

Prevalence of hypertension and associated risk factors among people living with HIV/AIDS in Kigeme, Rwanda 2020

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ABSTRACT

Introduction: Globally, hypertension is an emerging public health issue among People Living with HIV (PLHIV). Its prevalence and risk factors in Sub-Saharan African countries including Rwanda are inadequately documented. We determined the prevalence of hypertension and associated risk factors among PLHIV, who attended a rural district hospital in Rwanda. **Methods:** A cross-sectional study was conducted in a rural district hospital located in Southern Rwanda from January to December 2020. The study included 386 PLHIV aged 18 years and above, who were systematically selected. Hypertension was defined as a sustained rise in systolic and or diastolic blood pressure above a certain level or the use of antihypertensive medicines. The factors associated with hypertension among the PLHIV were identified using logistic regression. **Results:** The mean age was 47±14 years. The prevalence of hypertension among the PLHIV was 29.8% (95%CI: 25.5-34.5). Being on ART for more than 5 years (aOR: 2.0, 95%CI: 1.44-3.87) and overweight (aOR: 2.1, 95%CI: 1.26-3.61) were associated with being hypertensive, whereas being underweight (aOR: 0.1, 95%CI: 0.04-0.49) was protective. **Conclusion:** The prevalence of hypertension was high among PLHIV who have been followed up in a rural district hospital, in Rwanda. Patients who had been on ART for a longer duration and were overweight were at higher risk of developing hypertension. Being underweight seemed to be protective against hypertension. These findings highlighted the need for strengthening the current HIV surveillance system and integrating hypertension screening and care program into HIV treatment programs to mitigate the burden of hypertension among PLHIV.

KEYWORDS: Hypertension, PLHIV and ART, Rwanda

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Introduction

Hypertension (HTN) is a chronic medical condition in which there is a sustained rise in the blood pressure (BP) above given levels [1]. HTN is a major public health burden and a leading risk factor for cardiovascular disorders [2]. Every year, it affects one billion people across the world [3], and causes approximately 15 million deaths, of which 80% occur in low- and middle-income countries (LMIC)[4]. In 2008, 74.7 million individuals, who were affected by HTN lived in sub-Saharan Africa (SSA), where the prevalence rate of HTN was estimated to increase from 16.2% in 2008 to 17.4% by 2025 with over 125.5 million people living with HTN [5]. HTN accounts for approximately 9.4 million deaths annually. The prevalence of HTN in SSA varies across different population groups defined by occupation and degree of urbanization. HTN accounts for approximately 9.4 million deaths annually. The prevalence of HTN in SSA varies across different population groups defined by occupation and degree of urbanization [6].

Globally, the life expectancy of persons living with HIV (PLHIV) has increased due to improved accessibility to the Antiretroviral Treatment (ART)[7]. Currently, the number of PLHIV receiving ART has significantly increased, which has contributed to the reduction of HIV mortality from an estimated two million deaths in 2005 to one million in 2016 [8]. However, PLHIV have a higher prevalence of HTN compared to those who are uninfected [9], and mortality rates related to cardiovascular diseases have doubled among PLHIV [10].

In high-income countries, risk factors of HTN among PLHIV mainly include age and weight gain [11]. In these countries, the prevalence of HTN was also predicted to rise due to other factors related to increasing levels of development and changing life conditions [12]. On the other hand, LMICs have a high prevalence of HIV, and the behavioural risk factors of HTN include physical inactivity, excessive alcohol consumption, unhealthy diet, and tobacco use [13]. A study conducted in Zimbabwe reported a higher prevalence of HTN among PLHIV, who routinely used alcohol or added some salt to the ready-to-eat food, and those who were physically inactive or overweight[14].

In Rwanda, a particular interest is focused on non-communicable diseases (NCDs) with the reduction of HTN considered as an emerging priority, especially among PLHIV [15]. In 2018, the national prevalence of HTN was 15% and HIV 3% [16]. However, like many other countries in SSA, Rwanda has limited data on HTN in the PLHIV [17]. This study aimed to determine the prevalence of HTN and associated factors among PLHIV, who have been followed up in a rural district hospital located in Southern Rwanda.

Methods

Study design and setting

This was a cross-sectional study conducted in Kigeme District Hospital (KDH)- a rural district hospital located in Southern Rwanda. The hospital has a catchment population of 209,543 persons. KDH provides a wide range of secondary healthcare services, including HIV and NCDs-related services.

Study population

This study targeted a total population of 3,429 PLHIV who fell under the KDH catchment area for HIV services during the study period from January to December 2020. Considering the most probable prevalence of HTN as 50% and acceptable error as 5% with a 95% confidence interval (95%CI), the sample size (n) was calculated using this formula: $n = Z^2 P(1-P)/e^2$ and the estimated minimal sample size was $1.96^2 * 50\%(1-5\%)/0.05^2 = 384$ [18]. All PLHIV aged 18 years or older and who consented to participate were included in this study. Those who were mentally or physically unable to participate were excluded from the study.

Data collection

The study adapted a structured questionnaire from the World Health Organisation STEPwise approach to noncommunicable disease risk factor [19]. The questions were categorised into four categories. First, the questionnaire captured socio-demographic characteristics like age, gender, education, marital status and occupation. Secondly, it captured the information, pertaining to the social lifestyle such as smoking status, physical activity whereby “No” means less than 30 minutes exercise per day 5 times a week, alcohol consumption, fruit intake,

vegetables intake and routinely adding salt to a served food. Thirdly, information on medical history included diabetes history, family history of HTN, duration on ART, ART regimen, duration of HIV infection, viral load level and lastly captured anthropometric and nutritional variables, including a body mass index (BMI).

Enrolled participants were systematically selected using the interval (i) calculated as $i = N/n$; where n is the estimated sample, N the study population then $i = 3,429 / 384 = 10$. Therefore, every tenth person was selected from among the eligible participants at the hospital and included in the study. Each selected participant was interviewed and three consecutive BP measurements (systolic and diastolic) were taken using a well-calibrated Omron Upper Arm BP Monitor, with a time interval of 2 to 3 minutes to ensure the reliability, and the average reading was recorded. Heights were measured using a stand meter while patients were barefoot. The Ozeri ProMax 560 lbs body weight scale was used to measure weights to the nearest of 0.1kg with patients wearing light cloths. Data were collected by the three nurses, who had been trained before the fieldwork commenced. The data collection process was supervised by the main investigator.

Data management and analysis

Data were collected using Epi-Info 7 (version March 2015, CDC Atlanta), cleaned and then exported to the Stata version 16 (StataCorps.2016) for analysis. Descriptive statistics were performed, and frequency tables were generated. Independent variables were based on sociodemographic and medical characteristics of patients. The outcome variable was dichotomised as having or not having hypertension. Having hypertension was defined as a systolic BP ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg. Patients who had a systolic BP < 140 mm Hg and/or diastolic < 90 mm/Hg were considered as hypertensive-free [20]. The bivariate analysis was conducted to determine the association between the outcome and the independent variables. All variables that had p-value less than 0.05 in the bivariate analysis were entered into a multivariate logistic regression model to determine the independent associated factors. The adjusted odds ratio (aOR) and 95% confidence interval were reported.

Ethical Consideration

The study was approved by the Rwanda University, College of Medicine and Health Sciences Institutional Review Board (IRB) (Ref: No109/CMHS IRB/2021). Written informed consent was obtained from the participants. In this study, strict confidentiality measures were implemented to safeguard participant data. During the data collection phase, all identifying information was anonymized. Data analysis was conducted using password secured laptops, and only authorized personnel had access to the raw data. Additionally, aggregated results were presented without revealing individual participant details.

Results

A total of 386 participants were enrolled in this study. The mean age of the participants was 47 ± 14 years with a majority in the 55 years and above age group (34.5%, 133/386). Most were women 60.6% (234/386), 42.8% (165/386) were married, 41.1% (159/386) had attained primary education, and 63.2% (244/386) were farmers. Ninety one percent (350/386) had been HIV positive for 5 years or more, 88.4% (341/386) had been on antiretroviral medications for at least 5 years, 93.0% (359/386) had viral load of < 200 copies/ml and 71.2% (275/386) had a CD4 cell count of ≥ 500 cells/mm.

Regarding lifestyle factors, 85.5% (330/386) of participants had never smoked, 86.8% (335/386) had no household member who was a smoker, 17.4% (67/386) engaged in physical activities, 47.9% (185/386) never consumed alcohol and 22.8% (88/386) routinely added salt to served food.

There were 115 participants with hypertension giving a prevalence of 29.8% (95%CI:25.5-34.5). Among the participants that had HTN 43.5% (50/115) were aged ≥ 55 years, 45.2% (52/115) were men, 45.2 % (52/115) had a primary educational level, and 23.5% (27/115) were single (Table 1).

Bivariate analysis showed no statistically significant difference in the sociodemographic factors and lifestyle characteristics between participants who had hypertension and those without hypertension Table 1 and Table 2 respectively).

The association between hypertension status and medical characteristics of participants was assessed using bivariable analysis ([Table 3](#)). HTN was significantly associated with being on ART for at least five years (COR: 2.5; 95%CI: 1.09-5.82), tested HIV positive at least five years' prior to the current study (COR: 2.8; 95%CI: 1.08-7.50), being overweight (COR: 2.2; 95%CI: 1.31-3.57) and being underweight (COR: 0.2; 95%CI: 0.06-0.62).

After running the multivariate logistic regression model; the factors that were significantly associated with HTN were being: on ART ≥ 5 years (aOR: 2.0, 95% CI: 1.44-6.78), overweight (aOR: 2.1, 95% CI: 1.26-3.61) and underweight (aOR: 0.1, 95% CI: 0.45-0.49) ([Table 4](#)).

Discussion

The study revealed high prevalence of HTN among PLHIV at Kigeme which is almost double Rwanda's national HTN prevalence [[16](#)]. Also, being on ART treatment beyond 5 years and being overweight were associated with increased risks of HTN among PLHIV. Whereas patients living with HIV and classified as underweight seemed to be protected against HTN. The prevalence of HTN among PLHIV in our study was similar to what was reported in Zimbabwe and Ethiopia studies [[21-22](#)]. However, our finding has indicated that the prevalence of HTN was higher than that found in Malawi and Tanzania [[23-24](#)], but lower than the prevalence in Uganda [[25](#)].

We found that the longer the duration on the ART the higher the odds of developing HTN among PLHIV. This could be due to increasing age of the patients which is known to be associated with HTN or other factors inherent among those on ART. Similar finding was also observed in previous studies conducted in South Africa and Malawi [[7,23](#)]. However, other studies, which were carried out in Zimbabwe and Brazil did not confirm the relationship between the elapsed time since the initiation of ART and the development of HTN [[14-26](#)]. The fluctuating association between the duration on ART and the development of HTN may be partly explained by the type of ART regimen used by patients. Previous authors have reported increased hazards of HTN among patients who were treated with zidovudine-based regimen compared to

the patients using tenofovir, efavirenz or ritonavir/lopinavir-based regimen [[4](#)]. More studies are needed to further understand this association.

The present study has also demonstrated an association between being overweight and increased HTN among PLHIV, which was in line with findings from earlier studies, conducted in other countries[[14,27](#)]. In addition, some of these studies have reported lower risks of developing HTN among underweight PLHIV, which was consistent with our finding [[22,28-29](#)].

This study systematically investigated the issue of HTN among PLHIV in the Rwandan context who were stable on long term ART. However, our findings should be interpreted alongside some limitations. This study was carried out in one rural district hospital, suggesting the limited generalisability of findings to the country as a whole. A multicentre study, including a larger number of hospitals attending PLHIV across the country would provide a true national picture regarding the prevalence of HTN and associated factors. Further, our study could not thoroughly explore the development of HTN in relation to the ART regimen used by patients. Thus, future research should consider addressing this gap.

Our findings have both clinical and policy implications. There is need to raise the awareness of healthcare providers about the magnitude of HTN and associated factors among PLHIV and therefore lead them to readjust their routine practice to incorporate HTN screening and health education on prevention strategies for PLHIV as well providing HTN care management for those who need it. Our findings also provide further insights to the policy makers regarding the development of strategies and guidelines to prevent HTN and its detrimental effects among PLHIV.

Conclusion

This study has contributed to shedding light on prevalence of HTN and associated factors among PLHIV in a rural district hospital in Rwanda. Findings have shown a high HTN prevalence of 29.8% among PLHIV which is higher than the national prevalence of the general population. Being on ART for 5 years and above and being overweight

may significantly contribute to increased risks of developing HTN. Underweight patients seemed to be protected against the HTN. Thus, routine screening, prevention and management of hypertension (such as blood pressure control and weight management) should be emphasized among PLHIV and integrated into HIV care programs.

What is known about this topic

- HTN is an emerging public health issue among PLHIV
- HTN is a major risk factor for cardiovascular and cerebral vascular disease, which are both associated with high morbidity and mortality rates

What this study adds

- A high prevalence of hypertension at 29.8% among PLHIV attending a rural hospital in Rwanda
- The need to routinely screen for and provide hypertension prevention and care services for PLHIV

Competing interests

The authors declare no competing interests.

Authors' contributions

Aphrodis Hagabimana conceived and designed the study participated in data collection, analysis and interpretation, and drafted the original manuscript; Francine Birungi Supervised the research and Albert ndagijimana co-supervised the research and contributed to the methodology, analysis and interpretation. Aphrodis Hagabimana, Francine Birungi, Albert Ndagijimana, Jared Omolo, Ziad El-Khatib, Aimable Musafili, Ephraim Nzabonimana, Kelly Kaneza, revised the original manuscript. All authors read, revised and approved the final version of the manuscript.

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Tables and figures

Table 1: Sociodemographic characteristics of persons living with HIV by hypertension status, Kigeme, Rwanda 2020 (N=386)

Table 2: Lifestyle characteristics of persons living with HIV/AIDS by hypertension status, Kigeme, Rwanda 2020 (N=386)

Table 3: Medical characteristics of persons living with HIV by hypertension status, Kigeme, Rwanda 2020 (N=386)

Table 4: Independent factors associated with hypertension among people living with HIV at Kigeme Rwanda 2020 (N=386)

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Table 1: Sociodemographic characteristics of persons living with HIV by hypertension status, Kigeme, Rwanda 2020 (N=386)						
Variable	Overall N= 386 n (%)	Had HTN N=115 n (%)	No HTN N=271 n (%)	COR	95% CI	p- Value
Age (Years, Mean $\pm$ SD, range						
	47 $\pm$ 14.1 (18-82 years)					
≤ 24	31(8.0)	9 (7.8)	22 (8.1)	1		
25-34	44(11.4)	10 (8.7)	34 (12.5)	0.71	(0.25-2.05)	0.54
35- 44	78(20.2)	18 (15.7)	60 (22.2)	0.73	(0.29-1.87)	0.52
45-54	100(25.9)	28 (24.3)	72 (26.6)	0.95	(0.39-2.31)	0.91
≥ 55	133(34.5)	50 (43.5)	83 (30.6)	1.47	(0.63-3.45)	0.37
Gender						
Women	234(60.6)	63 (54.8)	171 (63.1)	1		
Men	152(36.4)	52 (45.2)	100 (36.9)	1.4	(0.97-2.20)	0.13
Education						
Secondary and higher	91(23.6)	24 (20.9)	67 (24.7)	1		
Primary	159(41.2)	52 (45.2)	107 (29.5)	1.4	(0.76-2.40)	0.29
Illiterate	136(35.2)	39 (33.9)	97 (35.8)	1.2	(0.66-2.17)	0.36
Marital status						
Single	77(19.9)	27 (23.5)	50 (18.5)	1		
Married	165(42.7)	42 (36.5)	123 (45.4)	0.63	(0.35-1.13)	0.12
Divorced and Widowed	144(37.4)	46 (40.0)	98 (36.2)	0.86	(0.48-1.56)	0.65
Occupation						
Unemployed	56(14.5)	14 (12.2)	42 (15.5)	1		
Business	60(15.5)	15 (13.0)	45 (16.6)	1	(0.43-2.32)	1.00
Formal employed	26(6.8)	9 (7.8)	17 (6.3)	1.58	(0.58-4.36)	0.37
Farmer	244(63.2)	77 (67.0)	167 (61.6)	1.38	(0.71-2.68)	0.34

Table 2: Lifestyle characteristics of persons living with HIV/AIDS by hypertension status, Kigeme, Rwanda 2020 (N=386)						
Variables	Overall N=386 n (%)	Had HTN N=115 n (%)	No HTN N=271 n (%)	COR	95% CI	p- Value
Tobacco use						
Never smoking	330 (85.5)	96 (83.5)	234 (86.3)	1		
Previous smoking	37 (9.6)	13 (11.3)	24 (8.9)	1.32	(0.64-2.70)	0.45
Current smoking	19 (4.9)	6 (5.2)	13 (4.8)	1.12	(0.41-3.05)	0.82
A member of \household smoking						
No	335 (86.8)	102 (88.7)	233 (86.0)	1		
Yes	51 (13.2)	13 (11.3)	38 (14.0)	0.78	(0.39-1.53)	0.47
Physical activities						
Yes	67 (17.4)	22 (19.1)	45 (16.6)	1		
No	319 (82.6)	93 (80.9)	226 (83.4)	0.84	(0.48-1.48)	0.55
Alcohol use or Consumption						
Never	185 (47.9)	49 (42.6)	136 (50.2)	1		
Occasional (One per week)	166 (43.0)	53 (46.1)	113 (41.7)	1.30	(0.820-2.065)	0.26
Frequent ($\geq$ one/week)	35 (9.1)	13 (11.3)	22 (8.1)	1.64	(0.77-3.50)	0.20
Fruit intake						
$\geq$ 5days/ week	48 (12.4)	18 (15.7)	30 (11.1)	1		
< 5days/ week	338 (87.6)	97 (84.3)	241 (88.9)	0.67	(0.36-1.26)	0.21
Vegetable intake						
$\geq$ 5days/ week	202 (52.3)	59 (51.3)	143 (52.8)	1		
< 5days/ week	184 (47.7)	56 (48.7)	128 (47.2)	1.06	(0.68-1.64)	0.79
Routinely add salt to served food						
No	298 (77.2)	88 (76.5)	210 (77.5)	1		
Yes	88 (22.8)	27 (23.5)	61 (22.5)	1.05	(0.63-1.77)	0.84

Table 3: Medical characteristics of persons living with HIV by hypertension status, Kigeme, Rwanda 2020 (N=386)						
Variable	n (%)	Had HTN, N=115 n (%)	No HTN, N=271 n (%)	COR	95% CI	p-Value
Diabetic history						
Don't know	49 (12.7)	10 (8.7)	39 (14.4)	1		
No	328 (85.0)	103 (89.6)	225 (83.0)	1.7	(0.85-3.72)	0.12
Yes	9 (2.3)	2 (1.7)	7 (2.6)	1.1	(0.199-6.21)	0.91
Family history of HTN						
Yes	48 (12.4)	13 (11.3)	35 (12.9)	1		
No	201 (52.1)	62 (53.9)	139 (51.3)	1.2	(0.59-2.42)	0.61
Don't know	137 (35.5)	40 (34.8)	97 (35.8)	1.1	(0.53-2.32)	0.78
ART duration						
< 5 years	45 (11.6)	7 (6.1)	38 (14.0)	1		
≥ 5 years	341 (88.4)	108 (93.9)	233 (86.0)	2.5	(1.09-5.82)	0.03
ART regimen						
First line	374 (96.9)	111 (96.5)	263 (97.0)			
Second line	12 (3.1)	4 (3.5)	8 (3.0)	1.18	(0.35-4.01)	0.79
Duration of HIV infection						
< 5 years	36 (9.3)	5 (4.3)	31(11.4)	1		
≥ 5 years	350 (90.7)	110 (95.7)	240(88.6)	2.84	(1.08-7.50)	0.03
Viral load (copies/ml)						
< 200	359 (93.0)	106 (92.2)	253 (93.4)	1		
≥ 200	27 (7.0)	9 (7.8)	18 (6.6)	1.19	(0.52-2.74)	0.68
CD4 cell count (cells/mm³)						
≥ 500	275 (71.2)	78 (67.8)	197 (72.7)	1		
< 500	111 (28.8)	37 (32.2)	74 (27.3)	1.26	(0.79-2.03)	0.33
BMI (kg/m²)						
Normal	255 (66.1)	72 (62.6)	183 (67.5)	1		
Underweight	44 (11.4)	3 (2.6)	41 (15.1)	0.2	(0.06-0.62)	0.01
Overweight	87 (22.5)	40 (34.8)	47 (17.3)	2.2	(1.31-3.57)	0.00

Table 4: Independent factors associated with hypertension among people living with HIV at Kigeme Rwanda 2020(N=386)

Variable	Adjusted OR	95% CI	p-Value
ART duration			
< 5 years	Reference		
≥ 5 years	2.0	1.44-3.87	0.04
Duration of HIV Infection			
< 5 years	Reference		
≥ 5 years	1.6	(0.29-8.89)	0.58
BMI, kg/m2			
Normal	Reference		
Underweight	0.1	(0.04-0.49)	<0.01
Overweight	2.1	(1.26-3.61)	<0.01