

# Assessing the Magnitude and Risk Factors Associated With Undiagnosed Hypertension in Rural Rwanda

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## Abstract

Individuals living with hypertension are predisposed to higher risk of stroke, kidney diseases and heart failure. Approximately 9.4 million people worldwide die from complications related to hypertension every year. Hypertension is often known as the silent killer because many people do not develop any symptoms until they get very sick. Early screening is particularly important for better treatment outcomes yet it remains a challenge in many countries. Worldwide, approximately 50% of people are living with undiagnosed hypertension. In Rwanda, the rate of undiagnosed hypertension is unknown, and so are the associated risk factors in rural communities. A cross-sectional descriptive study was conducted to determine the rate and risk factors of undiagnosed hypertension among adults in a rural community in Rwanda.

The proportion of people having undiagnosed hypertension was found to be high. Out of 155 study participants, 41.9% had undiagnosed hypertension, with slightly more men having hypertension (52.3%) than women (47.7%). More than 98% of respondents either did not know or knew wrong information about hypertension, and only 3% knew they should have regular checkups with physicians. Age ( $p=0.027$ ) and alcohol consumption ( $p=0.014$ ) were found to be statistically significantly associated with hypertension. Smoking and exercise were not found to be risk factors as most Rwandans living in the rural areas are physically active. Programs to promote hypertension awareness, encourage regular physical checkups, and reduce alcohol consumption are needed to improve diagnosis and control of hypertension in Rwanda. Community programs offering free regular blood pressure checks may also be helpful in identifying early hypertension. Larger scale studies of this kind should be conducted to understand whether results can be generalized to other areas of Rwanda

**Keywords:** undiagnosed hypertension, Rwanda, rural community, risk factors

## 1. Introduction

Globally, one billion individuals are living with high blood pressure, also known as hypertension, defined as having a blood pressure reading is higher than normal (120 mmHg for systolic and 80 mmHg for diastolic pressure for adults) (WHO, 2017). In 2010, it was estimated that 46% of people aged 25 and above in Africa and 35% in Western countries had hypertension (WHO, 2010). However, such prevalence could be higher in many low- and middle-income countries due to underdiagnosing and underreporting as a result of weaker health systems (WHO, 2014).

Worldwide, 51% of stroke-related deaths (Gaciong, 2013), 46.9% of cases of chronic kidney disease (Osafu et al., 2017), and 50% of heart failures (Roger, 2013; WHO, 2014) are attributable to high systolic BP. Approximately 9.4 million deaths are due to complications of hypertension every year (Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, 2012). In addition to its health effect, hypertension also has considerable economic impacts on individuals, their families, and societies. The total cost of treatment and lost productivity associated with non-communicable diseases, including hypertension, in low-income countries could be as high as 7 trillion USD between 2011 and 2025 (WHO, 2013). Such a huge financial burden mostly rests on patients and their families, especially in countries where financial protection from governments is limited and insurance systems are not well established (Kankeu, Saksena, Xu, & Evans, 2013; Elliott, 2003).

Hypertension is often known as a silent killer because many people do not develop any visible symptoms until they get very sick, causing worse treatment outcomes and higher treatment cost (Makridakis & DiNicolantonio, 2014; Kankeu et al., 2013). In 2007, it was estimated that approximately 50% of people worldwide were living with undiagnosed hypertension (Chockalingam, 2007). Evidence has shown that early hypertension screening has been particularly effective in reducing mortality over the last three decades (World Health Organization, 2013; Arrieta, Woods, Qiao, & Jay, 2014; Glynn et al., 2010; Wen et al., 2007; Hashmi et al., 2007; Hashmi et al., 2007; Puska, 2008; Kankeu et al., 2013). Nonetheless, early screening of hypertension remains a challenge in many countries (Khatib et al., 2014; WHO, 2000).

In Rwanda, two cross sectional studies were conducted in two urban settings and found that 36% to 38.3% of participants had hypertension, but only 3% to 8% were aware of their hypertensive status (Banyangiriki & Phillips, 2013; Umwangange, 2016), indicating the severity of undiagnosed hypertension in Rwanda. However, both studies were conducted in urban communities in Rwanda. Accordingly, this study was conducted to assess the rate of undiagnosed hypertension and the associated risk factors in a rural community.

## **2. Method**

### *2.1 Setting*

This study was conducted in a rural community in Rulindo district, Rwanda. The district has a total population of 287,681, of which 97% of them live in rural areas (NISR, 2012)

### *2.2 Study Design and Sample*

A cross-sectional study was conducted to determine the rate of and risk factors for undiagnosed hypertension among adults. Individuals who were 18 years or older were randomly selected from the community to participate in a survey and hypertension screening. Individuals who were previously diagnosed with hypertension were excluded from this study.

### *2.3 Measures and Data Collection*

The key measure of this study was the prevalence of hypertension. A participant was classified as hypertensive when his/her systolic blood pressure was equal to or above 140 MmHg and/or diastolic blood pressure was equal to or above 90 MmHg. Some basic demographic information and potential risk factors were also collected. Participants were invited by data collectors to participate in the study at the sites where the community held their monthly community services in March 2017. After data collectors explained the purpose and procedures of the study, they obtained informed consent from each participant. A private room was set up at the study site to provide privacy for the participants. Data collected included basic demographics; habits related to exercise, smoking and alcohol consumption; and knowledge about the definition of hypertension and optimal frequency of seeing a physician for checkups. The blood pressure, weight, and height of the participants were also measured. The interviews/examinations were conducted in Kinyarwanda (the local language). The information collected was recorded in a data collection form. The data collection form was designed in English and was translated to Kinyarwanda and back translated by two independent translators to ensure consistency. Participants' names were not collected to ensure that participants' privacy was protected.

### *2.4 Data Analysis*

Descriptive statistics were used to summarize the characteristics of the sample. Chi-square tests were used to analyze the association of all variables with hypertension. All statistical analyses were conducted using SPSS v.21, with the significance level set at 0.05.

## **3. Results**

A total of 155 respondents met the inclusion and exclusion criteria. Among them, 85 (54.8%) were females and 70 (45.2%) were males. The average age of the respondents was 42.8 years (SD  $\pm$ 12.3). The majority of the participants had only obtained the primary level of education (114, 73.5%). More than 83% were in socio-economic categories 2 and 3, 76.1% did not perform any physical exercise outside their work, 16.8% were smokers, 67.1% consumed one to three bottles of alcohol per day, and 80.6% were within normal BMI range (table 1). Out of all participants, 152 (98.1%) did not know what hypertension was and 151 (97.4%) did not know how often they should see a physician for a checkup (Table 1). The result showed 65 out of the 155 participants were found to have hypertension, translating to 41.9% prevalence (Table 1).

Table 1. Table summarizing the characteristics of the sample

Variable		n (%)
Sample (N)		155
Age (year)	Mean (SD)	42.8 ( $\pm$ 12.3)
	<35	41 (26.5%)
	35-50	73 (47.1%)
	>50	40 (25.8%)
Sex	Male	70 (45.2%)
	Female	85 (54.8%)
Education	None	30 (19.4%)
	Primary	114 (73.5%)
	Secondary	9 (5.8%)
	College or above	2 (1.3%)
Socioeconomic class	1 (poor)	23 (14.8%)
	2	68 (43.9%)
	3	61 (39.4%)
	4 (rich)	2 (1.3%)
Exercise	None	118 (76.1%)
	<3 times per week	25 (16.1%)
	3 times or more per week	12 (7.7%)
Smoking	None	129 (83.2%)
	<10 cigarettes a day	23 (14.8%)
	10 or more cigarettes a day	3 (1.9%)
Alcohol	None	47 (30.3%)
	1-3 bottles a day	104 (67.1%)
	>3 bottles a day	4 (2.6%)
Knowledge on HT	Not knowing or incorrect	152 (98.1%)
	Correct	3 (1.9%)
Knowing how often for physical	No	151 (97.4%)
	Yes	4 (2.6%)
BMI	Underweight (<18.5)	10 (6.5%)
	Normal (18.5 - 24.9)	125 (80.6%)
	Overweight (25-29.9)	17 (11.0%)
	Obese (30 or more)	3 (1.9%)
HT prevalence	No HT	90 (58.1%)
	HT	65 (41.9%)

In the bivariate analysis conducted to identify the risk factors associated with hypertension, age ( $p=0.027$ ) and alcohol consumption ( $p=0.014$ ) were found to be statistically significant (Table 2). Gender, education level, socioeconomic class, frequency of exercise, smoking status, BMI and knowledge were not statistically significant at  $p=0.05$ .

Table 2. Results of bivariate analysis to hypertension

Variables		HT	P-value
Age (year)	<35	16 (24.6%)	
	35-50	25 (38.5%)	0.027*
	>50	24 (36.9%)	
Sex	Male	34 (52.3%)	
	Female	31 (47.7%)	0.143
Education	None	16 (24.6%)	0.366
	Primary	43 (66.2%)	
	Secondary	5 (7.7%)	
	College or above	1 (1.5%)	
Socioeconomic class	1 (poor)	9 (13.8%)	
	2	25 (38.5%)	0.536
	3	30 (46.2%)	
	4 (rich)	1 (1.5%)	
Exercise	None	52 (80.0%)	
	<3 times per week	9 (13.8%)	0.623
	3 times or more per week	4 (6.2%)	
Smoking	None	50 (76.9%)	
	<10 cigarettes a day	14 (21.5%)	0.135
	10 or more cigarettes a day	1 (1.5%)	
Alcohol	None	12 (18.5%)	
	1-3 bottles a day	50 (76.9%)	0.014*
	>3 bottles a day	3 (4.6%)	
Knowledge on HT	Not knowing or incorrect	63 (96.9%)	0.572
	Correct	2 (3.1%)	
Knowing how often for physical	No	64 (98.5%)	0.640
	Yes	1 (1.5%)	
BMI	Underweight (<18.5)	5 (7.7%)	0.706
	Normal (18.5 - 24.9)	50 (76.9%)	
	Overweight (25-29.9)	8 (12.3%)	
	Obese (30 or more)	2 (3.1%)	

\* significant at p=0.05

#### 4. Discussion

Our study found that 41.9% of the adults residing in rural Rulindo district were hypertensive without previously being diagnosed. The prevalence was slightly higher than that found by the two studies previously conducted in Rwanda, in which data was collected in mixed settings that included both rural and urban populations (Banyangiriki & Phillips, 2013; Umwangange, 2016). Many studies have shown that men are more prone to having hypertension (Cutler et al. 2008; Vitale, Mendelsohn, Rosano, 2009; Sandberg and Ji 2012; Vitale et al. 2010), and our study also found that more men had hypertension, although the difference was not statistically significant. The prevalence of hypertension among older age groups were statistically significantly higher, which is consistent with the general physiological understanding of hypertension – the blood vessel walls become less elastic as we age (Franklin, Jacobs, Wong, L’italien, & Lapuerta, 2001; Anderson, 1999).

The levels of exercise, alcohol consumption, and smoking habits of our sample resembled those of the general Rwanda population (MOH/RBC, 2015). Since smoking is not common among Rwandans and only a very small proportion of our sample were smokers, it is reasonable to expect no significant association could be detected

between smoking and hypertension in our study despite the fact that smoking is a common risk factor for hypertension (Niskanen, et al, 2004).

Exercise has been well established to be a protective factor against hypertension for decades (Blair, Goodyear, Gibbons, & Cooper, 1984; Hayashi, Tsumura, Suematsu, Okada, Fujii, & Endo, 1999; Pereira, et al, 1999; Haskell, et al, 2007; Hu, Barengo, Tuomilehto, Lakka, Nissinen, Jousilahti, 2004). Our study did not find significant association. However, the results must be interpreted with care. For most people living in rural areas in Rwanda, physical activities are part of their daily lives, from working in the farm to fetching water, from delivering goods to markets to walking to workplaces. While many respondents many not consider these activities as “exercise” when responding to our questionnaires, they could be indeed physically active – supported by the evidence that most respondents also fell within the normal BMI range.

While most Rwandans do not smoke cigarettes, drinking alcohol is common; nearly 70% of our respondents reported that they consumed some alcohol on regular basis. According to an unofficial report by Helicopter View, a private business organization in Europe, Rwanda ranked 4th among the countries that consume the most alcohol in Africa, behind only Nigeria, Uganda and Kenya (Helicopter View, 2017). Decades of epidemiologic evidences have established that alcohol consumption a risk factor for hypertension (Sesso, Cook, Buring, Manson, & Gaziano, 2008; Klatsky, 1996; Beilin & Puddey, 2006; Taylor, et al, 2009; Shang et al., 2016) and our results showed the same. Effective policies or interventions for hypertension in Rwanda must not ignore alcohol consumption.

Having basic knowledge about hypertension is important for blood pressure control (El-hay & Mezayen, 2015; Hashmi et al., 2007; Egan, Zhao, Axon, 2010; Guo, He, Zhang, Walton, 2012). This study found that more than 98% of respondents either did not know what hypertension was or had incorrect information about hypertension. In addition, only 3% knew they should have regular checkups with physicians. Despite the current Rwandan MOH policy encouraging citizens to have yearly routine checkups, which are covered by the community-based health insurance (Rwanda, 2014), most study participants were not aware of the policy or coverage. The low uptake of regular physical checkups and the absence of signs and symptoms of early stage of hypertension both contribute to a high percentage of hypertension cases left undiagnosed in Rwanda. Interventions to raise awareness of hypertension and to promote regular physical checkups are necessary. Community programs that provide free regular blood pressure checks may also be helpful in diagnosing hypertension early.

## 5. Conclusion

Our study was the first in Rwanda to measure the prevalence of undiagnosed hypertension in a rural setting. Although the sample size was relatively small, our findings are comparable to those of other studies carried out in Rwanda. Nonetheless, a larger scale study of this kind should be conducted to fully understand the epidemiology of undiagnosed hypertension in Rwanda. Hypertension-related programs should focus on raising awareness, reducing alcohol consumption, and encouraging regular physical checkups. Services providing regular free blood pressure checks in the community would also promote earlier diagnosis.

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