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Adherence to Hypertensive Medication among Hypertensive Patients Aged ≥ 35 Years Old Attending Muhima District Hospital, Rwanda

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Abstract

The burden of hypertension is estimated to be over nine million globally. The drain associated with hypertension is worsened by poor medication adherence, among other factors. Medication nonadherence in hypertensive patients is a complex problem that results in enormous health and economic burdens. In Africa, medication adherence is reported as low as 37.5%, while the global rate remains at 45.3%. Therefore, this study was conducted to determine the prevalence and factors associated with adherence to antihypertensive medication among hypertensive patients at Muhima District Hospital, Rwanda. Ministry of Health, Muhima District Hospital and other stakeholders may use these findings to plan and develop evidence-based health interventions to promote adherence to antihypertensive medication. A cross-sectional study was conducted among 272 patients attending NCD service at Muhima District Hospital of Rwanda. A systematic sampling technique was employed to recruit participants. A study questionnaire was used to collect quantitative data. Descriptive analysis (frequencies, mean and percentages), bivariate analysis (Chi-square test with α=0.05) and Poisson logistic regression (AOR and 95% CI) were computed by using SPSS v21.0. The majority of the patients (59.2%) were 55 years and older, with a mean (±SD) of 55.8 (9.9) years. More than half of the participants, 159 (58.5%), were females. This study revealed that prevalence of adherence to antihypertensive medication among participants was 70.6%. Patient-related factors with significant association with adherence included patients who had no problems affording your antihypertensive medication [AOR 1.15, CI (1.03 - 1.28), p=0.011], no problems of transport to go for appointment [AOR 1.15, CI (1.06 - 1.25), p<0.001], patient who never stopped taking their medication due to fear of adverse effect [AOR 1.65, CI (1.51 - 1.81), p<0.0001]. Patient belief that some medications are expensive [AOR 1.08, CI= (1.01 - 1.15), p=0.021 is the only healthcare delivery factor significantly associated with adherence to antihypertensive medication. Therefore, the Ministry of Health, Muhima DH and other stakeholders are recommended to ensure that antihypertensive medications are always available and affordable cost at the hospital's pharmacy and conduct

comprehensive information education communication sessions for hypertensive patients so that they understand the complications of nonadherence to medication.

Keywords: *Hypertensive Medication, Hypertensive Patients, Muhima District Hospital, Rwanda*

1. Introduction

Hypertension's global prevalence is steadily increasing, contributing to severe complications like stroke, heart disease, and chronic kidney disease (Alsofyani, 2022). Poor adherence to pharmacological treatment, whether accidental or deliberate, diminishes the benefits of medication (Win, 2021). Factors influencing nonadherence include patients' beliefs and health conditions. In the United Kingdom and the United States, inadequate hypertension control is linked to poor compliance (Gutierrez, 2021). Various strategies, including patient profiles, treatment features, and enhanced patient–provider engagement, aim to improve adherence. In China, nonadherence correlates with demographic factors, emphasizing the need for a multifaceted approach to antihypertensive adherence (Zhang, 2018; Burnier, 2019).

In developing countries, hypertension management faces challenges due to limited resources, particularly in rural areas with lower awareness, limited healthcare availability, and medication access (Tibazarwa, 2014). Sub-Saharan Africa has seen a steady rise in hypertension prevalence, ranging from 15% to 70%. Lifelong medication use is crucial for hypertension control (Sibomana, 2019). Poor adherence, influenced by various factors such as health literacy, cost, cultural beliefs, and provider–patient relationships, contributes to inadequate treatment, potentially leading to complications (James, 2014). Additional factors include comorbidities, medication changes, side effects, and dosage variations (Enslin, 2022; Weldegebreal, 2019; Agbor, 2018; Ferdinand, 2017).

Despite the availability of effective anti-hypertensive medications, hypertension remains a significant public health concern in Rwanda with the prevalence of 15.9% and is expected to increase to 17.78% in 2025, contributing to the burden of cardiovascular diseases (Sibomana, 2019). At Muhima District Hospital, there is a pressing need to understand the prevalence of adherence to anti-hypertensive medications and address the factors that influence this adherence among hypertensive patients. As a result, Muhima District Hospital, which offers functional nun communicable disease services that are affordable for the people of Nyarugenge District at every category level.

Non-adherence to prescribed medication regimens can lead to uncontrolled hypertension, increased morbidity, and healthcare resource utilization. This study aimed to investigate and identify the multifaceted factors associated with adherence to anti-hypertensive medication within the context of Muhima District Hospital, in order to develop targeted interventions and strategies for improving medication adherence among hypertensive patients, ultimately enhancing the management of hypertension and reducing its associated health complications.

1.2 Objectives of the study

1.2.1 General objective

The general objective of this study was to assess the adherence to medication among hypertensive patients aged ≥ 35 years old attending OPD service at Muhima District Hospital, Rwanda.

1.2.2 Specific objectives

(i) To determine the prevalence of adherence to anti-hypertensive medications among patients aged 35years and above attending Muhima District Hospital of Rwanda.

(ii) To determine the patient-related factors associated with adherence to anti-hypertensive medications among patients aged 35years and above attending Muhima District Hospital of Rwanda.

(iii) To determine the healthcare provider related factors associated with adherence to anti-hypertensive medications among patients aged 35years and above attending Muhima District Hospital of Rwanda.

2. Empirical literature

2.1 Prevalence of adherence to anti-hypertensive medication among hypertensive patients

Globally, adherence to anti-hypertensive medications is a global health concern and it creates a major obstacle to safe, cost-effective, and effective use of drugs (Gemeda, 2020). A comprehensive meta-analysis (MA) indicated a wide range of adherence rates, with adherence levels often falling below the optimal threshold of 80% or more. Rates of adherence ranged from as low as 30% to as high as 80%, highlighting the substantial variation in patient adherence to anti-hypertensive medications (Abegaz, 2017). Studies consistently demonstrated that higher adherence to anti-hypertensive medications resulted into better blood pressure control. Patients who adhered to their medication regimens were more likely to achieve target blood pressure levels compared to non-adherent individuals (Kimani, 2019).

In developed countries, the prevalence of adherence to anti-hypertensive medications varies, but research consistently shows that adherence rates are often suboptimal. A study that examined medication adherence among hypertensive patients in the United States reported that only around 50% of patients with hypertension were adherent to their prescribed anti-hypertensive medications (Boratas, 2018). The National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention (CDC) has consistently shown suboptimal adherence rates among hypertensive individuals in the U.S., with adherence rates fluctuating but generally remaining below 60% (CDC, 2022). In Canada, studies have also indicated suboptimal (Peacock, 2018). For example, research published in the "Canadian Journal of Cardiology" found that nearly one-third of hypertensive patients were non-adherent to their prescribed medications (Peacock, 2018). Studies in Australia have shown similar patterns of suboptimal adherence. For instance, a study conducted in Australia found that only 46% of hypertensive patients were adherent to their medications (Shahin, 2020). Adherence rates in various European countries also exhibit variability. Studies in countries like Germany, France, and Spain have reported adherence rates ranging from 40% to 70%, with some variation depending on the specific population studied (Mennini, 2015).

In Sub-Saharan Africa, the prevalence of adherence to anti-hypertensive medications varies across countries and regions, but empirical evidence generally indicates lower adherence rates compared to developed countries (Agbor, 2018). Several factors contribute to these lower rates,

including limited access to healthcare, socioeconomic disparities, and cultural beliefs (Asgedom, 2018). Studies conducted in Nigeria have reported variable adherence rates. For example, research published in the "Nigerian Journal of Clinical Practice" found that adherence rates among hypertensive patients ranged from 23% to 69%, with a considerable proportion of non-adherent individuals (Akintunde, 2015). In South Africa, a study published in the "South African Medical Journal" reported that only 27% of hypertensive patients were adherent to their prescribed medications (Enslin, 2022).

In East Africa, Low adherence to treatment is the main reason for poor BP control (Sorato, 2021). According to facility-based studies in Ethiopia, medication adherence was 61.8–75.1% (Asgedom, 2018). Research in Kenya, such as a study in the "Pan African Medical Journal", found that adherence rates among hypertensive patients varied, with some estimates suggesting adherence rates below 50% (Moss, 2021). A cross-sectional study conducted in Tanzania showed that the proportion of participants with treatment adherence was 56% (Sorato, 2021). A cross-sectional study conducted in Uganda showed that only 17% were adherent to antihypertensive medications (Mugwano, 2016). No recent study assessed the prevalence of adherence to anti-hypertensive medication among hypertensive patients in Rwanda.

2.2 Patient-related factors associated with adherence to anti-hypertensive medications

Globally, studies investigated patient-related factors affecting adherence to antihypertensive medications. A systematic review of studies conducted in Philippines on adherence about “Patient-related determinants of adherence to antihypertensive medications among adults with moderate to severe hypertension” found that factors such as patient beliefs about the necessity of medication, concerns about side effects, and health literacy significantly influenced adherence. Additionally, the study highlighted the importance of patient-provider communication in addressing these factors patient-related factors are the knowledge, attitudes, beliefs, and perceptions of hypertensive patients were found to be associated with adherence to anti-hypertensive medication (Gutierrez, 2021). One meta-analysis summarized literatures that were done about patient-related factors (Mamangon, 2018).

The results indicated that disease awareness is statistically significant where they related this to the coping mechanism to stress of the participants (Mamangon, 2018). In two literatures, knowledge is directly associated with medication adherence (Gutierrez, 2021). For attitude, three studies conducted on effectiveness of a community-based health program on the blood pressure control, adherence and knowledge of adults with hypertension concluded that positive attitude led to higher adherence (Calano, 2019). In the case of social support, three studies found a direct relationship between social support system and higher adherence and specifically, patients that were being supported by their children financially were twice more likely to be adherent (Sorato, 2021). Race and ethnicity are becoming essential concerns for hypertension treatment and control. Compared with white patients, hypertension in black patients tends to be more common, starting early, more severe, and rapidly progressive (Gutierrez, 2021). Black patients are at significantly greater risk for stroke than white patients, especially at younger ages. For example, the adjusted relative risk of stroke is more than two times higher in hypertensive black patients aged 45–64 years (Howard, 2013). The Important risk factors for hypertension among black patients include lower socioeconomic status, high-salt intake, and poor maternal nutrition (Whelton, 2018).

In sub-Saharan Africa (SSA), patients-related factors associated with adherence to antihypertensive medications were highly studied. A meta-analysis of studies from twelve SSA countries showed that using traditional medicine and individual wealth index are independent predictor of poor adherence to medication (Sorato, 2021). Zimbabwe's study showed that good adherence and having received health education on hypertension were protective against uncontrolled hypertension (Goverwa, 2014). A study assessed factors influencing treatment adherence in Malawi showed that 66.7% of the patients using the clinic's services did not adhere to their treatment. Predictors for nonadherence were long waiting times at the clinic and the interrupted supply of medicines (Mbeba, 2014). A systematic review in LMICs showed patient socioeconomic factors as the major reason for nonadherence (Nielsen, 2017). A study conducted in Ethiopia showed that lack of awareness of hypertension and related complications, Age, religious beliefs, and cost of medication were independent predictors of nonadherence (Gikunda, 2019). This cross-sectional study in Ethiopia, explored patient-related factors affecting adherence among hypertensive patients in Ethiopia. It found that factors such as medication beliefs, perceived social support, and knowledge about hypertension influenced adherence. The study underscored the importance of patient education and support in improving adherence (Gikunda, 2019). A similar study conducted in Zimbabwe showed that participants with normal BP measurements were more than three times as likely to report maximal adherence to prescribed drug schedules (Mugwano, 2016). A facility-based cross-sectional study conducted in Addis Ababa showed that the affordability of drugs has sometimes been implicated in poor treatment adherence. Higher co-payment, medication side effects, and poor patient-provider relationship were associated with poor adherence (Sorato, 2021).

In East Africa, a study conducted in northern Tanzania showed that good knowledge, attitude, and practices concerning hypertension were independently associated with increased BP control, even after adjusting for mediation through adherence (Maginga, 2015). A study from Uganda showed that awareness about hypertension helped in having controlled BP (Musinguzi, 2013). A study conducted in Kenya showed that about 53.6% of patients believed they should stop taking antihypertensive medication once hypertension is controlled (Kimani, 2019). A cross-sectional study conducted in Uganda showed that the main causes of nonadherence were lack of knowledge and lack of prescribed drugs (Mugwano, 2016).

2.3 Healthcare provider related factors associated with adherence to anti-hypertensive medications

Globally, health care providers' practice habits, particularly the reluctance to intensify treatment and therapeutic inertia, have been implicated in the failure to meet BP goals (Saleh, 2015). Physician uncertainty over adherence is the main contributor to clinical inertia. Another important provider related barrier to BP control was knowledge of evidence-based guidelines (Sorato, 2021).

In sub-Saharan Africa, the availability and affordability of essential medicines and diagnostic technologies for CVD were barriers to BP control. This could be due to lack of political will, insufficiency of human resources or funding, conflict of interests, and weak social insurance system (Sorato, 2021). A recent study showed that one pill combination (aspirin, β-blocker, ACE inhibitor, and statin) was not affordable for 60% of households (Khatib, 2016). According to Ethiopia's third national pharmaceutical sector survey, none of the essential medicines for NCDs were affordable (Gerba, 2017). Poor accessibility of health services is also contributing to poor

BP control. In Ethiopia, living within 30 min distances of a public-sector hospital was associated with improved adherence to therapy (Maimaris, 2013). The study evaluated the impact of poverty on hypertension and Cardio Vascular Diseases (CVD) in SSA showed that about 24% of the world's disease burden is in Africa, but only 3% of the world's healthcare workers and just 1% of the global financial resources to manage this burden. Thirty-six out of 57 countries that can't meet an accepted basic healthcare standard are in SSA (Sorato, 2021).

In East Africa, health facility capacity to manage hypertension in the Uganda survey showed the need of additional training on hypertension management by all health workers (Musinguzi, 2013). A similar study from Zimbabwe showed that professional knowledge was poor among 47.7% of health workers (Mungati, 2014). Another study from Rwanda showed that 43% of clinicians had poor knowledge (Sibomana, 2019). Similar study from northern Tanzania showed that poor point-of-care communication, poor understanding of hypertension and structural barriers such as long wait times and undertrained providers were barriers to optimal care (Galson, 2017). A recent household study showed that in Uganda, 35% of households had to travel > 15 min to reach a health facility and only 16% of Ugandan households have access to medicines for hypertension and other NCDs (Sorato, 2021).

2.4 Research Gap

Different research studies were conducted to assess the factors associated with adherence to anti-hypertensive medications. However, three research gaps were identified. The first research gap was limited exploration of psychological factors as the key factors among patients-related factors. The studies reviewed didn't thoroughly investigated psychological factors such as patient beliefs, attitudes, and perceptions related to anti-hypertensive medication. Understanding these factors could inform targeted interventions. The second research gap was socioeconomic factors: The study might not have adequately addressed socioeconomic determinants of adherence, including access to healthcare and affordability of medications among healthcare system related factors. The last gap was geographical consideration. Geographical variation in adherence patterns may exist, but this aspect has not been explored. Research focusing on different regions or healthcare settings could reveal variations in adherence prevalence and factors.

3. Materials and Methods

This cross-sectional study, conducted at Muhima District Hospital in Rwanda, employed a systematic random sampling method to select 272 hypertensive patients aged >35 years attending the Non-Communicable Diseases (NCD) Clinic over a one-month period. The study utilized a questionnaire developed by the researcher, including sections on demographics, prevalence assessment, patient-related factors, and healthcare system-related factors. To establish reliability, Cronbach's Alpha was calculated, demonstrating strong internal consistency ($\alpha = 0.80$), and test-retest reliability was confirmed through a high correlation in repeated administrations. For validity, content validity was ensured by expert reviews from NCD clinic medical professionals.

Data collection involved two trained data enumerators conducting interviews with patients at Muhima Hospital. The analysis, performed using SPSS software, included descriptive statistics, presenting continuous variables as mean and standard deviation, and categorical variables as

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Journal of Medicine, Nursing & Public Health
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frequency and proportion. The prevalence of adherence to antihypertensive medication was illustrated using a bar chart. Bivariate analysis, employing the Pearson chi-square test, explored relationships between adherence and socio-demographic, patient-related, and healthcare delivery system factors.

Therefore, the factors with a significant p-value in bivariate analysis were considered in the subsequent multivariate analysis. Poisson Logistic regression with robust variance was utilized for multivariate analysis, considering the high adherence prevalence (70.6%). Ethical considerations involved obtaining clearance from the Mount Kenya University Institutional Review Board and permission from the General Director of Muhima District Hospital. Informed consent was obtained from participants, ensuring confidentiality and ethical conduct throughout the study.

4. Results

4.1 Description of independent variables

4.1.1 Description of socio-demographic characteristics of respondents

Table 4.1: Socio-demographic characteristics of hypertensive patients at Muhima District hospital in 2023 (n=2022).

Variables (n=272)	Frequency (n)	Percent (%)
Age(in years)		
35-44 years	40	14.7
45-54 years	71	26.1
55-64 years	95	35.3
65 years and above	66	23.9
Mean (SD)	55.8 (9.9)	
Min, Max	35, 80	
Sex		
Male	113	41.5
Female	159	58.5
Marital status		
Single	1	0.4
Divorced	25	9.2
Widow	44	16.2
Married	202	74.2
Religion		
Traditional/No religion	16	5.9
Catholic	109	40.1
ADEPR	77	28.3
Adventist	51	18.8
Islam	18	6.6
Others	1	0.3
level of education		
No formal education	24	8.8
Primary school	106	39.0
Secondary school	101	37.1

University	41	15.1
Occupation		
Unemployed	10	3.7
Farmer	82	30.1
self employed	144	52.9
Employed	36	13.2
Monthly income (000 Rwf)*		
< 50	6	2.1
50 – 200	84	30.9
201 – 400	153	56.3
> 400	29	10.7
Time to reach at Health Facility		
< 30 mins	3	1.1
30-60 mins	111	40.8
1hr-2 hr	135	49.6
Above 2 hours	23	8.5
Require a family/friend to accompany to clinic		
Yes	15	5.5
No	257	94.5

*Rwf, Rwanda Francs

Source: Primary data, 2023

In this study, 272 respondents were involved. As indicated in Table 4.1, most patients fall within the age range of 45-64 years (62.5%). Female participants slightly outnumber males, constituting 58.5% of the sample. Most participants are married (74.2%). The largest religious group is Catholic (40.1%), followed by ADEPR (28.3%) and Adventist (18.8%). Primary and secondary education holders comprise the majority (76.1%), with 39.0% and 37.1% respectively. Self-employed individuals form the largest group (52.9%), followed by farmers (30.1%). The majority (56.3%) reported having a monthly income of 201 - 400 thousand Rwanda francs. Most participants (49.6%) take 1-2 hours to reach a health facility. The majority (94.5%) do not require a family or friend to accompany them to the hospital.

4.1.2. Description of patient related factors

Table 4.2 describes various patient-related factors among the surveyed individuals.

The majority of the patients (52.6%) have been suffering from the disease for 4-6 years, followed by those with a duration of 7 years or more (40.8%). Most patients (82.4%) are on two medications. All surveyed individuals reported not using recreational drugs. Regarding comorbidities, a minority have additional health conditions such as diabetes (3.7%), heart diseases (2.9%), kidney diseases (3.3%), and lung diseases (2.2%). The majority (87.9%) reported having no comorbidities. Most patients (93.4%) do not feel that their condition is under control enough to stop their medication. Nevertheless, 26.5% expressed fear about the side effects of their medications. A minority of individuals reported using alcohol (9.6%), while the majority (90.4%) did not. Most patients (77.2%) had knowledge about the serious complications of non-adherence to medication. Some patients faced challenges related to transport for appointments (14.7%), and a portion (19.9%) felt that their medicines disrupt their life.

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

Table 4. 2:Description of patient related factors at Muhima District Hospital, Kigali, 2023 (n=272)

Variables (n=272)	Frequency (n)	Percent (%)
Duration of disease		
< 3 years	18	6.6
4-6 years	143	52.6
≥ 7 years	111	40.8
Number of medications		
One	28	10.3
Two	224	82.4
Three	13	4.8
Four and above	7	2.5
Recreational drugs		
No	272	100.0
Yes	0	0.0
Comorbidity		
Diabetes	10	3.7
Heart diseases	8	2.9
Kidney disease	9	3.3
Lung diseases	6	2.2
None	239	87.9
Fear of side effect of medication		
Yes	72	26.5
No	200	73.5
Feeling of condition is under control and stop medication		
Yes	18	6.6
No	254	93.4
Alcohol use		
Yes	26	9.6
No	246	90.4
Knowledge of serious complication of non-adherence		
Yes	210	77.2
No	62	22.8
Believe that hypertension can be healed by prayers		
Yes	21	7.7
No	251	92.3
Herbal remedies use		
Yes	17	6.3
No	255	93.7
Ever had high blood pressure medication affordability problem?		

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Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

Yes	14	5.1
No	258	94.9
Problems of transport to go to appointment?		
Yes	40	14.7
No	232	85.3
My medicines disrupt my life		
Yes	54	19.9
No	218	80.1

Source: Primary data, 2023

4.1.3. Description of Healthcare delivery system factors

The distribution of healthcare delivery system factors as perceived by the surveyed patients is presented in Table 4.3.

All surveyed patients (100%) reported having health insurance, indicating a high coverage within this sample. None of the respondents reported facing costs for anti-hypertensive medications, suggesting they might be covered by their health insurance or provided without direct charges. However, 14.3% indicated that some medications are expensive despite not being directly charged for their anti-hypertensive drugs. Most patients are satisfied with how information is communicated about their health problem and its treatment (89.3%) and the hospital's pharmacy services (82.4%). A high level of trust is placed in the medications provided by the hospital to help with their condition (92.3%). Most patients (85.7%) reported being satisfied with the care they received at the clinic.

Table 4. 3: Description of Healthcare delivery system factors at Muhima District Hospital, Kigali, 2023 (n=272)

Variables (n=272)	Frequency (n)	Percent (%)
Have health insurance		
Yes	272	100.0
No	0	0.0
Any cost charged for anti-hypertensive medications		
Yes	272	100.0
No	0	0.0
Some medications are expensive		
Yes	39	14.3
No	233	85.7
Are you satisfied with how information is communicated concerning your health problem and its treatment?		
Yes	243	89.3
No	29	10.7
Are you satisfied with hospital's pharmacy services?		
Yes	224	82.4
No	48	17.6

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

Do you have a trust in the medications given by the hospital will help with your diseases condition?		
Yes	251	92.3
No	21	7.7
Are you satisfied with the care you receive at the clinic?		
Yes	233	85.7
No	39	14.3

Source: Primary data, 2023

4.2 Presentation of Findings

4.2.1 Prevalence of adherence to anti-hypertensive medications

Figure 4.1 illustrates the prevalence of adherence to antihypertensive medication among hypertensive patients at Muhima District Hospital.

The overall prevalence of adherence to antihypertensive medication at Muhima District Hospital was 70.6%

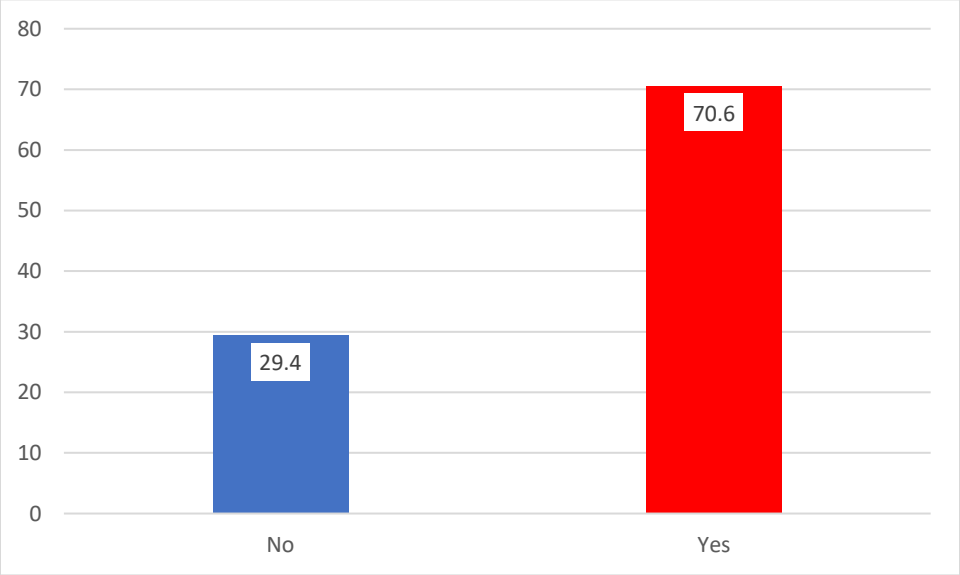

Figure 4. 1:*Prevalence of adherence to antihypertensive medication*

4.2.2. Bivariate association of socio demographic factors with adherence

Table 4.4 shows the bivariate association of socio-demographic factors with adherence to antihypertensive medication among the surveyed patients.

Education is the only socio-demographic variable with a significant association with adherence ($p<0.001$). There is no significant association between age and adherence ($p>0.05$). Adherence rates appear consistent across different age brackets. Similarly, no significant association exists between sex (male/female) and adherence ($p=0.739$). The association between marital status ($p=0.900$), occupation ($p=0.909$), monthly income ($p=0.118$), religion ($p=0.788$), travel time to

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

the clinic (p=0.603), and family/friend accompanying patient (0.810) and adherence did not reach statistical significance.

Table 4. 4:Bivariate association of socio-demographic factors with adherence at Muhima Distric Hospital, 2023 (n=272)

	Adherence		Chi-square	*p*-value
Variable	**Yes (n,%)**	**No (n,%)**		
Age (years)			0.240	0.971
35-44	27 (14.1)	13 (16.3)		
45-54	51 (26.6)	20 (25.0)		
55-64	68 (35.4)	28 (35.0)		
≥65	46 (24.0)	19 (23.8)		
Sex			0.111	0.739
Male	81 (42.2)	32 (40.0)		
Female	111 (57.8)	48 (60.0		
Marital status			0.016	0.900
Not married*	49 (25.5)	21 (26.2)		
Married	143 (74.5)	59 (73.8)		
Education			22.186	**<0.001****
No formal education	11 (5.7)	13 (16.3)		
Primary	64 (33.3)	42 (52.5)		
Secondary	82 (42.7)	19 (23.8)		
University	35 (18.3)	6 (7.4)		
Occupation			0.546	0.909
Unemployed	7 (3.6)	3 (3.8)		
Farmer	60 (31.3)	22 (27.4		
Self-employed	101 (52.6)	43 (53.8		
Employed	24 (12.5)	12 (15.0)		
Monthly income (000 Rwf)*			2.445	0.118
<200	58 (30.2)	32 (40.0)		
≥200	134 (69.8)	48 (60.0)		
Religion			0.476	0.788
Traditional/no religion/other	11 (5.7)	6 (7.5)		
Christianity	169 (88.0)	68 (85.0)		
Islam	12 (6.3)	6 (7.5)		
Time to reach health facility			1.011	0.603
< 1 hour	77 (40.1)	37 (46.3)		
1 - 2 hours	99 (51.6)	36 (45.0)		
> 2 hours	16 (8.3)	7 (8.7)		
Require a family/friend to accompany to clinic			0.058	0.810
Yes	11 (5.7)	4 (5.0)		

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Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

No	181 (94.3)	76 (95.0)

**Significant at *p*-value<0.001

Source: Primary data, 2023

4.2.3 Bivariate association of patient-related factors with adherence

Table 4.5 presents a bivariate analysis showing the association between various patient-related factors and adherence to medication among individuals with hypertension. The Chi-square test was used to assess the significance of associations.

A significant statistical association was observed between adherence and patients' fear of medication side effects, stopping medication due to feeling HTN is under control, knowledge of complications due to non-adherence, belief that HTN can be healed with prayers, herbal remedy use, medication affordability issue, and transport to clinic problem, *p* is less than 0.001 in all the variables. However, the association between adherence and disease duration, number of pills, alcohol use, comorbidity, and patients' feeling that medication disrupt their life was not statistically significant, p>0.05 in all cases.

Table 4. 5: Bivariate association of patient-related factors with adherence at Muhima District Hospital, Kigali, 2023 (n=272)

	Adherence		Chi-square	*p*-value
Variable	**Yes (n, %)**	**No (n, %)**		
Duration of disease			1.002	0.606
< 3 years	12 (6.3)	6 (7.5)		
4 - 6 years	98 (51.0)	45 (56.3)		
≥ 7 years	82 (42.7)	29 (36.2)		
Number of medications			4.308	0.230[a]
One	18 (9.4	10 (12.5)		
Two	164 (83.3)	64 (80.0)		
Three	11 (5.7)	2 (2.5)		
Four and above	3 (1.6)	4 (5.0)		
Comorbidity			4.374	0.358[a]
Diabetes	9 (4.7)	1 (1.2)		
Heart diseases	7 (3.6)	1 (1.2)		
Kidney disease	6 (3.1)	3 (3.8)		
Lung diseases	5 (2.6)	1 (1.2)		
None	165 (86.0)	74 (92.6)		
Fear of medication side effect			225.851	**<0.001****
Yes	191 (99.5)	9 (11.3)		
No	1 (0.5)	71 (88.7)		
Feeling of condition is under control and stop medication			46.261	**<0.001****
Yes	0 (0.0)	18 (22.5)		

No	192 (100.0)	62 (77.5)		
Alcohol use			0.556	0.486
Yes	20 (10.4)	6 (7.5)		
No	172 (89.6)	74 (92.5)		
Knowledge of serious complication of nonadherance			21.936	**<0.001****
Yes	163 (84.9)	47 (58.7)		
No	29 (15.1)	33 (41.3)		
Believe that hypertension can be healed by prayers			40.873	**<0.001****
Yes	2 (1.0)	19 (23.7)		
No	190 (99.0)	61 (76.3)		
Herbal remedies use			35.569	**<0.001[a]****
Yes	191 (99.5)	64 (80.0)		
No	1 (0.5)	16 (20.0)		
Ever had high blood pressure medication affordability problem?			31.929	**<0.001****
Yes	0 (0.0)	14 (17.5)		
No	192 (100.0)	66 (82.5)		
Problems of transport to go to appointment?			112.552	**<0.001****
Yes	0 (0.0)	40 (50.)		
No	192 (100.0)	40 (50.)		
My medicines disrupt my life			0.139	0.709
Yes	37 (19.3)	17 (21.2)		
No	155 (80.7)	63 (78.8)		

[a]Fisher,
**Significant at *p*-value < 0.001

Source: Primary Data 2023

4.2.4 Bivariate association of healthcare delivery factors with adherence

Table 4.6 shows the analysis of various factors associated with various healthcare delivery factors and patient adherence among patients attending Muhima District Hospital in Rwanda.

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Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

The patients' feeling that some medications are expensive is the only variable with a statistically significant association with adherence; p<0.001. There is no statistically significant association between patients' satisfaction with how information is communicated about health problems and treatment and their satisfaction with the care at the clinic and pharmacy service, trust in the medication and adherence; p-value is greater than 0.05 in all variables.

Table 4. 6:Bivariate association of healthcare delivery factors with adherence at Muhima District Hospital, Kigali, 2023 (n=272)

	Adherence			
Variable	**Yes**	**No**	**Chi-square**	***p*-value**
Are you satisfied with how information is communicated concerning your health problem and its treatment?			4.350	0.510
Yes	170 (88.5)	73 (91.2)		
No	22 (11.5)	7 (8.8)		
Are you satisfied with hospital pharmacy services?			0.008	0.930
Yes	177 (92.2)	74 (92.5)		
No	15 (92.5)	6 (7.5)		
Do you have trust the medications given by the hospital will help with your diseases condition?			73.180	<0.001**
Yes	5 (2.6)	34 (42.5)		
No	187 (97.4)	6 (57.5)		
Are you satisfied with the care at the clinic?			2.958	0.085
Yes	169 (88.0)	64 (80.0)		
No	23 (12.0)	16 (20.0)		

**Significant at *p*-value < 0.001

Source: Primary Data 2023

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Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
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4.2.5. Multivariate analysis of socio-demographic, patient-related and healthcare delivery factors associated with adherence.

As indicated in Table 4.7, the results of a multivariate analysis examining the association between various factors and adherence to antihypertensive medication. The variables include marital status, knowledge of serious complications of non-adherence, belief in the healing power of prayers for hypertension, herbal remedies use, medication adherence behaviour, affordability of medication, problems with transportation for appointments, fear of adverse effects, and skipping medication due to financial reasons.

All the variables, except marital status ($p>0.05$), were statistically significant in the unadjusted models. Nevertheless, the association between knowledge of complications due to nonadherence, the belief that HTN can be healed with prayers or herbal remedy use, as well as stopping the medication when feeling HTN is under control was attenuated in the adjusted model; there was no statistically significant association observed between these variables and adherence ($p>0.05$).

No statistically significant association was found between marital status and medication adherence. The crude odds ratio (COR) and adjusted odds ratio (AOR) were close to 1, indicating no significant effect. Respondents with knowledge of serious complications of non-adherence were significantly more likely to adhere to medication. The odds of adherence were reduced by 20% for those who did not know (COR = 0.80), but this association became non-significant after adjusting for other factors (AOR = 0.98). Those who believed that prayers could heal hypertension were significantly less likely to adhere to medication. The odds of non-adherence were 53% higher for this group (COR = 1.53), but the effect became non-significant after adjustment (AOR = 1.04).

Respondents using herbal remedies were significantly less likely to adhere to medication. The odds of non-adherence were 55% higher for this group (COR = 1.55), but the effect became non-significant after adjustment (AOR = 1.02). Several factors were significantly associated with non-adherence, including the belief that prayers can heal hypertension, not feeling the need for medication when blood pressure is controlled, problems affording medication, problems with transportation, fear of adverse effects, and skipping medication due to financial reasons, Here there no-statistical significance levels with p-values are great than 0.05.

Furthermore, those who had problems affording medication were significantly more likely to be non-adherent. The odds of non-adherence were 59% higher for this group (COR = 1.59), and this association remained significant after adjustment (AOR = 1.15). Respondents with problems of transportation were significantly more likely to be non-adherent. The odds of non-adherence were 71% higher for this group (COR = 1.71), and this association remained significant after adjustment (AOR = 1.15). Those who ever stopped taking medication due to fear of adverse effects were significantly more likely to be non-adherent. The odds of non-adherence were 90% higher for this group (COR = 1.90), and this association remained significant after adjustment (AOR = 1.65).

Respondents who skipped medication due to financial reasons were significantly more likely to be non-adherent. The odds of non-adherence were 56% higher for this group (COR = 1.56), and this association remained significant after adjustment (AOR = 1.08). The significance levels are

Stratford Peer Reviewed Journals and Book Publishing
Journal of Medicine, Nursing & Public Health
Volume 7||Issue 1||Page 1-22 ||January||2024|
Email: info@stratfordjournals.org ISSN: 2706-6606

indicated by asterisks, with p-values less than 0.05. The adjusted odds ratios consider the simultaneous influence of multiple variables on medication adherence.

Table 4. 7:Multivariate analysis of socio-demographic, patient-related and healthcare delivery factors associated with adherence at Muhima District Hospital, Kigali, 2023 (n=272)

Variable	COR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Marital status				
Not married	1		1	
Married	1.01 (0.91 - 1.11)	0.900	1.01 (0.97 - 1.05)	0.702
Knowledge of serious complication of non-adherence				
Yes	0.80 (0.73 - 0.88)	**<0.001****	0.98 (0.94 -1.02)	0.336
No	1		1	
Believe that hypertension can be healed by prayers				
Yes	1		1	
No	1.53 (1.42 - 1.66)	**<0.0001*****	1.04 (0.97 - 1.12)	0.243
Herbal remedies use				
Yes	1		1	
No	1.55 (1.44 - 1.67)	**<0.0001*****	1.02 (0.94 - 1.11)	0.589
When you feel like your high blood pressure is under control, do you sometimes stop taking your medication?				
Yes	1		1	
No	1.61 (1.54 - 1.68)	**<0.0001*****	1.04 (0.97 - 1.11)	0.304
Have you had or currently have problems affording your antihypertensive medication?				
Yes	1		1	
No	1.59 (1.53 - 1.66)	**<0.0001*****	1.15 (1.03 - 1.28)	**0.011***
Have you had or currently have problems of transport to go for appointment?				
Yes	1		1	
No	1.71 (1.64 - 1.78)	**<0.0001*****	1.15 (1.06 - 1.25)	**<0.001****
Have you ever stooped taking your medication due to fear of adverse effect?				
Yes	1		1	
No	1.90 (1.84 - 1.96)	**<0.0001*****	1.65 (1.51 - 1.81)	**<0.000*****
Some medications are expensive. Have you ever skipped your medication due to financial reasons?				
Yes	1		1	
No	1.56 (1.46 - 1.68)	**<0.0001*****	1.08 (1.01 - 1.15)	**0.021***
*Significant at p<0.05, **Significant at p<0.001, ***Significant at p<0.0001, COR, Crude odds ratio, AOR, Adjusted odds ratio				

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4.3. Discussion

Patients' adherence to their antihypertensive medication/s has paramount importance for preventing its squealed or associated morbidities. This study revealed that (70.6%) of hypertensive patients had good adherence to their medication therapy. This implies that out of (29.4%) patients were non-adherent to their medication therapy. This finding was in line with those of studies done by (Raja et al., 2021)among Africa Americans with 77.4%

The number of drugs that patients were taking had a significant association with medication adherence. This study revealed that patients who took a double drug per day were two times as likely to adhere to their prescribed drugs as compared to patients who took one drugs per day. This finding is in line with those of studies done in North India,(Smaje et al., 2018). The explanation of these results was that the better adherence can be achieved by streamlining prescription regimens, offering patient-friendly instructions that are easy to understand, addressing cost issues, and encouraging patient education, particularly when multiple medications are prescribed(Smaje et al., 2018)

Hypertensive patients who had good knowledge of serious complication of non-adherence about HTN its treatment were good as likely to adhere to their medication therapy as compared to patients who had poor knowledge. This finding is supported by studies done in Congo-Brazzaville by Nsitou (Smaje et al., 2018). The possible reason may be that knowledgeable patients are more conscious of the consequences of not taking drugs ariately. The explanation of this founding was that patients may be more health literate if they are well-informed about their illness and available treatments. The ability to gather, process, and comprehend basic health information is referred to as health literacy. Better compliance with medical advice and treatment regimens is correlated with higher health literacy.(Raja et al., 2021)

Hypertensive patients between 55-64 years were (35.4)% less likely to adhere to their antihypertensive medication therapy as compared to younger respondents. This is consistent with findings of studies done on African Americans by(Raja et al., 2021). The possible reason might be age-related cognitive impairment, which is usually seen in older people.

Use of self-report, which has the disadvantage of recall bias, as the one method of measuring adherence the second adherence was assess only on the patients who were motivated enough to seek care in the hospital. The findings cannot be generalized beyond those patients who obtaining care at the hospital those are limitations of the study. One of the reason of this result was that medication adherence among hypertensive individuals in the 55–64 age group can be improved by being aware of these factors and customizing interventions to meet their unique needs and challenges. Encouraging improved health outcomes requires tailored strategies that take into account unique situations and obstacles.(Uchmanowicz et al., 2018).

5. Conclusions and recommendations

The overall prevalence of adherence to antihypertensive treatment in this study is 70.6%. Education is the only socio-demographic variable with a significant association with adherence. Antihypertensive medication affordability, transport to clinic problems and fear of medication side effects were the patient-related factors significantly associated with adherence. The belief that some medications are expensive is the only healthcare delivery factor associated significantly with adherence.

Therefore, recommendations are made on enhancing adherence among hypertensive patients include prioritizing education, particularly on hypertension and medication adherence, countering beliefs in alternative remedies, providing financial and access support, and fostering effective healthcare communication. Additionally, further research is encouraged to uncover additional factors influencing adherence, allowing for more targeted interventions.

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