

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

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Objectives: Hypertension is a major burden among African migrants, but the extent of the differences in prevalence, treatment, and control among similar African migrants and nonmigrants living in different contexts in high-income countries and rural and urban Africa has not yet been assessed. We assessed differences in hypertension prevalence and its management among relatively homogenous African migrants (Ghanaians) living in three European cities (Amsterdam, London, and Berlin) and nonmigrants living in rural and urban Ghana.

Methods: A multicenter cross-sectional study was conducted among Ghanaian adults ($n = 5659$) aged 25–70 years. Comparisons between sites were made using prevalence ratios with adjustment for age, education, and BMI.

Results: The age-standardised prevalence of hypertension was 22 and 28% in rural Ghanaian men and women. The prevalence was higher in urban Ghana [men, 34%; adjusted prevalence ratio = 1.37, 95% confidence interval (CI), 1.10–1.70]; and much higher in migrants in Europe, especially in Berlin (men, 57%; prevalence ratio = 2.21, 1.78–2.73; women, 51%; prevalence ratio = 1.74, 1.45–2.09) than in rural Ghana. Hypertension awareness and treatment levels were higher in Ghanaian migrants than in nonmigrant Ghanaians. However, adequate hypertension control was lower in Ghanaian migrant men in Berlin (20%; prevalence ratio = 0.43 95%, 0.23–0.82), Amsterdam (29%; prevalence ratio = 0.59, 0.35–0.99), and London (36%; prevalence ratio = 0.86, 0.49–1.51) than rural Ghanaians (59%). Among women, no differences in hypertension control were observed. About 50% of migrants to 85% of rural Ghanaians with severe hypertension (Blood pressure > 180/110) were untreated.

Antihypertensive medication prescription patterns varied considerably by site.

Conclusion: Hypertension prevalence, awareness, and treatment levels were generally higher in African migrants, but blood pressure control level was lower in Ghanaian migrant men compared with their nonmigrant peers.

Journal of Hypertension 2017, 35:000–000

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Received 14 May 2017 **Revised** 30 June 2017 **Accepted** 17 July 2017

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DOI:10.1097/HJH.0000000000001520

Further work is needed to identify key underlying factors to support prevention and management efforts.

Supplement Figure 1, <http://links.lww.com/HJH/A831>.

Keywords: ethnic minority groups, Europe, Ghana, hypertension, hypertension therapy, migration, Research on Obesity and Diabetes among African Migrants study

Abbreviations: BP, blood pressure; CCB, calcium channel blockers; RAS, renin–angiotensin–aldosterone system; RODAM, Research on Obesity and Diabetes among African Migrants; SSA, Sub-Saharan African

INTRODUCTION

Hypertension is the most important preventable cause of cardiovascular disease worldwide and it is highly prevalent among Sub-Saharan African (SSA) descent populations living in high-income countries [1–7]. The magnitude of the hypertension burden among SSA descent populations, however, varies across high-income countries. In an earlier study using existing databases in England and the Netherlands, a higher prevalence of hypertension was found among African Caribbeans living in the Netherlands than African Caribbeans living in England [7], suggesting potential unique environmental factors contributing to the development of hypertension among these populations. Furthermore, the prevalence of hypertension is rising in SSA, with a large number of people with hypertension being undiagnosed [8,9].

In addition, poor hypertension control has been found among SSA descent hypertensive patients living in diverse settings [4–8]. The poor hypertension control is particularly disturbing as it is a serious risk factor for adverse cardiovascular events such as stroke and target organ damage [10]. Studies have consistently shown that adequate hypertension control significantly reduces the occurrence of cardiovascular events and premature deaths and therefore, effective hypertension management has been recommended as an important strategy in preventing cardiovascular complications and premature deaths associated with hypertension [11,12]. Evidence indicates variations in responses to different antihypertensive agents in different ethnic groups [13]. For example, antihypertensive agents such as thiazide diuretics and calcium channel blockers (CCB) have been shown to be more effective in controlling hypertension in SSA descent populations than other antihypertensive agents such as renin–angiotensin–aldosterone system (RAS) or β -blocking agents [13]. As a result, current hypertension guidelines recommend thiazide diuretics and CCB for hypertensive patients of SSA descent [11,12], but data on antihypertensive prescription patterns among these populations are lacking in different high-income countries, and in SSA in general. As health systems, adoption and adherence to hypertension treatment guidelines, and access to antihypertensive therapy differ importantly across countries [11–17], it is important to assess the situation in different countries where migrant populations reside as well as rural and urban communities in Africa to aid prevention and clinical management efforts.

Migration studies involving relatively homogeneous migrant populations living in different high-income countries as well as the source population in the country of origin provide innovative ways of assessing the role of contexts and migration on hypertension risk and its management outcomes [18]. However, such data are so far lacking in migrant populations. Earlier studies used migration surrogates such as comparison of African descent populations living in diverse geographic environments [19,20]. Key limitations of the earlier studies relate to the diverse nature of the African populations studied including genetic admixture populations as these populations left Africa several centuries ago under different circumstances [21]. Furthermore, earlier studies [19,20] lack data on hypertension treatment and control.

The main aim of this study was, therefore, to assess the prevalence of hypertension, level of hypertension awareness and treatment, and control among relatively homogenous SSA migrants (Ghanaians) living in three European countries and their counterparts living in rural or urban Ghana. In addition, we assessed antihypertensive medication prescription patterns across sites.

METHODS

Study population and study design

The Research on Obesity and Diabetes among African Migrants (RODAM) study was a multicenter cross-sectional study. The full details of the study, including rationale, conceptual framework, design, and methodology of the RODAM study have been described elsewhere [18,22,23]. In short, the study was carried out between 2012 and 2015 and it included Ghanaians aged 25–70 years living in rural and urban Ghana, and three European cities, including Amsterdam, The Netherlands; Berlin, Germany; and London, United Kingdom. The respective ethics committees in Ghana, and the three European countries approved the study protocols before data collection began in each country. Informed written consent was obtained from each study participant prior to the enrolment in the study. The response rate was 76% in rural Ghana and 74% in urban Ghana. In London and Berlin, of those individuals that were registered in the various Ghanaian organizations and were invited, 75 and 68%, respectively, agreed and participated in the study. In Amsterdam, we received a response from 67% of those invited. Of these, 53% agreed and participated in the study. About 99% of the Ghanaian participants in Europe were first generation migrants.

Measurements

Information on sociodemographics, education level, medical history, treatment and lifestyle, and psychosocial stress was obtained by questionnaire. Smoking status was assessed as a positive answer to the question ‘Do you smoke at all?’ Physical activity level was assessed using the WHO Global Physical Activity Questionnaire including frequency, duration, and intensity of the various types of major activities in the domains of work-related physical activity, active commuting, and leisure time physical activity [24]. Metabolic equivalents/week was determined using the

compendium of Ainsworth [25], and was categorized into low and high physical activity. The patient health questionnaire 9 was used to assess the presence of depressive symptoms [25]. A presence of depressive symptoms was defined as patient health questionnaire 9 score of at least 10 points according to the recommended threshold [25]. Energy intake was assessed using the standardized food propensity questionnaire developed specifically for Ghanaian populations, based on the European food propensity questionnaire [26].

Physical examination was done with validated devices according to standardized operational procedures across all study sites. All the anthropometrics were measured two times by the same assessor and the mean of the two measurements were used for analyses. Weight was measured in light clothing and without shoes with SECA 877 (SECA, Hamburg, Germany) weighing scales to the nearest 0.1 kg. Height was measured without shoes and in light clothing with a portable stadiometer (SECA 217) to the nearest 0.1 cm. BMI was calculated as weight (kg) divided by height squared (m^2). Blood pressure (BP) was measured three times using a validated semiautomated device (the Microlife WatchBP home Widnau, Switzerland) with appropriate cuffs in a sitting position after at least 5-min rest. The mean of the last two readings was used in the analyses. Hypertension was defined as SBP at least 140 mmHg, or DBP at least 90 mmHg, or being on antihypertensive medication [11,12]. Hypertension awareness was defined as the proportion of individuals with hypertension who self-reported any prior diagnosis of hypertension by a healthcare professional. Hypertension treatment was defined as the proportion of hypertensives who were prescribed antihypertensive medication for high BP management. Adequate hypertension control was defined as the proportion of hypertensives on antihypertensive medication with SBP less than 140 mmHg and DBP less than 90 mmHg. Furthermore, all the study participants were asked to bring their prescribed medications to the research location and the antihypertensive agents were identified and categorized using anatomical therapeutic chemical classification system: diuretics, β -blockers, CCBs, and agents acting on RAS and centrally acting antihypertensives [27].

Data analysis

The study population characteristics were expressed as percentages for categorical variables and means for continuous variables with corresponding 95% confidence intervals (CI). Age-standardized prevalence rates of hypertension, awareness, treatment, and control were calculated using the direct method, with the standards being the age distribution of the total RODAM population. Prevalence ratios and 95% CIs were estimated using Poisson regression with robust variance to study differences in hypertension prevalence levels of awareness, treatment, and control between rural Ghanaians and their Ghanaian compatriots living in urban Ghana and the various European countries with adjustment for age, educational levels, and BMI. Analyses were stratified by sex. All analyses were performed using STATA 14.0 (Stata Corp, College Station, Texas, USA).

RESULTS

Characteristics of the study population

Of the 6385 people that participated, 5659 were included in the analysis after exclusion of those with missing data and outside the age range. The mean age was similar across sites although men in Amsterdam and Berlin were marginally older than in other sites. Rural Ghanaians were the least educated group, whereas London Ghanaians were the most educated group (Table 1). Berlin Ghanaians were the most likely to smoke and had the highest total energy intake in both men and women compared with other sites. Urban Ghanaians had the lowest mean energy intake. London Ghanaian men were the most likely, whereas rural Ghanaian men were the least likely to be physical inactivity. Among women, Berlin Ghanaians were the most, whereas Amsterdam Ghanaians were the least physical inactive. Amsterdam Ghanaians had the highest prevalence of depressive symptoms in both men and women, whereas urban Ghanaians were the least likely to report depressive symptoms. The mean anthropometrics and BP levels varied substantially across sites, with rural Ghanaians having lower mean levels than their peers in urban Ghana and Europe.

Prevalence of hypertension

Figure 1a and b shows age-standardized hypertension prevalence, awareness, treatment, and control by site in men and women. Age-standardized hypertension prevalence ranged from 22% in rural Ghana, 34% in urban Ghana to 58% in Ghanaians in Amsterdam in men; and from 28% in rural Ghanaians, 29% in urban Ghanaians to 51% in London Ghanaians in women. Compared with rural Ghanaian men, the adjusted prevalence ratios of hypertension were higher among Ghanaians living in all sites ranging from 1.37 (95% CI, 1.10–1.70) in urban Ghanaian men to 2.21 (1.78–2.73) in Ghanaian migrant men in Berlin (Fig. 2a), and from 1.45 (1.25–1.68) in Amsterdam Ghanaian women to 1.74 (1.45–2.09) in Ghanaian women in Berlin (Fig. 2b). The adjusted prevalence ratio of hypertension did not differ between rural and urban Ghanaian women. These differences remained the same when we additionally adjusted for lifestyle factors (i.e. energy intake, physical activity, and smoking) and depressive symptoms in the regression models (Supplementary Table 1, <http://links.lww.com/HJH/A830>). Large proportions of the study participants were prehypertensives (BP 120–139/80–89 mmHg) in both men (Fig. 3a) and women (Fig. 3b). Figure 3 shows that stage 2 (BP 160–179/100–109 mmHg) and stage 3 hypertension (BP > 180/110 mmHg) were common in all sites.

Levels of hypertension awareness, treatment, and control

Age-standardized hypertension awareness ranged from 30% in rural Ghana to about 61% in Ghanaians in Berlin in men, and from 44% in rural Ghana to about 70% among Ghanaian migrant women in Berlin (Fig. 1a and b). The adjusted prevalence ratio of hypertension awareness did not differ between rural Ghana and urban Ghana, but the adjusted prevalence ratios were 1.7–2 times higher in

TABLE 1. Characteristics of the population by site and sex

	Rural Ghanaians	Urban Ghanaians	Amsterdam Ghanaians	Berlin Ghanaians	London Ghanaians
Men	(n = 405)	(n = 415)	(n = 609)	(n = 297)	(n = 410)
Age (years)	46.2 (45.0, 47.5)	46.5 (45.4, 47.7)	48.4 (47.7, 49.2)	45.8 (44.6, 47.0)	46.1 (45.0, 47.1)
Education level (%)					
None or elementary	39.0 (34.4, 43.8)	22.2 (18.4, 26.4)	20.5 (17.5, 23.9)	6.1 (3.9, 9.4)	3.9 (2.4, 6.3)
Lower secondary	36.1 (31.5, 40.9)	42.4 (37.7, 47.2)	40.6 (36.7, 44.5)	47.8 (42.2, 53.5)	24.9 (20.9, 29.3)
Higher secondary	13.3 (10.4, 17.0)	20.5 (16.9, 24.6)	25.1 (21.8, 28.7)	28.3 (23.4, 33.7)	16.8 (13.5, 20.8)
Tertiary education	5.7 (3.8, 8.4)	9.2 (6.7, 12.3)	8.2 (6.2, 10.7)	17.5 (13.6, 22.3)	41.0 (36.3, 45.8)
Unknown	5.9 (4.0, 8.7)	5.8 (6.9, 8.5)	5.6 (4.0, 7.7)	0.3 (0.0, 2.4)	13.4 (10.4, 17.7)
Current smoking, yes (%)	5.8 (3.8–8.6)	3.3 (1.9–5.6)	8.1 (6.1–10.7)	14.8 (11.2–19.3)	1.4 (1.0–3.2)
Physical activity, low (%)	10.9 (8.1, 14.4)	22.7 (18.8, 27.2)	21.8 (17.9, 26.3)	24.9 (20.3, 30.2)	54.6 (40.3, 50.9)
Depressive symptoms (%)	5.1 (3.2, 7.8)	2.8 (1.6, 5.0)	7.3 (5.4, 9.8)	4.8 (2.8, 7.9)	6.4 (4.2, 9.7)
Total energy intake, kcal/day	3041.8 (2895.3, 3188.3)	2431.5 (2354.1, 2508.9)	2677.2 (2572.4, 2781.97)	3317.2 (3151.2, 3483.2)	3186.7 (3011.9, 3361.4)
BMI (kg/m ²)	20.9 (20.6, 21.2)	24.1 (23.8, 24.5)	27.0 (26.7, 27.3)	26.4 (26.0, 26.9)	27.5 (27.1, 27.9)
SBP (mmHg)	123.9 (122.0, 125.7)	131.0 (129.0, 133.0)	138.2 (136.8, 139.6)	138.9 (136.8, 141.0)	136.6 (134.9, 138.3)
DBP (mmHg)	77.4 (76.3, 78.4)	82.2 (81.0, 83.5)	87.9 (87.0, 88.8)	88.7 (87.4, 90.0)	84.6 (83.6, 85.7)
Women	(n = 638)	(n = 1034)	(n = 931)	(n = 250)	(n = 670)
Age (years)	46.7 (45.7, 47.6)	44.7 (44.1, 45.4)	45.6 (45.0, 46.1)	44.7 (43.5, 45.8)	47.7 (46.9, 48.5)
Education level (%)					
None or elementary	62.2 (58.4, 65.9)	50.5 (47.5, 53.6)	40.8 (37.7, 44.0)	11.6 (8.2, 16.2)	10.0 (8.0, 12.5)
Lower secondary	26.0 (22.8, 29.6)	35.9 (33.0, 38.9)	30.7 (27.8, 33.7)	54.0 (47.8, 60.1)	28.9 (26.5, 33.4)
Higher secondary	3.0 (1.9, 4.6)	8.5 (7.0, 10.4)	17.9 (15.5, 20.5)	24.8 (19.8, 30.5)	24.2 (21.1, 27.6)
Tertiary education	1.9 (1.1, 3.3)	2.7 (1.9, 3.9)	3.8 (2.7, 5.2)	7.6 (4.9, 11.6)	22.1 (19.1, 25.3)
Unknown	6.9 (5.2, 9.2)	2.3 (1.6, 3.4)	6.9 (5.4, 8.7)	6.9 (5.4, 8.7)	2.0 (1.0, 4.7)
Current smoking, yes (%)	0.0 (0.0–0.1)	0.1 (0.0–1.0)	2.1 (1.3–3.4)	3.3 (1.6 (6.3)	0.2 (0.0–1.2)
Physical activity, low (%)	22.3 (20.0, 26.8)	40.6 (37, 43.7)	17.4 (14.7, 20.7)	30.9 (27.2, 39.2)	46.1 (42.0, 50.3)
Depressive symptoms (%)	7.8 (6.0, 10.4)	4.2 (3.1, 5.6)	9.9 (8.1, 12.2)	5.7 (4.0, 8.0)	6.4 (4.2, 9.7)
Total energy intake, kcal/day	2918.2 (2812.8, 3023.6)	2293.3 (2249.6, 2337.0)	2471.2 (2394.7, 2782.0)	3317.2 (3151.2, 3483.2)	3186.7 (3011.9, 3361.4)
BMI (kg/m ²)	23.7 (23.3, 24.0)	28.0 (27.7, 28.3)	30.3 (30.0, 30.6)	29.1 (28.5, 29.7)	30.9 (30.5, 31.3)
SBP (mmHg)	123.7 (122.0, 125.5)	124.7 (123.5, 125.9)	131.9 (130.8, 133.0)	132.0 (129.7, 134.3)	134.4 (133.1, 135.7)
DBP (mmHg)	76.9 (76.0, 77.9)	78.3 (77.6, 79.0)	82.0 (81.4, 82.7)	83.6 (82.2, 85.0)	82.3 (81.5, 83.0)

Values are means or % with corresponding 95% confidence intervals. BP, blood pressure.

European cities than in rural Ghana in men (Fig. 2a). Among women, adjusted prevalence ratio of hypertension awareness were higher in all sites than in rural Ghanaians although 95% CI slightly overlapped in urban Ghanaians (Fig. 2b). Age-standardized hypertension treatment was lower in both rural (men 19%, women 32%) and urban Ghanaians (men 18%, women 41%) than their counterparts in Europe ranging from 44% in London to 49% in Berlin in men, and 56% in London to 63% in Berlin in women (Fig. 1a and b). The adjusted prevalence ratio of treatment was 2–2.3 times higher in men, and from 1.5 to 1.8 times higher in women in European sites than in rural Ghana (Fig. 2a and b). The adjusted prevalence ratio of hypertension treatment did not differ between rural and urban

Ghana. Large proportions of the participants with severe hypertension (BP > 180/110 mmHg) were not under treatment ranging from 50% in London and Berlin to 85% in rural Ghana (Fig. 4).

Despite the higher levels of awareness and treatment, adequate hypertension control was significantly lower in Ghanaian migrant men in all the European cities, particularly in Berlin with control rate among treated hypertensive patients being 20% in Berlin compared with nearly 59% in rural Ghana. These differences persisted in adjusted models in Amsterdam (prevalence ratio = 0.59, 0.35–0.99) and in Berlin (prevalence ratio = 0.43, 0.23–0.82) compared with rural Ghanaian men. Adequate hypertension control rates did not differ among women across all sites.

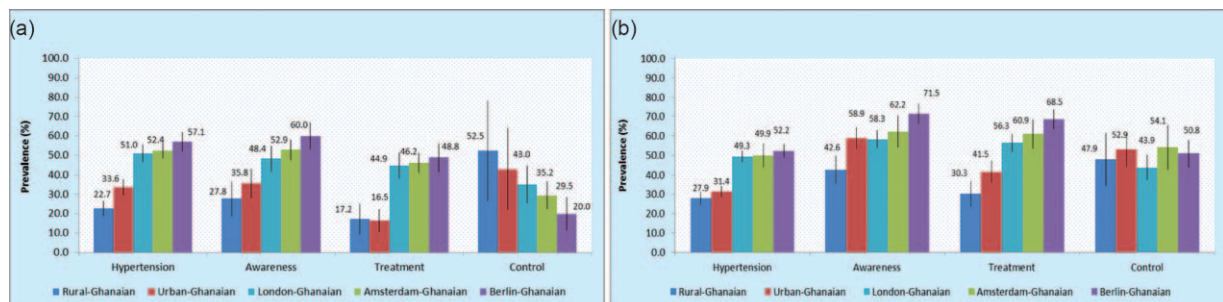


FIGURE 1 Age-standardized hypertension prevalence, awareness, treatment, and control by site in men (a) and women (b).

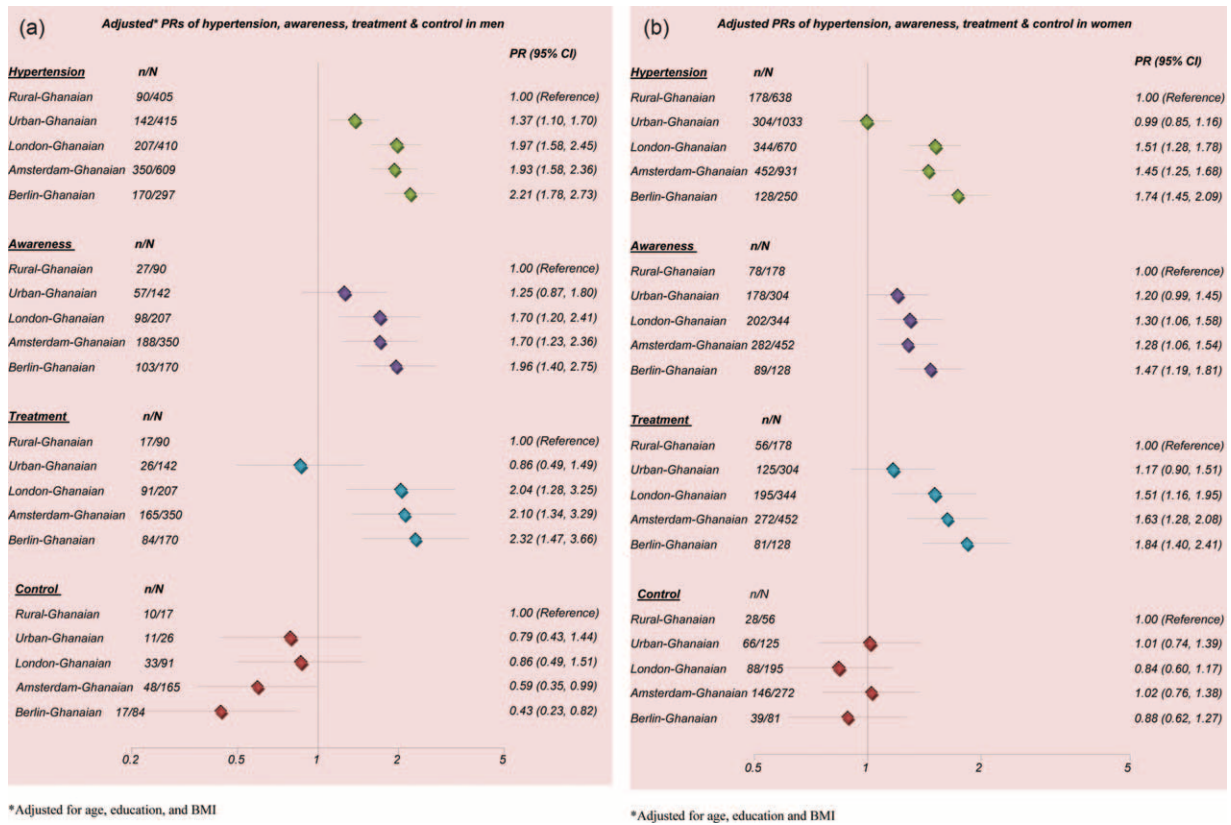


FIGURE 2 (a) Adjusted prevalence ratios of hypertension, awareness, treatment and control in men, *Adjusted for age, education, and BMI. (b) Adjusted prevalence ratios of hypertension, awareness, treatment and control in women, *Adjusted for age, education, and BMI. PR, prevalence ratio; CI, confidence interval.

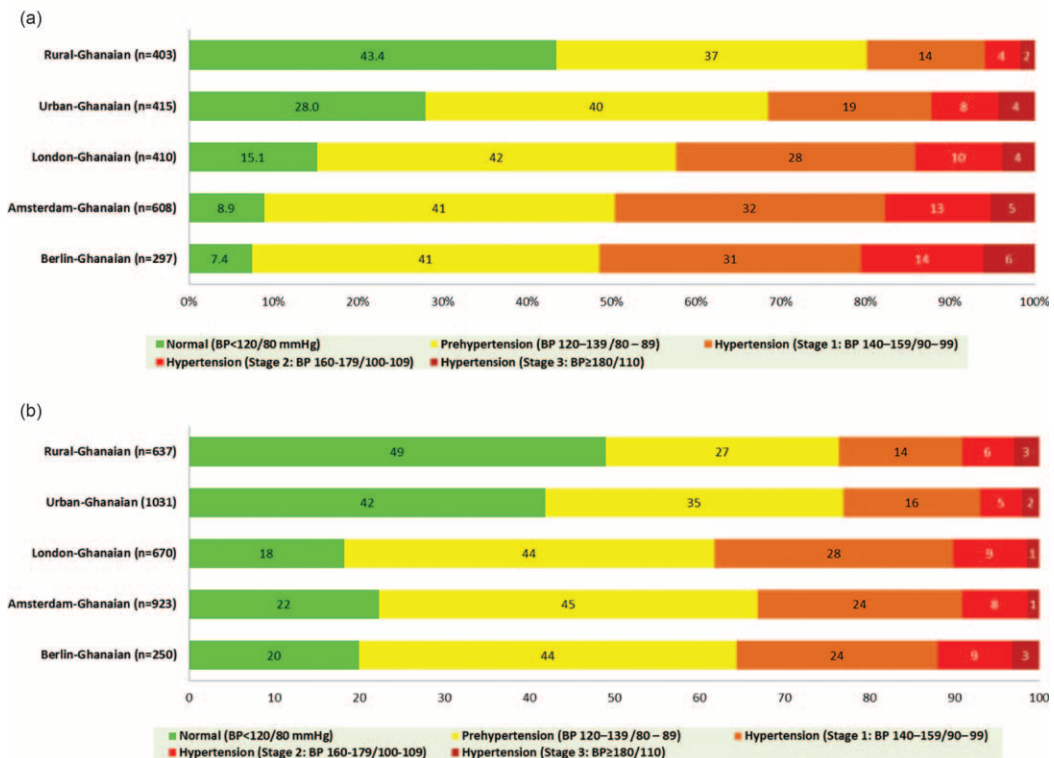


FIGURE 3 Classification of blood pressure levels (mmHg) by site in men (a) and women (b). BP, blood pressure.

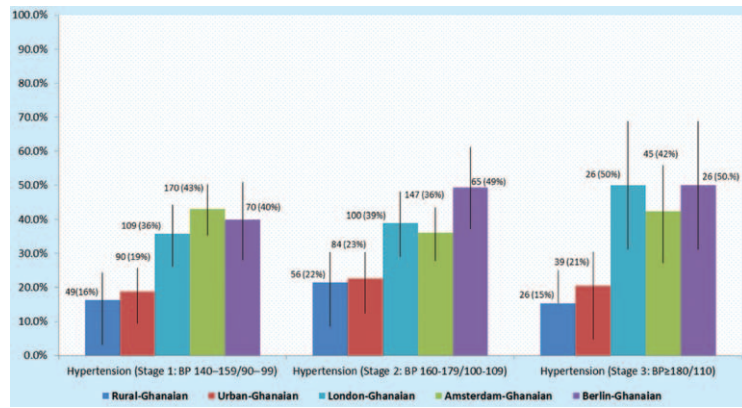


FIGURE 4 Treatment in hypertension categories by site (men and women combined because of small numbers). Figures are numbers and percentages with corresponding 95% CI. BP, blood pressure.

Antihypertensive medication prescription patterns among Ghanaians in different locations

Antihypertensive medication prescription patterns varied considerably by site with the Berlin Ghanaians showing the most striking differences (Fig. 5). Hypertensive Ghanaian men (Fig. 5a) and women (Fig. 5b) in Berlin were significantly the least likely to be prescribed diuretics and CCBs. By contrast, RAS blocking prescription was significantly more likely to be prescribed in Berlin than all sites in both men and women. β-blockers were significantly more likely to be prescribed in London and rural Ghana than other sites. No clear differences were observed for centrally acting antihypertensives among the groups.

DISCUSSION

Key findings

Our findings show higher prevalence rates of hypertension in urban Ghana and Ghanaian migrants in Europe compared with their rural Ghanaian counterparts. Hypertension awareness and treatment levels were generally higher in Ghanaian migrants in Europe, but adequate BP control level was lower in Ghanaian migrant men in Amsterdam and Berlin compared with their rural Ghanaian counterparts. About half of Ghanaian migrants in Europe to 85% of rural Ghanaians with severe hypertension were untreated. Antihypertensive medication prescription patterns varied

considerably by site with Berlin Ghanaians being the least likely to be prescribed recommended antihypertensives for SSA populations.

Limitations and strengths

There are limitations to our study [22]. First of all, as in most epidemiological studies, hypertension definition was based on three measurements on a single occasion. Second, although the same methods were applied in all sites, the recruitment strategies had to be adapted to suit the local situations because of differences in registration systems. In addition, about 7% of the study population that agreed to participate did not attend physical examination. The non-response analysis shows that nonrespondents were younger than respondents in all sites; and were more often men than women in all sites except for Berlin. Further non-response analysis in Berlin also showed that the distribution of respondents and nonrespondents across Berlin city districts was, however, fairly similar. Furthermore, evidence suggests that most Ghanaian migrants in Europe are affiliated with Ghanaian organizations [22,28] indicating that members within these organizations may be representative of the Ghanaian populations living in different European countries. Additionally, some of our measures such as hypertension awareness and educational level were based on self-report, which may be subject to reporting bias. Furthermore, we lack data on important factors such as locus of control, and health beliefs, which could influence

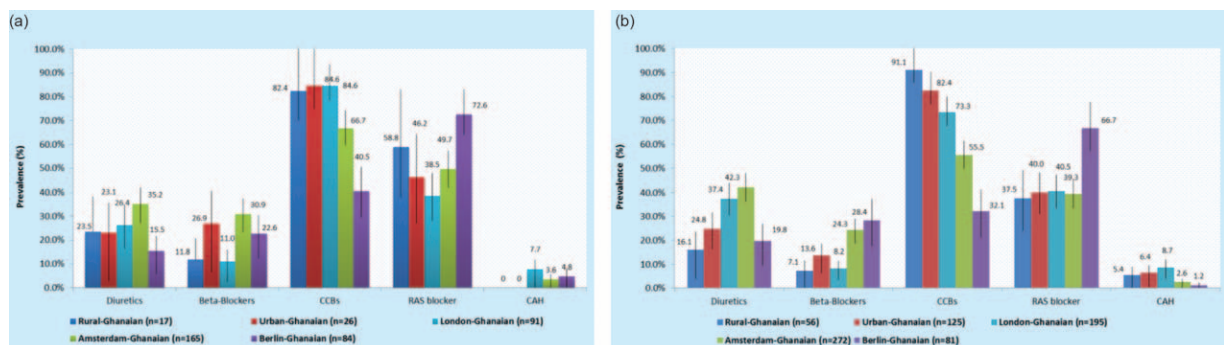


FIGURE 5 Antihypertensive prescription use among treated hypertensives by site in men (a) and women (b). CAH, centrally acting antihypertensives; CCB, calcium channel blockers; RAS, renin-angiotensin-aldosterone system.

hypertension management and outcomes. Notwithstanding, the study provides novel and relevant findings on hypertension burden and management outcomes among African populations. A major strength of the RODAM study is the use of well standardized approaches across the five study sites. Another unique strength of the RODAM study is the relatively homogenous nature of the study population of Ghanaians living in different locations in rural and urban Ghana and three European countries.

Discussion of the key findings

Prevalence of hypertension

Our findings show higher prevalence of hypertension in urban Ghana and Ghanaian migrants in Europe compared with rural Ghanaians although the magnitude of the differences were considerably higher among migrants in Europe than in urban Ghanaians. The higher rate of hypertension in urban Ghana compared with rural Ghana is consistent to earlier studies [8,9,29]. About half of the study populations in all the European sites have hypertension and the rates are higher than the European local populations. In the Healthy Life in an Urban Setting (HELIUS) study in Amsterdam, hypertension prevalence among Dutch local population was 34% in men and 19% in women compared with 58% and 49% in Amsterdam Ghanaian men and women observed in our current study [4]. Likewise, in the 2011 Health Survey for England, the prevalence of hypertension among the English general population was 31% in men and 27% in women [30] compared with the observed 51% in both Ghanaian men and women living in London. Furthermore, in the German Health Survey 2008–2011, the prevalence of hypertension was 33 and 30% among German men and women compared with 57 and 51% among Ghanaian migrant men and women living in Berlin [31]. The observed prevalence of hypertension among Ghanaian migrants are also higher than other African descent populations such as African Americans in the USA and African Caribbeans in Europe [5,7,32]. In the USA, for example, the prevalence of hypertension among African American men and women were 42 and 44% [32], and 39 and 41% among Ghanaian and Nigerian migrant men and women [33], whereas in the Netherlands, the prevalence rates were 47 and 46% among African Surinamese men and women [5], respectively. The reasons for the high prevalence of hypertension among urban Ghanaians and Ghanaian migrants in Europe are unclear. However, the clear gradient in the prevalence of hypertension from rural through urban Ghana to Europe seems to suggest that exposure to urban environment may potentiate hypertensive effect in urban Africans and even more so in African migrants in high-income countries in Europe, and suggest the need for further studies to unravel the key-specific factors behind the high burden of hypertension among these populations [7,17]. The higher rates of hypertension observed among these migrants in multiple European countries relative to the host population provides clear indication that specific factors such as unmeasured unhealthy lifestyle or epigenetics may be shaping their hypertension risk in a very profound way, and that identifying

and addressing these factors may help to reduce the ethnic inequalities in hypertension [7].

Hypertension awareness, treatment, and control

Adequate hypertension control is the key in minimizing the risk of adverse cardiovascular events associated with hypertension [11,12]. Awareness creation and effective management of hypertension have been the main approaches in preventing hypertension and related complications [11,12]. These approaches have had a major impact on hypertension management in various populations, particularly in North America where the effort have been most intense [4,6]. However, inequalities in hypertension management outcomes persist between population subgroups across countries probably driven by differences in health systems and sociocultural factors [7,14–17]. As we expected, hypertension awareness and treatment rates were higher among migrants in Europe than their peers in Ghana possibly because of the better resourced health-care systems in Europe, which may facilitate easier access to antihypertensive medications as observed in this study. However, the higher levels of awareness and treatment among Ghanaian migrants in Europe did not translate into better control. In fact, rural Ghanaian-treated hypertensive men surprisingly had a better hypertension control than their migrant Ghanaian counterparts. Explanations for this unexpected finding are unclear, but might relate to several factors including patient-level factors (e.g. noncompliance with antihypertensive therapy, lifestyle) and national context (e.g. differences in adherence to antihypertension prescription guidelines and awareness among clinicians on ethnic inequalities in hypertension) [14,34]. Further studies are needed to identify factors driving the poor control among SSA migrant men.

The observed differences between European countries may be influenced by national contextual factors such as level of awareness in ethnic inequalities in hypertension as well as adherence to ethnic-specific hypertension treatment guidelines, which may differ between countries [14–16]. Evidence suggests that hypertension awareness, treatment, and adequate hypertension control are higher in Germany [31] than the Netherlands [5] and England [30]. Awareness and treatment levels were also generally higher in Ghanaians in Berlin, but adequate hypertension control was poorer among Ghanaian men in Berlin, which may be driven by the differential prescription patterns. Hypertension guidelines recommend CCBs or thiazide diuretic as first-line treatment option for hypertension in SSA descent populations [11,12]. Ghanaians in Berlin were the least to be prescribed diuretics and CCB and were most to be prescribed RAS-blocking agents. Interestingly, although both Ghanaian men and women in Berlin were the least to be prescribed diuretics and CCB compared to other sites, the differences in hypertension control were greater in men than in women. The reasons for this sex difference are unclear, but may relate to several factors, including compliance, frequency of physician visits which requires further investigation. Nonetheless, the huge differences in the prescription practices between the European countries

suggest the need for better awareness among clinicians regarding ethnic-specific hypertension guidelines in all European countries to ensure that these populations receive appropriate targeted therapy, especially diuretics in which large proportions of treated hypertensives in all sites were not receiving. This could be achieved by either developing ethnic-specific hypertension guidelines for ethnic minorities or the need to give more attention to the ethnic diversity in guidelines by the major European guidelines developers, such as European Society of Hypertension and European Society of Cardiology, to assist clinicians for effective management of hypertension among all ethnic groups in Europe.

Hypertension guidelines stress that patients with severe hypertension require immediate antihypertensive medication targeting hypertension control (BP < 140/90) to prevent adverse outcomes [11,12]. Our data show that large proportions of the hypertensive patients in the severe hypertension category were not receiving treatment. Only about half of severe hypertensive Ghanaian migrants in Europe and under a quarter in rural and urban Ghanaian were receiving antihypertensive medication treatment. The high prevalence of severe hypertension accompanied by lack of medication treatment among this category population is worrying given high rates of complications associated with severe hypertension [12]. Poorly controlled hypertension has been documented as the number one cause of stroke and heart failure in Ghana, accounting for about 85 and 50% of cases, respectively [35]. These findings suggest the urgent need to address the hypertension burden among these populations both in Europe and in Africa particularly resource-poor settings like Ghana where such deleterious consequences of hypertension are difficult to manage because of lack of adequate capacity and resources.

In conclusion, our findings show higher rates of hypertension in urban Ghana and Ghanaian migrants in Europe compared with their rural Ghanaian counterparts. Hypertension awareness and treatment levels were generally higher in Ghanaian migrants in Europe, but adequate hypertension control level was lower in Ghanaian migrant men compared with their rural Ghanaian counterparts. A large proportion of severe hypertensive patients were untreated. Antihypertensive medication prescription patterns varied considerably by site with Berlin Ghanaian hypertensive patients showing the most striking differences. Future studies should identify factors driving the observed differences between sites to implement interventions to improve hypertension management outcomes.

ACKNOWLEDGEMENTS

The authors are very grateful to the Advisory Board members of the RODAM study for their valuable support in shaping the methods, to the research assistants, interviewers, and other staff of the five research locations who have taken part in gathering the data and to the Ghanaian volunteers participating in this project.

The work was supported by the European Commission under the Framework Programme (Grant Number: 278901). L.M.'s contribution was supported by the Wellcome Trust,

grant number WT082178. J.S. was supported by the DZHK (German Center for Cardiovascular Research) and the Berlin Institute of Health (BIH).

Conflicts of interest

There are no conflicts of interest.

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Reviewers' Summary Evaluations

Reviewer 1

The main weakness of this study is its relatively small size - a total of 5659 study participants were evaluated. In addition a limited amount of data were collected, some of this by means of questionnaire. However, the relatively 'lean' database may also be seen as an advantage insofar as the study focused on the key elements of BP prevalence, awareness, treatment and control in a relatively homogeneous ethnic group. The key measurement - of blood

pressure itself, was undertaken by means of a validated, objective technique estimating clinic pressure. The poor BP control in Europe is a salutary message.

Reviewer 2

Strengths: Design, methodology, quality of measurement
Weaknesses: Need to add the impact of missing data; include the fact that personal/cultural health behaviors and beliefs are important in this context and not assessed, which is a significant limitation of this study.