Prevalence factors associated with Hypertension in Rukungiri District, Uganda - A Community-Based Study

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Abstract

Background: Hypertension is a growing public health problem in Uganda and Africa as a whole. We conducted a study to determine the prevalence and identify factors associated withy hypertension among residents of the rural district of Rukungiri, Uganda.

Methods: A community-based cross-sectional study design was used to conduct this study. Between January and February 2006, a random sample of consenting district residents, aged 20 years or older were enrolled to participate in this study. Trained research assistants administered a standardized questionnaire and performed the physical measurements. The questionnaire collected data on demographics, social economic and exposure history to various potential risk factors for hypertension. Hypertension was defined as systolic blood pressure (BP) equal or greater than 140mmHg and/or diastolic BP equal or greater than 90mmHg, and/or being on regular anti-hypertensive therapy. Logistic regression analysis was used to identify factors associated with hypertension.

Results: Of the 842 study participants, 252 were hypertensive. The age-standardized prevalence of hypertension was 30.5%, with a 95% Confidence Interval (CI) of 26.6 - 34.3%. Factors found to be associated with hypertension included: past alcohol use, Odds Ratio (OR)=2.28, [1.42 - 3.64], present alcohol use OR=1.64 [1.12 - 2.43], being overweight OR=1.95 [1.37 – 2.79], obesity OR=5.07 [2.79 - 9.21], female sex OR=1.44 [1.03 - 2.06], having attained tertiary education OR=1.91 [1.03 – 3.56], and older age OR=1.42 [1.27 - 1.59]).

Conclusion: The prevalence of hypertension in this rural Ugandan district is relatively high. The findings confirm the growing concern about hypertension as a public health problem in Uganda. More studies are however required to determine the distribution and determinants of hypertension in other parts of the country.

Key words: Prevalence of Hypertension, Risk factors for hypertension, Community-based study, Rural Setting, Uganda**.**
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Introduction

Hypertension is classified into primary hypertension, which accounts for the majority of adulthood hypertension with no identifiable cause, although there are usually recognisable risk factors; and secondary hypertension, which accounts for the majority of childhood hypertension[1]. Some of the known risk factors for primary hypertension like age, heredity, and gender are non-modifiable. However, the majority of the other risk factors like tobacco use, alcohol use, unhealthy diet, physical inactivity, overweight and obesity can be effectively prevented[2]. Hypertension is the most common cardiovascular disorder affecting approximately 1 billion people globally and accounts for approximately 7.1 million deaths annually[3]. Until recently, hypertension has been given low priority in Africa. The condition is now being widely reported in many parts of Africa and is the most common cause of cardiovascular disease on the continent[3]. Recent studies conducted in Africa have revealed prevalence ranging from 7.5% in Sudan (Elbagir and Ahmed 1990 cited in Addo et al 2007[4], to as high as 37.7% in Tanzania[5].

A literature search on the prevalence and/ or determinants of hypertension in Uganda reveal no recent publications on this problem in the past few decades. Published community-based studies to estimate the prevalence of hypertension in Uganda were conducted before the 1960s. The first was conducted in the then Teso District in 1941, which showed a prevalence of hypertension of 2.9% among adults aged 21-50 years[6]. Another population-based survey was conducted in the early 1960s in Kasangati, a rural community outside of Kampala city, which revealed prevalence of hypertension of 13.7% among persons aged 10 years or older[7]. There is therefore scanty literature on the

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estimated burden, and the determinants of hypertension in the Ugandan population. Anecdotal data however suggests that hypertension has increased over the years, and is increasingly becoming a public health problem. A recent study conducted among Makerere University students showed prevalence of systolic blood pressure of 11% and diastolic blood pressure of 18%[8]. An exploratory study conducted in 2005 among adults attending outpatient clinics in Rukungiri District in Uganda revealed a hypertension prevalence of 23.7% [Wamala *et al.,* 2005, un-published report]. Prompted by this relatively high prevalence of hypertension among outpatients, combined with the fact that currently there is limited information on the prevalence and determinants of hypertension in Uganda, we conducted a community-based study to determine the prevalence, and identify factors associated with hypertension in this rural Ugandan district.

Methods

Setting and Sample Selection

Rukungiri District is a rural district located in South Western Uganda, approximately 400km west of Kampala, the capital city of Uganda. According to the 2001 Uganda population census, the district has a total population of approximately 287,544 people[9]. The district has one main township, Rukungiri town, and the inner part of the district portrays characteristics of a typical Ugandan rural community with limited telephone service, electricity or tap water, and is mostly accessible via dirt roads.

Between January and February 2006, a sample of residents in the district was enrolled in this study. Study participants were selected using a two-stage sampling procedure. First, 19 villages were randomly selected from the 11 sub-counties in the district. The calculated sample size was allocated to the 19 villages in proportion to the estimated population size in the villages according to the 2001 Uganda population census[9]. Our study is the only community-based study conducted in recent years in Uganda to estimate the burden, and identify the determinants of hypertension in the general population. A household was defined as a group of individuals living within one domicile, who normally shared meals together. Only one consenting adult household member aged 20 years or older within each of the sampled households was included into the study. Further, only subjects who had resided within the district for at least one year prior to the date of identification of the household by the research team were eligible for inclusion into the study. The conduct of this study was approved by the Makerere University School of Public Health's Higher Degrees, Research and Ethics Committee.

Measurements

A cross-sectional study design was used to conduct this study. Trained research assistants performed the physical measurements and administered a standardized questionnaire. The questionnaire collected data on demographics, social economic and exposure history to various potential risk factors for hypertension for the period of up to 10 years prior to the date of interview. Blood pressure, weight and height of participants were also recorded. Hypertension was defined as systolic blood pressure (BP) 140mmHg and/or diastolic BP 90mmHg, or being on regular anti-hypertensive therapy. Potential risk factors for hypertension were classified into two categories, modifiable and non-modifiable. The modifiable potential risk factors measured included: amount of salt use in diet; history of alcohol use; tobacco use; fruit and vegetable consumption; physical activity; weight, use of hormonal contraceptives, occupation, highest level of formal education attained, and location of residence urban or rural as defined by the Uganda Bureau of Statistics[9] ; that is, participants residing in Rukungiri township were classified as urban and rest as rural. The non-modifiable potential risk factors assessed included: height, age, history of diabetes mellitus, history of renal disease, and first degree family history of hypertension.

Height was measured without shoes using roller type, Seca 208 body meter to the nearest 0.5cm. Weight was measured to the nearest 0.5kg with a manual round-dial flat, Seca™ weighing scale, with the participants in light clothing and without footwear. Body mass index (BMI) was calculated as weight (kg) divided by squared height (m^2)[3]. Blood pressure (BP) and pulse rate were measured after the participant had been sitting upright for at least 5 minutes with an automatic machine (Speidel+Keller). The medium adult cuff for arm circumference 22 to 32cm was used. Three blood pressure readings were taken 1 minute apart. The average of the last 2 readings was used in the analysis[10].

Statistical Analysis

Prevalence of hypertension was calculated as the percentage of participants classified as hypertensive, with all study participants as the denominator. Prevalence was standardized by age using the method suggested by Morris and Gardner[11]. Thus the age-standardised hypertension prevalence was calculated by directly standardising to the New-world population aged 20 years or older. Binary logistic regression analysis was used to identify potential risk factors associated with hypertension. Only potential risk factor variables with a p-value of less than 0.05 were retained in the final logistic regression model. For this analysis, Odds Ratios (OR) with their corresponding 95% confidence intervals (95% CI) are reported. All statistical analyses were performed using the Statistical Package for Social Sciences Version 10.0.1[12].

Results

Characteristics of study population

A total of 842 residents of Rukungiri District participated in this study, of which 441 (52%) were females. The average age of participants was 39.6 (SD=15.8) years, and 48% were aged 20-34 years. Only 37% of the participants reported to had attained secondary school education, or higher. Only 65 participants (8%) were enrolled from Rukungiri Township, therefore were classified as "urban" residents. Most of the participants, 689 (or 82%) reported to be engaged in manual type of work as their main occupation. Of all the participants, 503 (60%) reported to have ever used alcohol, and 365 of these were current users Only 166 (20%) of the participants reported to have ever used tobacco, and 114 of these were current users. Forty percent of the participants (336) had a BMI of 25 or higher. Table 1 provides a summary of the characteristics of the study participants.

Table 1: Characteristics of study participant

Characteristic	All n=842
Age-group:	
20-34	401 (48%)
35-44	162 (19%)
45-54	117 (14%)
55-64	88 (11%)
65-74	43 (5%)
75+	31 (4%)
Mean ± SD	39.6 ± 15.8
Sex:	
Men	441 (52%)
Women	401 (48%)
Residence:	
Urban	65 (8%)
Rural	777 (92%)
Education level:	
None	138 (16%)
Primary	395 (47%)
Secondary	203 (24%)
Tertiary	106 (13%)
Occupation:	
Sedentary	153 (18%)
Manual	689 (82%)
Tobacco use:	
Never	676 (81%)
Current user	114 (14%)
Past user	52 (6%)

Prevalence of hypertension

A total of 252 study participants were classified as being hypertensive, giving a crude prevalence of hypertension of 30.4%, with a 95% Confidence Interval (CI) of 26.1 - 34.6%. Among hypertensive participants, the average systolic blood pressure reading was 144.0 (SD=17.4) and the average diastolic blood pressure reading was 90.4 (SD=9.7); whereas the normal-tensive participants, the average systolic blood pressure reading was 120.1 (SD=12.5) and the average diastolic blood pressure reading was 76.2 (SD=8.6). The age-standardised prevalence of hypertension was 30.5% [26.6 - 34.3%]. There was no significant difference in the age-standardised prevalence of hypertension between urban and rural dwellers (*p-value* =0.489). Hypertension prevalence was significantly higher among females, 34.0% [29.6% - 38.4%] compared to males 25.4% [21.1% - 29.7%]; (*p-value* =0.007).

The majority of participants with hypertension (55%) were aged between 20 to 44 years (see Table 2). Participants with hypertension were significantly older with an average age of 44.5 (SD=15.8), compared to normal tensive participants with an average age of 37.6 (SD=14.8); (*p-value* < 0.001). Participants with hypertension also on average had greater BMI (average of 26.1 + 4.6), compared to those without hypertension (average of 23.6 + 3.6), *p-value* <0.001.

Table 2: Comparison of characteristics of hypertensive and normal tensive participant

Characteristic:	Hypertensive n=252	Normal-tensive N=590	p-value
Age-group:			
20-24	90 (36%)	311 (53%)	< 0.001
35-44	48 (19%)	114 (19%)	
45-54	40 (16%)	77 (13%)	
55-64	40 (16%)	48 (8%)	
65-74	20 (8%)	23 (4%)	
75+	14 (6%)	17 (3%)	
Mean ± SD	44.5 ± 16.7	37.6 ± 14.8	< 0.001
Sex: Men	102 (41%)	299 (51%)	0.007
Women	150 (60%)	291 (49%)	
Residence: Urban	17 (7%)	48 (8%)	0.489
Rural	235 (93%)	542 (92%)	
Education level: None	54 (21%)	84 (14%)	< 0.001
Primary	100 (40%)	295 (50%)	
Secondary	50(20%)	153 (26%)	
Tertiary	48 (19%)	58 (10%)	
Occupation: Sedentary	61 (24%)	92 (16%)	0.005
Manual	191 (76%)	498 (84%)	
Tobacco use: Never	213 (85%)	463 (78%)	0.077
Current user	24 (10%)	90 (15%)	
Past user	15 (6%)	37 (6%)	
Physical activity: Low	30 (12%)	59 (10%)	0.333
Moderate	102 (41%)	218 (37%)	
>Moderate	120 (48%)	313 (53%)	
Alcohol use: Never used	86 (34.1%)	253 (43%)	< 0.001
Current user	105 (41.7%)	260 (44%)	
Past use	61 (24.2%)	77 (13%)	
g/week Mean + SD	114.5 + 104.5	126.2 + 150.0	0.64
BMI (kgm^{-2}): <25	112 (44%)	394 (67%)	< 0.001
25-29.9	96 (38%)	173 (29%)	
>=30	44 (18%)	23 (4%)	
Mean + SD	26.1 + 4.6	23.6 + 3.6	< 0.001

Factors associated with hypertension

Of the modifiable factors measured in this study, three were found to be significantly associated with hypertension, that is alcohol use, level of education, and Body Mass Index (BMI). Current alcohol users were more likely to be hypertensive compared to participants reporting to have never used alcohol, with an adjusted Odds Ratio (OR) of 1.64, [95% CI= 1.12 – 2.43]. Past alcohol users were also more likely to be hypertensive compared to participants reporting to have never used alcohol with an adjusted OR=2.28 [1.42 – 3.64].

Participants reporting to had attained tertiary level of education were more likely to be hypertensive, compared to those reporting to have never received any formal education with an adjusted OR= 1.91 [1.03 – 3.56]. Having a BMI greater than 25 was significantly associated with hypertension, the association being highest in subjects with BMI of 30 or higher, with an adjusted OR of 5.07 [95% CI= 2.79 – 9.21], compared to subjected with BMI less than 25 (see Table 3).

Table 3: Risk factor analysis for hypertension

Characteristic	- n -	# Hypertensive (%)	Adjusted OR [95% CI]	p-value
Alcohol use:				
Never used	341	86 (25.2%)	1.0	
Present alcohol use	362	105 (29.0%)	1.64 [1.12 – 2.43]	0.012
Past alcohol use	139	61 (43.9%)	2.28 [1.42 – 3.64]	0.001
BMI (kgm^{-2}):				
<25.0	506	112 (22.1%)	1.0	
25.0 - 29.9	269	96 (35.7%)	1.95 [1.37 – 2.79]	< 0.001
e"30	67	44 (65.7%)	5.07 [2.79 – 9.21]	< 0.001
Age group (years):				
20-34	401	90 (22.4%)	1.0	
35-44	162	48 (29.6%)	1.39 [0.89 – 2.18]	0.148
45-54	117	40 (34.2%)	1.58 [0.96 – 2.61]	0.072
55-64	88	40 (45.5%)	3.32 [1.92 – 5.75]	< 0.001
65-74	43	20 (45.5%)	3.52 [1.70 – 7.31]	0.001
75+	31	14 (45.2%)	3.50 [1.50 – 8.17]	0.004
All	842	252 (29.9%)	1.42 [1.27-1.59]	<0.001
Sex:				
Men	401	102 (25.4%)	1.0	
Women	441	150 (34.0%)	1.44 [1.03 – 2.06]	0.047
Education level:				
No formal education	138	54 (39.1%)	1.0	
Primary	395	100 (25.3%)	0.87 [0.53 – 1.42]	0.577
Secondary	203	50 (24.6%)	0.88 [0.50 – 1.58]	0.687
Tertiary	106	48 (45.3%)	1.91 [1.03 – 3.56]	0.041
Residence location:				
Urban	65	17 (26.2%)	1.0	0.490
Rural	777	235 (30.2%)	1.22 [0.69 – 2.17]	

The non-modifiable factors measured in this study that were found to be associated with hypertension included age and sex of the participant. The likelihood of hypertension increased with advancing age, with a significant association to hypertension starting from the age group 55-64. Among subjects aged 55-64 years, the adjusted OR was 3.32 [1.92 – 5.75], whereas the adjusted OR in subjects aged 65-75 was 3.52 [1.70 – 7.31], and in subjects aged 75 years or older the adjusted OR= 3.50 [1.50 – 8.17], all compared to subjects aged 20-34 years. Female participants were more likely to be hypertensive compared to men, with an adjusted OR=1.44 [1.03 – 2.06].

Discussion

Our study has determined that approximately one in every three adults aged 20 years or older in the rural Ugandan district of Rukungiri is hypertensive. The age-standardised hypertension prevalence was found to be 30.5%, which is much higher than that found in the few community-based published studies previously conducted in Uganda. It should be noted that comparison with previous surveys is problematic since previous studies used diverse definitions of hypertension and varying phases of recording the diastolic BP. Despite the differences in measurement of hypertension however, hypertension prevalence in Uganda appears to have increased over the years. A blood pressure survey by Williams (1941) in the then Teso District of Uganda showed that 2.9% of adults aged 21-50 years had diastolic BP (4th korotkoff phase) just over 90mmHg[6]. Another hypertension prevalence study conducted among Baganda men and women aged 10 years or older residing in Kasangati, Uganda in the 1960s found a hypertension (160/95mmHg- 4th phase diastolic BP recording) prevalence of 13.7%[7]. The prevalence of hypertension in this rural district is also relatively much higher than what has been found in recent studies conducted in other parts of Africa. A recent review of published studies on hypertension in Africa by Addo *et al* showed prevalence of hypertension ranging from 7.5% in Sudan (Elbagir and Ahmed 1990 cited in Addo *et al*

2007[4]) to 29.5% in Ghana[13]. Only one recent community-based study conducted in Tanzania has reported prevalence higher than that in our study of 37.7%[5]. Our findings therefore confirm the growing concern of hypertension as a public health problem in Uganda.

We found three modifiable risk factors to be associated with hypertension, including alcohol use, level of education and weight. It should be noted that the three modifiable factors of tertiary education, alcohol use and being overweight or obese were identified in the World Health Report of 1997 as risk factors for hypertension[2]. Current alcohol users were approximately 1.6 times more likely to be hypertensive, while past alcohol users were 2.3 more likely to be hypertensive; all compared to those who had never used alcohol. Several studies have reported alcohol use to be a risk factor for hypertension. Here in Africa, Agyemang (2006), Aubert (1998) and the first demographic study in South Africa, among others have demonstrated an association between alcohol use (moderate to heavy consumption) and hypertension[13-15]. The magnitude of the risk imposed by alcohol use found in our study also closely compares with that found by Jo *et al* who have reported that adults aged 18 to 92 years in Korea who were present alcohol users were 1.3 times more likely to be hypertensive compared to those who had never used alcohol[16].

Participants reporting to had attained tertiary education were nearly 3 times more likely to be hypertensive compared to those reporting to have never gone to school. This finding is consistent with findings by Ordunez et al (2005), whose study revealed that Cuban men with a lower level of education had a 14% lower risk of hypertension compared with those above the median[17]. In Jamaica, Mendez et al (2003) found that blood pressure was positively associated some high school education among men[18]. In the developed world, studies have consistently revealed an inverse education-blood pressure association. In a multi-country study by Stamler (1992), found that age-adjusted systolic blood pressure was 1.3mmHg higher (*p-value* = 0.05) for men and 4.5mmHg (*p-value* < 0.001) for women with 10 fewer years of education. The less educated were found to have higher sodium excretion, greater body mass, and a higher alcohol intake leading to increased blood pressure[19]. Our findings are also similar to those from a study conducted in an urban population in early epidemiological transition in Tanzania where Bovet et al (2002), reported that non-educated men were more likely to have higher systolic blood pressure than those with primary education ($p < 0.01$) [20].

Participants with a BMI greater than 25 were more likely to be hypertensive compared to those with a BMI of 25 or lower. In Tanzania, Bovet et al (2002) found that body mass index was strongly and independently associated with systolic and diastolic blood pressure (1.01 mmHg systolic BP per 1 kg/ m^2 increase in BMI) [20]. In Nigeria, Agyemang (2006) has also reported an independent association between BMI and BP[13]. Similar results were reported by Önal *et al* (2004) who found that hypertensive adults aged 25 years or older were twice more likely to be overweight or obese in Istanbul, Turkey[21]. These findings imply that having a normal weight, or losing weight among those who are overweight or obese, would reduce the chances of developing hypertension. BMI is greatly influenced by dietary practices like high intake of saturated fatty acids, irregular fish consumption, tobacco use and low physical activity[3]. However in our study all these factors were not significantly associated with hypertension. Perhaps the risk imposed by these is all reflected in the BMI of the individual.

Two non-modifiable risk factors were found to be associated with hypertension, including age and sex. Adults aged 55 years or older were more likely to be hypertensive compared to those in the younger age groups. This is consistent with findings from several studies that have reported the risk of hypertension increasing with advancing age. Edwards *et al* (2000) found that hypertensive men and women in rural and urban areas in Tanzania tended to be significantly older compared to those who were not hypertensive[5]. Another study conducted among adults aged at least 20 years in Soussa, Tunisia found that hypertension was significantly higher for adults older than 40 years of age[22,23]. Advancing age increases the risk of exposure to the lifestyle risk factors for hypertension and hence the observed increase in hypertensive risk with aging.

In the present study, the female participants were nearly 1.5 times more likely to be hypertensive compared to male participants. Similar findings have been reported by Amoah (2003), who found higher age-adjusted hypertension prevalence in females (29.5%) compared to males (27.6%) in a study done among adults aged 25 years or older in Accra, Ghana[24].

Although it has been observed that many people in Uganda have tended to adopt "western-type" diet

and sedentatry life styles that facilitate fat accumulation in blood predisposing them to Cardio-Vascular Diseases[25,] having sedentary (non-manual) occupation was not associated with hypertension in this study. Also location of residence (urban or rural) was not significantly associated with hypertension. Studies conducted in developing countries have revealed a higher risk of developing hypertension in upper socio-economic groups (good education, and sedentary occupations). Generally this corresponds to emerging middle-class populations and it probably represents the initial stage of the epidemic of cardiovascular diseases[2].

Conclusion

Our study is the only community-based study conducted in recent years in Uganda to estimate the burden, identify the determinants of hypertension in the general population. The prevalence of hypertension in this rural Ugandan district is relatively high. Our findings confirm the growing public health challenge of Non Communicable Diseases (NCD) like hypertension as a public health problem in Uganda. However more community-based studies of this nature are required to determine the extent of this problem, and the risk factors for hypertension in other communities in Uganda. Interventions aiming at reducing the risk factors identified in this study are needed, and should target both the high risk and the overall population in order reduce the risk and prevalence of hypertension

Study limitations

Because we used a cross-sectional study design to identify factors associated with hypertension, and due to the long latent period between exposure to risk and the development of hypertension, it may be difficult for the study participants to remember exposures that preceded the disease from those that occurred after the disease had developed. Further, prevalent cases of hypertension may not be representative of all cases as some severe cases may die soon after developing the disease. We however we believe that the methods used in the conduct of this study enabled us minimize the possible effect of these limitations on the findings in this study.

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