.

Non-migrants (Ghanaians in Ghana)	Total (N = 2021)			Male (n = 657)			Female (n = 1364)		
	N	Hypertension (%)	p-value	n	Hypertension (%)	p-value	n	Hypertension (%)	p-value
Stress at home/work			0.543			0.592			0.719
No	571	195 (34.2)		200	67 (33.5)		371	128 (34.5)	
Yes	1450	516 (35.6)		457	163 (35.7)		993	353 (35.5)	
Depressive symptoms (DS)			<0.001			0.063			0.001
No DS	1420	463 (32.6)		491	162 (33.0)		929	301 (32.4)	
Presence of DS	601	248 (41.3)		166	68 (41.0)		435	180 (41.4)	
Negative life events			0.818			0.235			0.614
No	686	239 (34.8)		199	63 (31.7)		487	176 (36.1)	
Yes	1335	472 (35.4)		458	167 (36.5)		877	305 (34.8)	
Migrants (Ghanaians in Europe)	Total (N = 2466)			Male (n = 1041)			Female (n = 1425)		
	N	Hypertension (%)	p-value	n	Hypertension (%)	p-value	n	Hypertension (%)	p-value
Stress at home/work			0.717			0.590			0.897
No	1203	480 (39.9)		516	243 (47.1)			237 (34.5)	
Yes	1263	513 (40.6)		525	256 (48.8)			257 (34.8)	
Depressive symptoms (DS)			0.881			0.400			0.601
No DS	1891	763 (40.3)		821	388 (47.3)		1070	375 (35.0)	
Presence of DS	575	230 (40.0)		220	111 (50.5)		355	119 (33.5)	
Negative life events			0.623			0.167			0.042
No	959	392 (40.9)		396	179 (45.2)		563	213 (37.8)	
Yes	1507	601 (39.9)		645	320 (49.6)		862	281 (32.6)	

### Associations between psychosocial factors and hypertension

**Stress at home/work.** In the Ghanaian migrant population, a statistically significant association was found between stress at home/work and hypertension among women. In the age adjusted model, women who experienced stress at home/work had higher odds of hypertension compared to those who did not. This association remained after further adjustments for other covariates (adjusted odds ratio (AOR) = 1.29, 95% CI: 1.01–1.66). No associations were found between stress at home/work and hypertension among migrant men and in the non-migrant population (Table 3).

**Depression symptoms.** In the non-migrant population, women with depression symptoms were more likely to be hypertensive compared to those with no depression symptoms (Table 3). The association remained statistically significant after adjustment for the covariates (AOR = 1.36, 95% CI: 1.04–1.76). No associations were found between depression symptoms and hypertension among non-migrant men and in the migrant population.

**Negative life events.** A statistically significant association was found between negative life events and hypertension among non-migrant men. In the fully adjusted model (model 3), non-migrant men who reported experiencing negative life events had higher odds of hypertension compared to those who reported no negative life events (AOR = 1.51, 1.01–2.27). There was no statistically significant association between negative life events and hypertension among non-migrant women and in the migrant population (Table 3).

## Discussion

### Key findings

Findings from the study show that there was a statistically significant association between stress at home/work and hypertension among female migrants only. Presence of depression symptoms was significantly associated with higher odds of hypertension among female non-migrants only. In addition, the findings show that the experience of negative life events was associated with a higher likelihood of hypertension among non-migrant Ghanaian men only.

**Table 3.** Associations of psychosocial factors with hypertension prevalence in non-migrants and migrants, stratified by sex.

	Male			Female		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
<b>Non-migrants (Ghanaians in Ghana)</b>						
Stress at home/work						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.04 (0.73–1.48)	1.02 (0.69–1.50)	1.09 (0.72–1.64)	0.99 (0.77–1.27)	0.91 (0.69–1.20)	0.94 (0.71–1.25)
Depressive symptoms (DSs)						
No DS (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Presence of DS	1.42 (0.98–2.05)	1.41 (0.94–2.11)	1.37 (0.90–2.10)	1.48 (1.17–1.87) <sup>a</sup>	1.30 (1.01–1.68) <sup>b</sup>	1.36 (1.04–1.76) <sup>b</sup>
Negative life events						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.26 (0.89–1.80)	1.44 (0.97–2.14)	1.51 (1.01–2.27) <sup>b</sup>	0.93 (0.74–1.18)	0.95 (0.74–1.22)	0.96 (0.75–1.24)
<b>Migrants (Ghanaians in Europe)</b>						
Stress at home/work						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.12 (0.84–1.49)	1.15 (0.85–1.53)	1.11 (0.83–1.50)	1.32 (1.03–1.67) <sup>b</sup>	1.31 (1.02–1.69) <sup>b</sup>	1.29 (1.01–1.66) <sup>b</sup>
Depressive symptoms (DS)						
No DS (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Presence of DS	1.17 (0.83–1.66)	1.09 (0.76–1.57)	1.07 (0.74–1.55)	0.90 (0.68–1.19)	0.89 (0.67–1.20)	0.88 (0.66–1.18)
Negative life events						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.14 (0.87–1.51)	1.11 (0.83–1.47)	1.09 (0.81–1.45)	0.87 (0.69–1.09)	0.86 (0.68–1.10)	0.86 (0.68–1.11)

CI: confidence interval; OR: odds ratio; ref.: reference category; BMI: body mass index; CVD: cardiovascular disease.

Model 1: Psychosocial factors adjusted for age. Model 2: Psychosocial factors adjusted for age, education and employment status. Model 3: Psychosocial factors adjusted for age, education and employment status, smoking, physical activity, BMI, family history of CVD and length of stay (migrants only).

<sup>a</sup>Denotes statistical significance at 0.01 level.

<sup>b</sup>Denotes statistical significance at 0.05 level.

### Interpretation of key findings

Among Ghanaian migrant women, the association between stress and hypertension corroborates the finding of a similar study which showed that women evidenced greater odds of hypertension if they had experienced stress at work or home (Hu et al., 2015). Particularly for Ghanaian migrant women, inequalities at the domestic, social and economic levels may be important sources of stress. It has been suggested that female migrants are more susceptible to such stressors as they have to cope with these inequalities in addition to coping with discrimination, legal restrictions and structural barriers to healthcare in the host country (Heard et al., 2011; Irfaeya et al., 2008).

In such environments, female migrants may experience intense periods of irritability and anxiety, which may increase the risk of hypertension and other functional disorders (Irfaeya et al., 2008). Also, it is plausible that Ghanaian female migrants may not be able to better cope with the extra social and financial obligations to their relations back in Ghana, and this may increase the risk of stress (Beune et al., 2006).

These plausible explanations may also hold for migrant men; however, it is likely that female migrants (relative to

male migrants) have a higher vulnerability to stressors at home and/or work, which consequently leads to hypertension or other undesired health outcomes. Previous studies of physiological markers of emotional responses to stress have shown that women have a lower BP response than men (Allen et al., 1993).

Also, it is worth pointing out that in a previous study among Ghanaian and African–Surinamese migrants, stress was perceived by participants as an important contributor to hypertension (Beune et al., 2006). Although this study among Ghanaian and African–Surinamese migrants did not assess associations, it suggests that Ghanaian migrants recognize that stress could potentially lead to hypertension.

The finding in this study that non-migrant women with depression symptoms had higher odds of hypertension corroborates the assertion that depression is associated with, and increases the risk of, hypertension (Meng et al., 2012). In a recent similar study involving non-migrant women, depression was associated with an increase in the odds of hypertension after adjusting for age (Jackson et al., 2016). It is important to point out that the evidence of this association in other studies has been inconclusive (Levenstein et al., 2001; Shinn et al., 2001).

Generally, women tend to be more exposed than men to the factors that lead to depression symptoms or depression itself, which then increases their risk of hypertension (Aranda et al., 2001; Evans and Steptoe, 2002; McDonough and Walters, 2001). In addition, it is also likely that non-migrant women perceive and express stressors that lead to the manifestation of depression differently from men – which may also be the case for migrant women.

A plausible explanation to this study's finding is that depression and other mental health states or outcomes are usually not detected and treated in Ghanaian non-migrant populations partly due to the overburdened health system and a lack of priority to address mental health issues. A larger proportion of these undiagnosed and untreated cases of depression may be among women which consequently increases their risk of hypertension and other negative health outcomes. On the other hand, Ghanaian migrants often have access to a healthcare system which is able to diagnose and treat depression and other mental health conditions.

There are a number of possible pathways through which depression may contribute to the development of hypertension (Ginty et al., 2013). There is long-standing evidence that the regulation of adrenergic activity often fails in those with depression symptoms (Dwight and Stoudemire, 1997; Ford et al., 1998). The alterations in this adrenergic activity may play a role in sustaining elevated BP over a period of time (Davidson et al., 2000).

In addition, depression symptoms may negatively influence adherence to healthy behaviours and a general recognition of self-care, which may then lead to the development of hypertension. For example, the presence of depression symptoms may lead to a reduction in physical activity, uptake of smoking or the cultivation of unhealthy eating habits which are established risk factors of hypertension. Notwithstanding, it is important to point out that these mechanisms may differ from one setting to another (Davidson et al., 2000).

The study's findings also showed that among men in the non-migrant population, the experience of one or more negative life events increased the odds of hypertension. Negative life events have been long associated with hypertension in some studies (Schwartz et al., 2003; Sparrenberger et al., 2008). Nonetheless, the evidence remains inconclusive mainly due to differences in study design (Schwartz et al., 2003). Results of some studies have shown that men employ the use of a problem-focused coping approach to deal with acute stressors, while women use their social support systems and the emotion-focused coping approach in dealing with acute stressors (Eaton and Bradley, 2008; Watson and Sinha, 2008).

It is possible that non-migrant Ghanaian men are unable to better manage unexpected life events such as the loss of a close family or friend, the loss of a steady employment or major financial crisis. In many Ghanaian societies, men are expected to show bravery in the face of challenging life circumstances, and this may prevent them from utilizing or

taking advantage of the social support systems that may be in place. This may lead to elevations in BP during such periods. This association was not observed among men in the migrant population. It is plausible that the Ghanaian migrant population takes advantage of the social support systems that may be present in the host location during such periods.

### **Strengths and limitations**

A strength of this study is its contribution to knowledge on the evidence of the association between common mental health states and hypertension, a major public health burden in many SSA populations. In addition, the use of well-standardized methods across all study locations reduced measurement biases.

A limitation of this study is that it was cross-sectional in nature and therefore causal attributions should be inferred with caution. There is a possibility of reverse association/causation between hypertension and the psychosocial factors assessed in this study. Also, the self-reported nature of the stressors measured could have potentially introduced some level of reporting bias or socially desirable responses.

### **Conclusion**

The present analyses show that stress, depression symptoms and negative life events are associated with hypertension prevalence in Ghanaian populations, although the strength and direction of the associations differ by migration status (migrants and non-migrants) and sex (men and women). The findings suggest that addressing common mental health outcomes, such as stress and depressive symptoms, among Ghanaian populations in Ghana and in Europe may enhance emotional well-being and quality of life, and consequently contribute to reducing the burden of hypertension.

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### **Authors' contributions**

RBA, AdGA, FNAD and CA conceptualized the study. RBA analysed the data and wrote the first draft of the article. CA, AdGA, FNAD, KACM, EAJB, KK-G, JA, LS and SKB made important inputs to subsequent versions of the article. All authors read and approved the final article.

### **Declaration of conflicting interests**

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## References

- Addo J, Agyemang C, Smeeth L, et al. (2012) A review of population-based studies on hypertension in Ghana. *Ghana Medical Journal* 46(2): 4–11.
- Adepoju A (2008) *Migration and Social Policy in sub-Saharan Africa*. Geneva: International Organization for Migration.
- Agyemang C, Addo J, Bhopal R, et al. (2009) Cardiovascular disease, diabetes and established risk factors among populations of sub-Saharan African descent in Europe: A literature review. *Globalization and Health* 5(1): 7.
- Agyemang C, Beune E, Meeks K, et al. (2014) Rationale and cross-sectional study design of the research on obesity and type 2 diabetes among African migrants: The RODAM study. *BMJ Open* 4(3): e004877.
- Agyemang C, Kieft S, Snijder MB, et al. (2015) Hypertension control in a large multi-ethnic cohort in Amsterdam, The Netherlands: The HELIUS study. *International Journal of Cardiology* 183: 180–189.
- Agyemang C, Kunst A, Bhopal R, et al. (2010) A cross-national comparative study of blood pressure and hypertension between English and Dutch South-Asian and African-origin populations: The role of national context. *American Journal of Hypertension* 23(6): 639–648.
- Agyemang C, Nyaaba G, Beune E, et al. (2018) Variations in hypertension awareness, treatment, and control among Ghanaian migrants living in Amsterdam, Berlin, London, and nonmigrant Ghanaians living in rural and urban Ghana—the RODAM study. *Journal of Hypertension* 36(1): 169–177.
- Allen MT, Stoney CM, Owens JF, et al. (1993) Hemodynamic adjustments to laboratory stress: The influence of gender and personality. *Psychosomatic Medicine* 55: 505–517.
- Aranda MP, Castaneda I, Lee PJ, et al. (2001) Stress, social support, and coping as predictors of depressive symptoms: Gender differences among Mexican Americans. *Social Work Research* 25(1): 37–48.
- Ataklte F, Erqou S, Kaptoge S, et al. (2015) Burden of undiagnosed hypertension in sub-Saharan Africa: A systematic review and meta-analysis. *Hypertension* 65(2): 291–298.
- Awuah RB, Anarfi JK, Agyemang C, et al. (2014) Prevalence, awareness, treatment and control of hypertension in urban poor communities in Accra, Ghana. *Journal of Hypertension* 32(6): 1203–1210.
- Beune EJ, Haafkens JA, Schuster JS, et al. (2006) ‘Under pressure’: How Ghanaian, African-Surinamese and Dutch patients explain hypertension. *Journal of Human Hypertension* 20(12): 946–955.
- Campbell NR, Bovet P, Schutte AE, et al. (2015) High blood pressure in sub-Saharan Africa: Why prevention, detection, and control are urgent and important. *The Journal of Clinical Hypertension* 17(9): 663–667.
- Davidson K, Jonas BS, Dixon KE, et al. (2000) Do depression symptoms predict early hypertension incidence in young adults in the CARDIA study? *Archives of Internal Medicine* 160(10): 1495–1500.
- Dwight MM and Stoudemire A (1997) Effects of depressive disorders on coronary artery disease: A review. *Harvard Review of Psychiatry* 5(3): 115–122.
- Eaton RJ and Bradley G (2008) The role of gender and negative affectivity in stressor appraisal and coping selection. *International Journal of Stress Management* 15(1): 94–115.
- Evans O and Steptoe A (2002) The contribution of gender-role orientation, work factors and home stressors to psychological well-being and sickness absence in male and female-dominated occupational groups. *Social Science & Medicine* 54(4): 481–492.
- Ford DE, Mead LA, Chang PP, et al. (1998) Depression is a risk factor for coronary artery disease in men: The precursors study. *Archives of Internal Medicine* 158(13): 1422–1426.
- Ginty AT, Carroll D, Roseboom TJ, et al. (2013) Depression and anxiety are associated with a diagnosis of hypertension 5 years later in a cohort of late middle-aged men and women. *Journal of Human Hypertension* 27(3): 187–190.
- Gu Q, Burt VL, Dillon CF, et al. (2012) Trends in antihypertensive medication use and blood pressure control among United States adults with hypertension: The National Health and Nutrition Examination Survey, 2001 to 2010. *Circulation* 126(17): 2105–2114.
- Guimont C, Brisson C, Dagenais GR, et al. (2006) Effects of job strain on blood pressure: A prospective study of male and female white-collar workers. *American Journal of Public Health* 96(8): 1436–1443.
- Heard E, Whitfield KE, Edwards CL, et al. (2011) Mediating effects of social support on the relationship among perceived stress, depression, and hypertension in African Americans. *Journal of the National Medical Association* 103(2): 116–122.
- Hu B, Liu X, Yin S, et al. (2015) Effects of psychological stress on hypertension in middle-aged Chinese: A cross-sectional study. *PLoS ONE* 10(6): e0129163.
- Humphries N, Brugha R and McGee H (2009) Sending money home: A mixed-methods study of remittances by migrant nurses in Ireland. *Human Resources for Health* 7(1): 66.
- Ibekwe RU (2015) Modifiable risk factors of hypertension and socio demographic profile in Oghara, Delta state; prevalence and correlates. *Annals of Medical and Health Sciences Research* 5(1): 71–77.
- Ikram UZ, Snijder MB, Fassaert TJ, et al. (2015) The contribution of perceived ethnic discrimination to the prevalence of depression. *The European Journal of Public Health* 25(2): 243–248.
- Irfaeya M, Maxwell AE and Krämer A (2008) Assessing psychological stress among Arab migrant women in the city of Cologne/Germany using the Community Oriented Primary Care (COPC) approach. *Journal of Immigrant and Minority Health* 10(4): 337–344.
- Jackson CA, Pathirana T and Gardiner PA (2016) Depression, anxiety and risk of hypertension in mid-aged women: A prospective longitudinal study. *Journal of Hypertension* 34(10): 1959–1966.



- Kroenke K, Spitzer RL and Williams JB (2001) The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine* 16(9): 606–613.
- Kuo B (2014) Coping, acculturation, and psychological adaptation among migrants: A theoretical and empirical review and synthesis of the literature. *Health Psychology and Behavioral Medicine* 2: 6–33.
- Levenstein S, Smith MW and Kaplan GA (2001) Psychosocial predictors of hypertension in men and women. *Archives of Internal Medicine* 161(10): 1341–1346.
- Lewis TT, Everson-Rose SA, Powell LH, et al. (2006) Chronic exposure to everyday discrimination and coronary artery calcification in African-American women: The SWAN Heart Study. *Psychosomatic Medicine* 68(3): 362–368.
- McDonough P and Walters V (2001) Gender and health: Reassessing patterns and explanations. *Social Science & Medicine* 52(4): 547–559.
- Markovitz JH, Matthews KA, Whooley M, et al. (2004) Increases in job strain are associated with incident hypertension in the CARDIA Study. *Annals of Behavioral Medicine* 28(1): 4–9.
- Meng L, Chen D, Yang Y, et al. (2012) Depression increases the risk of hypertension incidence: A meta-analysis of prospective cohort studies. *Journal of Hypertension* 30(5): 842–851.
- Modesti PA, Reboldi G, Cappuccio FP, et al. (2016) Panethnic differences in blood pressure in Europe: A systematic review and meta-analysis. *PLoS ONE* 11(1): e0147601.
- Neylon A, Canniffe C, Anand S, et al. (2013) A global perspective on psychosocial risk factors for cardiovascular disease. *Progress in Cardiovascular Diseases* 55(6): 574–581.
- Nilsson E (2010) Psychological factors related to physical, social, and mental dimensions of the SF-36: A population-based study of middle-aged women and men. *Patient Related Outcome Measures* 1: 153–162.
- Okereke O and Manson J (2017) Psychosocial factors and cardiovascular disease risk. *Circulation Research* 120: 1855–1856.
- Pikhart H and Pikhartova J (2015) *The Relationship Between Psychosocial Risk Factors and Health Outcomes of Chronic Diseases: A Review of the Evidence for Cancer and Cardiovascular Diseases* (Health Evidence Network [HEN] Synthesis Report). Copenhagen, Denmark: WHO Regional Office for Europe.
- Pilakkadavath Z and Shaffi M (2016) Modifiable risk factors of hypertension: A hospital-based case-control study from Kerala, India. *Journal of Family Medicine and Primary Care* 5(1): 114–119.
- Rosengren A, Hawken S, Ôunpuu S, et al. (2004) Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): Case-control study. *The Lancet* 364(9438): 953–962.
- Sanuade OA, Awuah RB and Kushitor M (2018a) Hypertension awareness, treatment and control in Ghana: A cross-sectional study. *Ethnicity & Health* 16: 1–5.
- Sanuade OA, Boatemaa S and Kushitor MK (2018b) Hypertension prevalence, awareness, treatment and control in Ghanaian population: Evidence from the Ghana demographic and health survey. *PLoS ONE* 13(11): e0205985.
- Schwartz AR, Gerin W, Davidson KW, et al. (2003) Toward a causal model of cardiovascular responses to stress and the development of cardiovascular disease. *Psychosomatic Medicine* 65(1): 22–35.
- Seedat Y, Ali A and Ferdinand K (2018) Hypertension and cardiovascular disease in the sub-Saharan African context. *Annals of Translational Medicine* 6(15): 297–297.
- Shinn EH, Poston WS, Kimball KT, et al. (2001) Blood pressure and symptoms of depression and anxiety: A prospective study. *American Journal of Hypertension* 14(7): 660–664.
- Sparrenberger F, Fuchs SC, Moreira LB, et al. (2008) Stressful life events and current psychological distress are associated with self-reported hypertension but not with true hypertension: Results from a cross-sectional population-based study. *BMC Public Health* 8(1): 357.
- Watson DC and Sinha B (2008) Emotion regulation, coping, and psychological symptoms. *International Journal of Stress Management* 15(3): 222–234.
- World Health Organization (WHO) (2011) *Global Status Report on Noncommunicable Diseases 2010*. Geneva: WHO.
- World Health Organization (WHO) (2013) *Global Brief on Hypertension: Silent Killer, Global Public Health Crisis*. Geneva: WHO.
- World Health Organization, International Society of Hypertension Writing Group (2003) 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. *Journal of Hypertension* 21(11): 1983–1992.
- Wu J, Li T, Song X, et al. (2018) Prevalence and distribution of hypertension and related risk factors in Jilin Province, China 2015: A cross-sectional study. *BMJ Open* 8(3): e020126.