

HYPERTENSION IN THE ADULT POPULATION OF KAYA HEALTH AND DEMOGRAPHIC SURVEILLANCE SYSTEM IN BURKINA FASO: PREVALENCE AND ASSOCIATED FACTORS

ABSTRACT

Background: Recent scientific reports have shown that high blood pressure is a major public health problem in urban populations of sub-Saharan African countries. Yet, information on this morbidity in the rural areas is limited.

Objective: To estimate the prevalence of hypertension and to identify associated factors in rural and semi-urban populations in Burkina Faso

Methods: This is a community-based cross-sectional study conducted between September and December 2012 among residents of Kaya Health and Demographic Surveillance System (HDSS). A stratified sample of 1481 residents, at least 18 years of age, was randomly selected and interviewed. Anthropometric measurements were carried out. Two blood pressure (BP) measurements were taken after sitting at rest for about 25 to 30 minutes. Hypertension was defined as mean systolic BP of at least 140 mmHg and/or diastolic BP of at least 90mmHg. Those taking hypertensive medication were also considered hypertensive. Logistic regression was carried out to identify factors independently associated with hypertension.

Results: The study sample comprised 726 rural residents and 755 semi-urban residents. The weighted overall prevalence of hypertension was 9.4% (95% CI: 7.3%-11.4%); 5.5% (95% CI: 3.8%-7.1%) in the rural areas; and 11.0% (95% CI: 8.8%-13.2%) in the semi-urban areas. In rural areas, older age and higher body mass index were associated with hypertension. In semi-urban areas, older age, not being married, familial history of hypertension, physical inactivity, psychological distress, presence of chronic conditions and poor self-assessment of health, were associated with hypertension.

Conclusion: Hypertension prevalence was higher in semi-urban than in rural areas of Kaya HDSS, but was overall relatively low. However, it may be possible to further reduce its prevalence and prevent increasing prevalence by acting on the identified risk factors. Encouragement to maintain low body weight through traditional diets and to increase physical activity could be beneficial.

Keywords: hypertension, Kaya, Health and Demographic Surveillance System, urbanization

1. INTRODUCTION

In 2000, the global prevalence of hypertension was estimated at 26.4% among adults. Of an estimated 972 million people with hypertension, 65.7% lived in developing countries [1].

Projections for 2025 suggest a 60% increase and 1.56 billion people could be affected globally. A steeper increase (80%) is projected among populations living in developing countries. Prevalence studies in African countries have confirmed this projection. Four decades ago, prevalence of hypertension hardly exceeded 10% among adults in countries such as Kenya, Ghana and South Africa [2-4]. More recent studies have reported prevalence estimates in adult populations varying between 20 and 35% [5-9]. In Burkina Faso, studies on the urban adult population of Ouagadougou reported prevalence of 23% for those aged 18 years and older [10], 40.2% for those aged 35 years and older [11], and 22% between 25 and 60 years of age [12]. Most alarming reports came from a rural community in Nigeria and some urban areas in Senegal, where more than 45% over 40 years of age were hypertensive [13, 14]. These recent studies show that in African countries, the prevalence of hypertension is generally increasing in both urban and rural areas [15, 16].

Consequences of high prevalence of hypertension has also emerged. In Sub-Saharan African countries, while leading disease burdens are still childhood diseases and those related to poverty [17], an increase in non-communicable diseases related to hypertension has been observed. Better knowledge of the prevalence and risk factors for this chronic condition is needed to prevent cardiovascular and stroke epidemics.

Most hypertension risk factors have been shown to be associated with urbanization [11]. Hence it is particularly important to understand the situation in rural and semi-urban areas in Africa as they are rapidly undergoing urbanization. Because such information is still lacking, we conducted a cross-sectional study to estimate the prevalence of hypertension and to identify associated factors in rural and semi-urban populations in Burkina Faso.

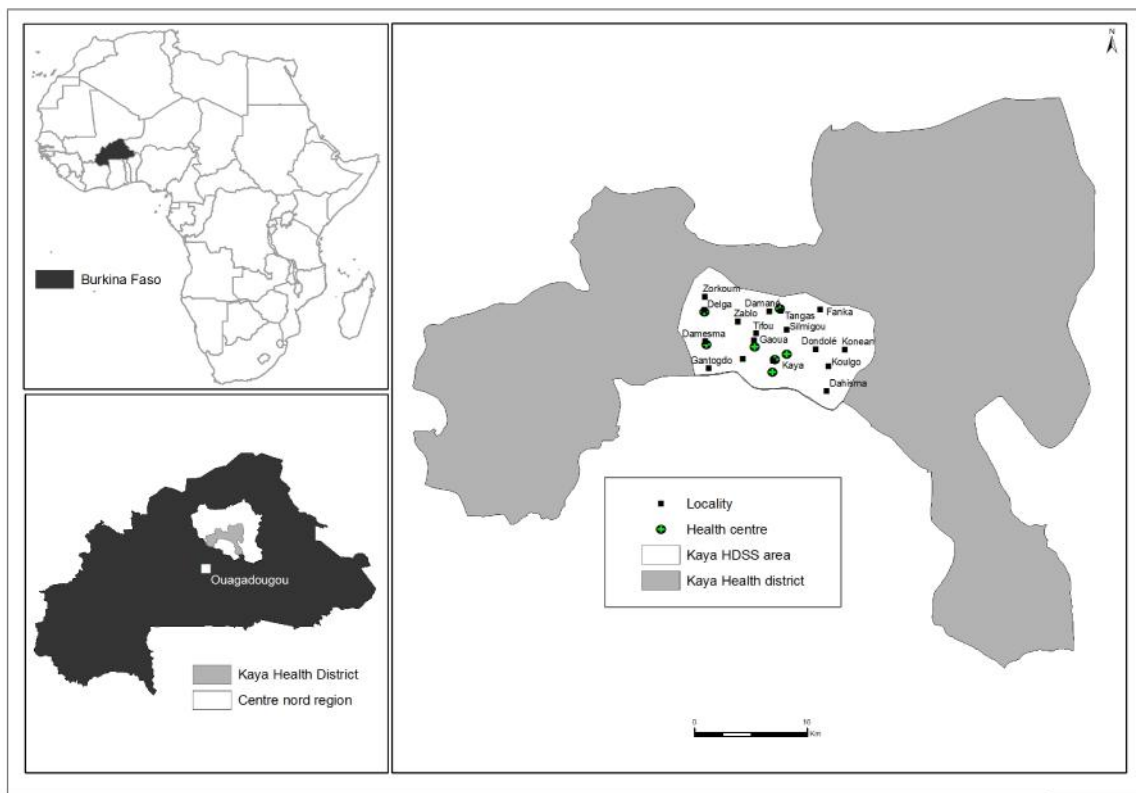
2. METHODS

2.1. Study Area

In Kaya health district, one of the 64 health districts of Burkina Faso, the Kaya Health and Demographic Surveillance System (Kaya HDSS) has been in operation since 2007 under the auspice of Institut de Recherche en Sciences de la Santé (IRSS). The system was established to collect demographic and health information to guide the development of health policies. It is affiliated with the International Network for the Demographic Evaluation of Population and their Health (INDEPTH) (www.indepth-network.org). Kaya HDSS, is situated 100 km from Ouagadougou (Figure 1). It covers all the seven sectors of the semi-

55 urban areas and 18 villages situated in the rural areas around the city of Kaya. In 2012, the
56 population was 67 676 inhabitants in 11 083 households, with an average size of 6.1. The
57 population is 70% semi-urban and 30% rural, about 80% is Muslims. The semi-urban areas
58 have cadastral organizations with streets. There are public services such as: tap water,
59 electricity, telephone, and a regional hospital. Parcels of land have been allocated to
60 inhabitants. The rural areas have no cadastral organization. Dwellings are separated by
61 fields. There are few public services such as a primary school or a health centre managed
62 by a nurse. Rural inhabitants are almost all natives, practicing agriculture or animal
63 husbandry.

64



65

66 **Figure 1 : Kaya HDSS location**

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68 **2.2. Study design**

69 This is a community-based cross-sectional study. The study population included all residents
70 who were 18 years and older residing in the Kaya HDSS between September and December
71 2012. Two strata (rural and semi-urban) were sampled; the Kaya HDSS list of households
72 was used as sampling frame. Before visiting the household, one person was randomly
73 selected among people living at that household who were at least 18 years old.

2.3. Data collection

Participants were interviewed at home by trained interviewers in the local language (Mooré) using a computer aided questionnaire. The information was directly recorded using William software version 1.5 of MultiSpectra.

2.4. Variables

Blood pressure (BP) was measured on a single occasion at home by a trained interviewer using a digital automatic sphygmomanometer (Omron 3) with the appropriate cuff size. At the end of the interview, after about 25 to 30 minutes' rest in a sitting position, BP and pulse were measured. BP was taken successively on the two arms; on the arm with the higher reading; two other readings were taken one minute apart. The mean of these two readings was used to determine hypertension [18]. In accordance with the Seventh Report of the Joint National Committee of Prevention, Detection, Evaluation and Treatment of High Blood Pressure, those who had a systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg or those who reported current use of anti-hypertensive medications were considered hypertensive [19]. All newly screened hypertensive participants were referred to a health facility for diagnosis and possible treatment.

Weight and height were measured with participants lightly dressed and after removal of shoes and pocket contents. Height was measured using a wooden stadiometer. Body mass index (BMI) was calculated by dividing the weight (kg) by the square of height (m^2). Participants were considered "underweight" when their BMI < 18.5 ; "normal weight" when $18.5 \leq \text{BMI} < 25$; "pre-obese" when $25 \leq \text{BMI} < 30$; "obese" when BMI ≥ 30 [20].

Age, sex, marital status, place of residence, education, and occupation were recorded. The World Health Organization Stepwise Approach to Chronic Disease Risk Factor Surveillance (STEPS), an instrument for ascertaining non-communicable disease risk factors, was used to collect information on behavioral factors [18]. For smoking, the question "Do you currently smoke tobacco products such as cigarettes, cigars or pipe?" was asked. If the answer was negative, a second question "In the past, did you smoke daily?" was asked to identify ex-smokers. Due to the small number of ex-smokers, smokers and ex-smokers were combined into one single category. For alcohol, the question was: "Have you ever consumed alcoholic beverages such as beer, wine, liquor, dolo (local beer)?" For physical activities, the participants were asked whether they had intensive activities in their current occupation,

110 (activities that required a substantial increase in breathing or heart rate for at least 10
111 minutes), or moderate activities (activity that required moderate increase in breathing or
112 heart rate for at least 10 minutes). Furthermore, the participants were asked if in their leisure
113 time, they took part in sports or other intense or moderate activities. Participants who had
114 intense or moderate work or leisure activities were classified as “having vigorous physical
115 activity”; otherwise as “having non-vigorous physical activity”. Brisk walking was coded as
116 vigorous activity.

117

118 Psychological distress was evaluated using the 28-item General Health Questionnaire
119 (GHQ). This questionnaire was designed to assess common mental health in general
120 medical practice and in the community [21, 22]. It was originally designed in a 60-item
121 format. Many shorter versions have been derived (12-item, 28-item, 30-item) but the 28-item
122 format had been validated prior to this study in African populations [21, 23]. It has four
123 subscales, each with seven items: somatic symptoms, anxiety and insomnia, social
124 dysfunction, and severe depression [21]. For each item, there are four answers that ranged
125 from best to worst. We used the binary scoring method [23]. The two best symptomatic
126 answers scored “0” while the two worst symptomatic answers scored “1”. The final score
127 had a possible range of “0” to “28”. Participants were considered having psychological
128 distress if the total score was “5” or higher [23].

129

130 For general health status, the participants were asked to assess their current health as “very
131 good”, “good”, “fair”, “poor”, or “very low”. Answers were then recoded as good (“for very
132 good” and “good”), moderate (for “fair”) and low (for “poor” and “very poor”).

133

134 Chronic conditions were assessed by asking the participants whether they had ever been
135 told by a health professional that they had a chronic disease such as diabetes mellitus,
136 cancer, HIV/AIDS, heart problems, or asthma. Family history of hypertension was assessed
137 by asking the participants if one of their grandparents, father, mother, brother or sister had
138 hypertension.

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140 **2.5. Statistical Analysis**

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142 Chi square tests were used to assess differences in prevalence of hypertension by levels of
143 categorical risk factors. Logistic regression was used to estimate adjusted odds ratios for
144 each risk factor for hypertension. All statistical tests were two-tailed and were performed
145 using IBM SPSS 20 for Windows.

146 3. RESULTS

147
148 The stratified random selection resulted in 1645 households, 148 were not found due to
149 inaccuracies in address and another 16 could not be located. From each located household,
150 one member who was at least 18 years old **was** invited to participate. No one refused. The
151 final sample size was 1481. One stratum with 726 participants was from rural areas and the
152 other stratum, with 755 participants was from semi-urban areas. The proportions of men and
153 women were approximately equal in both strata. Men from semi-urban areas were younger
154 than men from rural areas. Ages of women were similar (Table 1).

155
156 Participants were mostly young and had low levels of education. Regular employment was
157 almost non-existent in the rural areas for both men and women and **was** very rare among
158 semi-urban women. Overweight (**BMI $\geq$ 25**) **was uncommon** in the rural areas and only
159 relatively frequent among semi-urban women. Less than **35%** of men, and practically no
160 women, in both rural and in semi-urban areas smoked. "Ever had alcohol intake" was
161 reported by **few** men and women, in rural and semi-urban areas. Rural participants were
162 more physically active and reported less frequent family history of hypertension than
163 participants living in semi-urban areas (Table 1). **Our study population was comparable to**
164 **the general population of Burkina Faso with 51.7% of women, 57.0% of people under 20**
165 **years old and 70% without any instruction [24].**

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167

168 **Table 1 : Characteristics of participants by residence and by sex (N=1481)**

169

	Men			Women			All		
	Rural (n=329)	Semi- Urban (n=337)	<i>P</i> -value	Rural (n=397)	Semi- urban (418)	<i>P</i> -value	Rural (n=726)	Semi- urban (n=755)	<i>P</i> -value
	%	%		%	%		%	%	
Median Age (years)	42.0	35.0		32.0	34.0		36.0	34.0	
Civil status			.002			.000			.000
Married	88.1	79.2		88.2	75.8		88.2	77.4	
Other	11.9	20.8		11.8	24.2		11.8	22.6	
Education			.000			.000			.000
Illiterate	77.5	58.5		88.4	60.5		83.5	59.6	
Read/Write	22.5	41.5		11.6	39.5		16.5	40.4	
Occupational status			.000			.000			.000
Employed	0.9	15.1		1.0	6.9		1.0	10.6	
Independent	74.5	70.0		42.3	44.5		56.9	55.9	
Unpaid job	24.6	14.8		56.7	48.6		42.1	33.5	
Family history of hypertension			.003			.000			.000

No	86.9	78.3		89.7	73.9		88.4	75.9	
Yes	13.1	21.7		10.3	26.1		11.6	24.1	
<u>Self-rated health</u>			.007			.060			.001
Good	74.8	81.9		71.5	77.0		73.0	79.2	
Moderate	23.7	14.8		26.4	19.9		25.2	17.6	
Low	1.5	3.3		2.0	3.1		1.8	3.2	
<u>Chronic conditions</u>			.707			.014			.034
No	97.0	96.4		98.0	94.7		97.5	95.5	
Yes	3.0	3.6		2.0	5.3		2.5	4.5	
<u>Psychological distress</u>			.026			.259			.021
No	54.7	63.2		49.9	53.8		52.1	58.0	
Yes	45.3	36.8		50.1	46.2		47.9	42.0	
<u>Body Mass Index (Kg/m²)*</u>			.000			.000			.000
<18.5	19.8	8.0		23.5	13.0		21.7	10.7	
18.5 to 24.99	75.7	80.1		68.2	59.3		71.8	68.9	
≥25	4.6	11.9		8.4	27.7		6.6	20.4	
<u>Smoking status</u>			.476			.719			.409
No smoker	65.3	68.0		99.0	99.3		83.7	85.3	
Smoker or ex-smoker	34.7	32.0		1.0	0.7		16.3	14.7	
<u>Alcohol intake</u>			.375			.431			.921
Never	71.7	74.8		81.6	79.4		77.1	77.4	
Yes	28.3	25.2		18.4	20.6		22.9	22.6	
<u>Physical activity</u>			.000			.000			.000
Vigorous	85.7	57.3		84.6	33.0		85.1	43.8	
Non vigorous	14.3	42.7		15.4	67.0		14.9	56.2	

170 * excluding pregnant women

171

172 The overall weighted prevalence of hypertension was 9.4% (95% CI: 7.3%-11.4%); it was
173 lower in rural areas (5.5%; 95% CI: 3.8%-7.1%) than in the semi-urban areas (11.0%; 95%
174 CI: 8.8%-13.2%) (Table 2). Twenty five participants were taking hypertension medication. In
175 both rural and semi-urban areas, the prevalence of hypertension increased with age. In rural
176 areas, there was no significant difference in hypertension between married and unmarried
177 people (5.6% vs. 4.7%; $P = .48$), whereas in the semi-urban areas, that difference was
178 statistically significant (9.4% vs. 16.4%; $P = .01$).

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186 **Table 2: Prevalence of hypertension according to socio-demographic characteristics**
187 **by area of residence (N=1481)**

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	Rural (n=726)			Semi-Urban (n=755)		
	%	P-value	95% CI	%	P-value	95% CI
All	5.5		3.8-7.1	11.0		8.8-13.2
<u>Sex</u>		.111			.632	
Female	4.3		2.3-6.3	11.5		8.4-4.6
Male	7.0		4.2-9.8	10.4		7.1-13.7
<u>Age, (years)</u>		.007			.000	
18 to 24	1.9		0.0-4.5	2.2		0.0-4.6
25 to 34	2.6		0.5-4.7	2.5		0.5-4.5
35 to 44	5.6		1.8-9.4	9.9		4.9-14.8
45 to 54	8.4		3.4-13.5	19.6		12.2-27.1
55 to 64	10.1		3.3-16.9	22.9		12.8-32.9
65+	12.2		2.7-21.8	43.1		29.1-57.2
<u>Civil status</u>		.476			.011	
Married	5.6		3.8-7.4	9.4		7.0-11.8
Other	4.7		0.1-9.2	16.4		10.8-22.0
<u>Education</u>		.789			.403	
Illiterate	5.6		3.8-7.5	11.8		8.8-14.8
Read/write	5.0		1.0-9.0	9.8		6.5-13.2
<u>Occupational status</u>		.814			.074	
Employed	0.0		-	10.0		3.3-16.7
Independent	5.6		3.4-7.8	9.0		6.3-11.8
Unpaid job	5.6		3.0-8.1	14.6		10.2-19.0

189
190 **Figure 2 shows that the association between age and hypertension is linear. After age 30,**
191 **hypertension prevalence increased faster in semi-urban compared to rural areas. High levels**
192 **of hypertension > 15% were only observed in semi-urban populations 45 years and older.**

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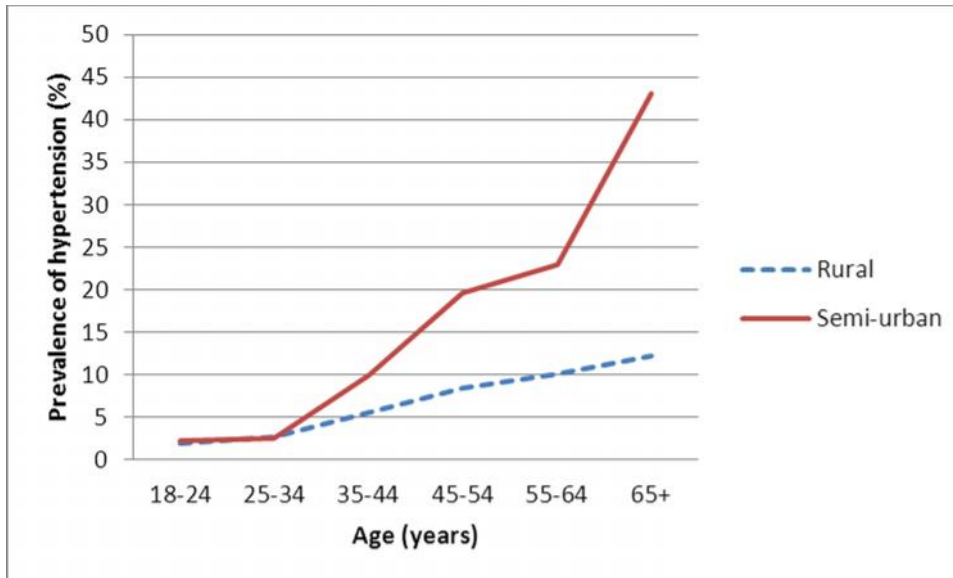


Figure 2: Prevalence of hypertension by age and place of residence (rural and semi-urban) among Kaya HDSS adults

The prevalence of hypertension according to behavioral risk factors and chronic conditions is shown in Table 3. Both smoking and alcohol intake were not associated with hypertension. Rural and semi-urban areas appeared to be quite different with respect to possible risk factors. In the rural areas, only body mass index was associated with prevalence of hypertension ($P = .02$). In the semi-urban areas, body mass index had no effect ($P = .56$) but “having non-vigorous physical activities”, “having psychological distress”, “having a chronic health condition” and “self-reported poor health” were associated with higher prevalence of the condition (all with $P = .00$).

Table 3: Prevalence of hypertension according to behavioral risk factors and chronic conditions (N=1481)

	Rural (n=726)			Semi-Urban (n=755)		
	%	P-value	95% CI	%	P-value	95% CI
Family history of hypertension		.228			.057	
No	5.1		3.4-6.9	9.8		7.3-12.2
Yes	8.3		2.3-14.4	14.8		9.6-20.1
Self-rated health		.138			.001	
Good	4.7		2.9-6.5	9.0		6.7-11.3
Moderate	7.1		3.4-10.9	16.5		10.1-22.9
low	15.4		0.0-38.1	29.2		9.6-48.8
Chronic conditions		.261			.000	

No	5.4		3.7-7.1	10.0		7.8-12.2
Yes	11.1		0.0-27.2	32.4		15.8-49.0
Psychological distress		.116			.000	
No	4.2		2.2-6.5	7.5		5.1-10.0
Yes	6.9		4.2-9.6	15.8		11.7-19.8
Body Mass Index (Kg/m²)*		.015			.562	
<18.5	4.7		1.3-8.1	14.1		6.2-22.0
18.5 to 24.99	5.3		3.3-7.3	10.3		7.7-13.0
≥ 25	15.6		4.5-26.6	12.2		6.8-17.4
Smoking status		.508			.793	
No smoker	5.8		3.9-7.6	10.9		8.5-13.3
Smoker or ex-smoker	4.2		0.6-7.9	11.7		5.6-17.8
Alcohol intake		.955			.738	
Never	5.5		3.6-7.5	10.8		8.3-13.3
Yes	5.4		1.9-8.9	11.7		6.8-16.7
Physical activity		.982			.004	
No-vigorous	5.6		1.2-10.0	13.9		10.6-17.2
Vigorous	5.5		3.7-7.3	7.3		4.4-10.1

*excluding pregnant women

Unadjusted and adjusted odds ratios for risk factors were estimated using logistic regressions (Table 4). In the unadjusted analysis, the odds of hypertension increased significantly with age, presence of chronic conditions (OR = 4.00; 95% CI: 2.07-7.71), presence of family history of hypertension (OR = 1.85; 95% CI: 1.22-2.82), presence of psychological distress (OR = 1.96; 95% CI: 1.35-2.86), having non-vigorous activity (OR = 2.14; 95% CI: 1.48-3.10) overweight (OR= 1.70; 95% CI: 1.06-2.73); and living in a semi-urban area (OR = 2.12; 95% CI: 1.43-3.14). After adjustment for all covariates, only older age, semi-urban areas and presence of family history of hypertension remained significantly associated with hypertension. Interaction terms of residence with physical activity was tested but they did not reach statistical significance (P=.103; 95% CI: 0.84-7.12).

Table 4 : Associations of selected risk factors with prevalence of hypertension (N=1481)

Characteristics	Prevalence of hypertension	Unadjusted	Adjusted
	n(%)	Odds ratio (95% CI)	Odds ratio (95% CI)
Age, years			
Continuous		1.05 (1.04-1.07)^d	1.06 (1.05-1.07)^d
18 to 24	5 (2.0)	1	1
25 to 34	12 (2.6)	1.26 (0.44-3.64)	1.21 (0.42-3.51)
35 to 44	22 (7.7)	4.03 (1.50-10.81)^c	4.13 (1.52-11.23)^c

45 to 54	32 (13.9)	7.75 (2.96-20.26)^d	8.80 (3.32-23.35)^d
55 to 64	24 (16.1)	9.25 (3.45-24.84)^d	10.50 (3.84-28.71)^d
65+	28 (28.0)	18.74 (6.98-50.31)^d	22.43 (8.08-62.03)^d
<u>Sex</u>			
Female	65(8.0)	1	1
Male	58(8.7)	1.10 (0.76-1.59)	0.96 (0.61-1.52)
<u>Residence</u>			
Rural	40 (5.5)	1	1
Semi-urban	83 (11.0)	2.12 (1.43-3.14)^d	1.69 (1.07-2.69)^a
<u>Family history of hypertension</u>			
No	89 (7.3)	1	1
Yes	34 (12.8)	1.85 (1.22-2.82)^b	1.97 (1.24-3.13)^b
<u>Chronic conditions</u>			
No	110 (7.7)	1	1
Yes	13 (25.0)	4.00 (2.07-7.71)^d	1.71 (0.82-3.56)
<u>Psychological distress</u>			
No	49 (6.0)	1	1
Yes	74 (11.1)	1.96 (1.35-2.86)^d	1.15 (0.73-1.81)
<u>Body Mass Index (Kg/m²)*</u>			
<18.5	18 (7.9)	1.01 (0.59-1.73)	0.65 (0.35-1.18)
18.5 to 24.99	78 (7.8)	1	1
≥25	25 (12.9)	1.74 (1.08-2.81)^a	1.29 (0.76-2.20)
<u>Smoking status</u>			
No smoker	105 (8.4)	1	1
Smoker or ex-smoker	18 (7.9)	0.93 (0.55-1.57)	1.17 (0.64-1.14)
<u>Alcohol intake</u>			
Never	94 (8.2)	1	1
Yes	29 (8.6)	1.05 (0.68-1.63)	0.94 (0.59-1.48)
<u>Physical activity</u>			
Vigorous	58 (6.1)	1	1
Non-vigorous	65 (12.2)	2.14 (1.48-3.10)^d	1.27 (0.81-1.99)

*excluding pregnant women; ^aP = .02; ^bP = .006; ^cP = .004; ^dP = .000

4. DISCUSSION

We found low prevalence of hypertension among participants from Kaya HDSS as a whole; with higher prevalence in semi-urban areas compared to that of the rural areas. This is not an isolated observation; a study conducted in Ethiopia, another sub-Saharan country reported a similarly low prevalence. Those with ages between 18 and 64, had a prevalence of hypertension of 7.6%, similar to that reported in Ethiopia (8.2%) among 25-64 years olds [25]. Overall, we found generally lower prevalence of hypertension than what has been previously reported.

Our prevalence estimate in rural areas (5.5%) is lower than those of other studies in rural regions of Africa. They found prevalences between 12.5% and 32.2% among populations 18

240 years and older [5, 15, 26-28]. Also, studies conducted in rural and urban populations aged
241 15 years and older in West African countries reported higher **hypertension** prevalence
242 **estimates**, between 21% and 30%. [5, 29-32]

243
244 **Prevalence estimate** in semi-urban areas (11%) is lower **in our study** than results **previously**
245 reported in Africa, including those from Ouagadougou, **that** ranged from 21 to 31% among
246 population aged 16 years and older [5, 10, 33]. **Our estimate** is also lower than **the**
247 **prevalence** found in urban areas of Africa with similar but slightly older participants (25 years
248 and older) [11, 12, 34, 35].

249
250 Taking these findings together, we conclude that **the** prevalence of hypertension remains low
251 in rural areas, **and** significantly **high** in semi-urban areas but still **remains** below that of urban
252 areas. Among participants from semi-urban areas, **the prevalence of hypertension** increases
253 with age, although at a lower rate than in European populations.

254
255 Our observation that the prevalence of hypertension was significantly higher in semi-urban
256 areas than in rural areas points to risk factors inherent in semi-urban living. This is also
257 supported by our finding that after adjusting for rural/semi-urban living, most of the **remaining**
258 risk factors became insignificant. Tesfaye compared three sites in three countries with
259 different levels of development (Ethiopia, Vietnam and Indonesia) and found that the more
260 developed the country, the higher the hypertension prevalence [25]. Moreover, previous
261 studies have shown that hypertension increases with urbanization in African populations [25,
262 34, 36-38]. These findings suggest that the increase in hypertension may be the result of
263 **urbanization**. Possible causes include stress, reduced physical activity, diet changes, and
264 smoking [39] (Table 5).

265
266 **Table 5: Risk factors associated with hypertension in some previous studies in sub-**
267 **Saharan Africa**
268

First author (Year of publication)	Country	Population type	size	Age range	Risk factors
Niakara (2007)[11]	Burkina Faso	Urban	2087	>35	Older age, Duration of residence in the city > 20 years, BMI≥25, Physical inactivity.
Sodjinou (2008)[35]	Benin	Urban	200	25-60	Long duration (≥21years) of urban residence
Macia (2011)[13]	Senegal	urban	500	≥50	Older age, BMI≥25

Agyemang (2006)[37]	Ghana	Urban and rural	1431	≥16	Older age, Urban area, overweight, obesity, Alcohol intake
Addo (2006)[15]	Ghana	Rural	362	≥18	Older age, Overweight, obesity
Cappuccio (2004)[34]	Ghana	Semi-urban and rural	1013	40-75	Older age, semi-urban areas
Van de vijver (2013)[33]	Kenya	Urban	5190	≥18	Older age, current drinking, waist circumference ≥94cm(men)/≥80cm(women)
Tesfaye (2007)[25]	Ethiopia	Urban and rural	4050	25-64	Older age, male sex, urban areas, BMI≥25
De Ramirez (2010)[26]	Malawi, Rwanda, Tanzania	Rural	1485	≥18	Older age, Television owner, BMI≥25, Physical inactivity, Less fruit/vegetable intake,
Musinguzi (2013)[38]	Uganda	Rural and urban	4563	≥15	Older age, urban areas, overweight, obesity
Wamala (2009)[27]	Uganda	Urban and rural*	842	≥20	Older age, Female sex, Tertiary education level, Overweight, obesity, Past and present alcohol use
Damasceno (2009)[6]	Mozambique	National	3323	25-64	Older age, Urban area
Malaza (2012)[28]	South Africa	Rural	11786	≥15	Older age, Female sex, HIV-uninfected status,
Pick (1990)[40]	South Africa	Urban	1046	≥15	family history of hypertension, Poor education, Obesity

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270

271 In Kaya HDSS, the rural population is predominantly agricultural with strenuous physical
272 efforts in daily work and transport (by foot or bike). The finding that hypertension was
273 associated with being overweight in rural areas may be explained by rapid changes in the
274 occupational activities of some individuals; for example, the transition from doing mostly
275 physical activity in the past (farming) to adopting less active jobs (vendors and merchants).
276 In semi-urban areas, informal trade is predominant. Much of the personal transport is done
277 by motorized means (motorcycle, car, taxi). Dietary changes may also be a factor in
278 urbanization. A study in Benin found that diet in the more urbanized area was less
279 preventive against chronic diseases after controlling for income [41]. Future studies on
280 dietary differences in Burkina Faso would be useful in identifying specific dietary risk factors.
281 In semi-urban areas, married people were less likely to be hypertensive than those who
282 were unmarried. This is consistent with previous studies that found that married individuals
283 tend to experience better health outcomes than those who were not married [42, 43].
284 Marriage could confer more protection in semi-urban than in rural areas by preserving
285 traditional healthy dietary behaviors.

286

287 Furthermore, we found that psychological distress was associated with a high prevalence of
288 hypertension in semi-urban areas; a likely product of urbanization [44]. In the urban
289 population of South Africa, this association was found especially among men [23]. A meta-
290 analysis in western populations reported that, depression, one of the manifestation of
291 psychological distress, was probably an independent risk factor for hypertension [45].

292

293 Family history was identified as a risk factor for hypertension. A South African study also
294 reported such an association [40]. However, the rural population is poorly served by health
295 services and most people did not know whether their parents or siblings had been diagnosed
296 with hypertension. This lack of recognition may explain why it is only a risk factor among
297 semi-urban participants. A similar conclusion could be drawn regarding self-recognized
298 chronic diseases.

299

300 **Strengths and limitations of the study.** The study sample was randomly selected and
301 participation was 100% among those we could locate even though participation was
302 voluntary and no payment was given to participants. This enables us to infer our findings
303 confidently to the target population as a whole. Nevertheless, we are aware of some
304 limitations of this study. Blood pressure was based on a single visit, which might have
305 overestimated the prevalence [46] but an adequate rest period could minimize such an
306 effect. Also, psychological distress measured by GHQ and administered by an interviewer,
307 instead of self-administration, may result in misclassification. This phenomenon could have
308 occurred because participants might tend to produce socially acceptable responses. Such
309 misclassifications could dilute the association between psychological distress and
310 hypertension. Furthermore, self-reporting of family history and chronic diseases could lead to
311 underestimation of their prevalence due to lack of diagnosis and low education.

312

313 5. CONCLUSION

314 Our findings suggest that while prevalence of hypertension remains relatively low in the rural
315 areas of Kaya, the semi-urban areas exhibit a trend towards higher prevalence. Moreover,
316 almost all the risk factors associated with urbanization were confirmed in the semi-urban
317 sample of our study. Consequently, preventive measures related to urbanization are needed
318 to curb the development of hypertension in rural and semi-urban areas. Possible actions
319 include: keeping healthy features of traditional diets to maintain healthy body weight,
320 increasing physical activity, and maintaining mental health. In parallel, because
321 hypertension is a known risk factor for heart disease, measures to control common risk

322 factors such as smoking and high fat diets should be taken to prevent an epidemic of heart
323 diseases and stroke in developing countries such as Burkina Faso.

324

325

326 **COMPETING INTERESTS**

327 The authors declare that they have no competing interests

328

329 **AUTHORS' CONTRIBUTIONS**

330 BD designed the study, collected and analyzed the data, drafted and reviewed the paper. SK
331 designed the study, drafted and reviewed the paper. AB and LN participated to data
332 collection and reviewed the paper. MVZ designed the study, supervised data analysis,
333 reviewed the paper. All authors read and approved the final manuscript.

334

335 **CONSENT**

336 Informed consent was signed by all the participants.

337

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