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Difficulties in treating hypertension in resource-limited settings: A cross-sectional study of four district hospitals in Rwanda

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DEDICATION

My wife, Modest, your love, patience and continuous moral support are invaluable.

Brave Kevin and Bryan Breval, my sons and my strength, go far.

Hail Mary Virgin, Mother of Jesus, watch my all steps in all my attempts

ACRONYMS

ACEI: Angiotensin converting enzyme inhibitors.

ALLHAT: Antihypertensive and Lipid-Lowering Heart Attack Trial.

BID: Bis In Die (Twice a Day)

BP: Blood pressure.

BMI: Body mass index.

CCB: Calcium channel blockers.

DBP: diastolic blood pressure

DH: District Hospital

FRW: Rwandan francs.

GFR: Glomerular filtration rate.

H: Hour

JNC: Joint of National Committee for Hypertension.

Min: Minute

MMASS: Modified Morisky Adherence scale Score.

MS: Microsoft.

NHANES: National Health and Nutrition Examination Survey.

OD: Omni Dei (once a day)

SD: Standard deviation.

SPSS: Statistical package in social sciences.

TID: three times a day (ter in die)

USA: United States of America

WHO: World health organization.

Abstract

Background

Hypertension is a common non-communicable diseases and the major risk factor for cardiovascular disease, stroke and chronic kidney disease.

Methods

We conducted a cross-sectional study in four rural Rwandan DH from April to July 2014 to review factors associated with adherence in population of low socio-economic status, cost and availability of antihypertensive drugs; knowledge of clinicians on antihypertensive drug prescription, cost and availability of these drugs in the hospitals and their communication to patients, all of which would contribute to poor BP control. The study targeted hypertensive patients, clinicians and registries for medication availability and costs.

Results

Of 112 study patients, 90 (80.4%) were female; 102 (91.1%) lived from subsistence farming, 95.5% are covered by community health insurance and 47 (42.3%) were illiterate. The median age was 61 years. Mean weight was 60.2 kg [SD 12.8], mean height of 159.1 cm [SD 10cm] giving a mean BMI of 23.5 kg/m^2 [SD 4.4]. Mean systolic BP was 152.6 mmHg [SD 23.7] and mean diastolic BP was 90.9 mmHg [SD 14.2] and 63 (76.4%) did not meet BP goal value.

High adherence was found in 86 (76.8%) patients and was associated with hospital in which patients were followed (p 0.001), to whether the patient received his medication in the hospital pharmacy (p 0.004) and education with ability to read (p 0.01). Antihypertensive drugs; Nifedipine, hydrochlorothiazide, furosemide, captopril, methyldopa, atenolol and spironolactone had been available in all hospitals for the previous four months and at affordable price considering community health insurance coverage. Half of clinicians (15/30, 50%) admitted to be non adherence to hypertension treatment guidelines and to constitute a key barrier to BP control of their patients. Loop diuretic was chosen as class of first choice to start to a newly diagnosed patient of hypertension without associated complications or other diagnoses by 36.7% clinicians and is most used in monotherapy to treat hypertension by 43.3%.

Conclusions

Patients characteristics including adherence and health facility factors involving cost and availability of antihypertensive drugs are conducive at DH, despite, patients followed at DH have low level of BP control. Clinician factors including knowledge of standard of care of hypertension and communication are barriers to be improved.

From this study, key interventions in Rwandan DH should be hypertension treatment guideline training for clinicians and initiating patient-centered care systems to improve BP control.

Acknowledgements

Jean Pierre SIBOMANA

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I.   Introduction

Hypertension is a globally prevalent, non-communicable disease, affecting more than 26% of the adult population worldwide (1). Hypertension, BP values above which there is pathophysiologic damage in end organs (SBP>150 and or DBP>90 in elderly people above 60 years old and SBP>140 and or DBP>90 mmHg in people below 60 years old)(2), is the leading risk factor for mortality and the third cause of disability world-wide (3).

Non-institutionalized civilian US population from 2005 to 2010 found the overall rates of above-goal BP defined by the JNC 7 guideline to be 11.9% in young adults and 41.3% of older adults, respectively. The proportion of younger adults (18-59 years) with treatment-eligible hypertension under the JNC 7 guideline was 20.3%(4), African-American adults have the highest rates (44%) of hypertension in the world and are more resistant to treatment.

The prevalence of hypertension is increasing in Africa; in 2008 it was nearly four times higher than the prior (2005) estimate of the World Health Organization Regional Office for Africa and is projected in 2025 to be 17.4% from 16.2% in 2008. The estimated prevalence in rural areas in 2008 was 13.7%(5). In a cross section study, the prevalence of hypertension among working adults in Rwanda was 36%(6) while in Uganda, the age standardized to the local population high BP prevalence 27.2%(7).

The prevalence and optimal treatment of hypertension has been demonstrated to vary with ethnicity and geography and there is an emerging consensus on the significance of racial disparities in the pathophysiology and treatment options of hypertension(8).

The race-related difference in hypertension manifests as a higher risk in Black populations(9) but clinical and etiopathogenesis are not completely elucidated or understood(10,11). Low renin level is one of pathogenesis factor more frequently found in Blacks(12) in whom hypertension is more likely to be salt-sensitive(13) and diuretics or calcium channel blockers show the greatest antihypertensive response(13,14). Rather, racial differences in clinical outcome can be largely eliminated by adequate antihypertensive therapy(15). Hypertension is quantitatively the major risk factor for cardiovascular disease(16–19); stroke(20,21) and chronic kidney disease and end-stage renal disease(22,23).

The treatment of hypertension, including its prevention, are important factors in overall efforts to control BP and reduce the incidence of hypertension-related cardiovascular, cerebrovascular and renal complications; medication adherence and lifestyle changes coupled with evidence-

based practice guidelines are effective tools to control chronic hypertensive disease and its sequellae(24).

NHANES 2007-2008 estimated 50.1% of all patients with hypertension in American population to be controlled, defined as systolic BP values of less than 140 mm Hg and diastolic BP values of less than 90 mm Hg (25) while the proportion in Uganda is one in three hypertensive patients under treatment(7).Adherence (26,27), access to health care and medications(27) are potential factors for BP control. Poor medication adherence is a major cause of failure to achieve BP control(26) and the asymptomatic, lifelong nature of the disease likely contribute to poor adherence. In a cross-sectional analysis of Medicaid hypertensive patients of Tennessee enrolled for 3 to 7 years from 1994 to 2000; 60.6% were classified as non adherent and 39.4% as adherent(28); WHO estimates that patients take only 50% to 70% of the prescribed doses of antihypertensive medications and up to 50% of patients discontinue their antihypertensive treatment within the first year(29).

Patient factors associated with nonadherence include male sex, black race, urban residence, obesity, mental illness and substance abuse(28), age, education, socioeconomic status, understanding and perception of hypertension, health care provider's mode of delivering treatment, relationships between patients and health care professionals, health systems influences, and complex antihypertensive drug regimens(29).

Understanding the patient factors and health services exposures associated with nonadherence enable clinicians and policy makers to identify and target patients at highest risk for nonadherence with effective interventions(28).

Lack of experience(29)and patient volume(30) are clinician parameters that may contribute to poor BP control. In Rwanda, there is a critical shortage of clinicians (i.e. 6.5 doctors counts for 100000 persons)(31); for this reason, new medical graduates are sent to DH prior to residency, where they care for patients with a wide range of acute and chronic diseases, including hypertension. It is unusual to find internal medicine physicians in rural DH to manage these cases, since trained specialist physicians are usually needed in Rwanda's larger clinical treatment centers.

Initial antihypertensive therapy recommended by JNC 8 stem from ALLHAT study, is a thiazide-type diuretic or calcium channel blocker (CCB). The recommendation stresses to choose

thiazide-type diuretics over ACEI and CCB over an ACEI as first-line therapy for black patients(32,33).

Thiazide diuretics followed by calcium channel blocker were cost effective in better control of hypertension in Nigerian population(34). Diuretics lower the BP by inducing sodium and fluid loss. Thiazide-type diuretics are recommended for the majority of hypertensive patients while loop diuretics are required for patients who have a decreased GFR with fluid overload (JNC 7). The longer antihypertensive effect of Thiazide diuretics compared to short duration of loop diuretics activity favor their use when the GFR is above 30 mL/min in primary hypertension. Loop diuretics might be counteracted by renin-angiotensin-aldosterone system activation with sodium retention during the period when its effect has worn off. Thiazide diuretics are less effective with GFR less than 30 ml/L; thus loop diuretics take importance of effective to control fluid overload(35).

The Morisky Medication Adherence Scale Score (MMASS) was developed as a self-reported medication adherence tool and has been proven reliable for assessment of adherence in patients with hypertension. It is significantly associated with BP control and might function as a screening tool in outpatient settings with different patient groups(36). For instance, in a Chinese population(36), MMASS found 65.1% of patients to have high adherence while in USA population, high adherence was reported in 71.6% patients(37).

i. Study Justification

In Rwanda, there are no population-based studies on hypertension prevalence, antihypertensive medication adherence, or rates of adequate BP control. The Rwandan health system is growing, and is now offering community health insurance to cover health related expenses for non-government employees, most of whom have low incomes. Community health workers associated with community health insurance are strong assets in the care of primary and preventable diseases like hypertension. These are strong potential targets in the prevention of hypertension and may improve adherence to antihypertensive therapy, thus reducing hypertension-related complications. Community health insurance and community health workers may help in interventional studies to effectively improve adherence and control of hypertension.

Rwandan DHs are intermediate health facilities; patients arrive as referrals from primary health facilities (health posts and community health centers). Under normal circumstances, community health centers refer approximately 15% of their patients for advanced care at DH. Fewer than

10% of hospitalizations at DH require treatment at referral hospitals and there is evidence that DH require sufficient staff qualified to better manage chronic diseases(38). In 4 DH covered in the study, each covers a population of approximately 252695 persons, with a mean of 215 hypertensive patients monthly(39). In the management of rural Rwandan patients presenting to DH, a patient-centered treatment approach and clinician knowledge of the availability and cost of antihypertensive medications may influence which medication is prescribed, patient adherence to the recommended regimen, and ultimately, BP control.

A cross sectional descriptive and analytic study in 4 rural DH in Rwanda investigated factors which may be associated with poor BP control in population of low socioeconomic status in rural area including characteristics of patients and clinicians, communication of clinicians and patients, adherence of patients to regimen and clinicians to protocols, knowledge and awareness of clinicians on availability and cost of medications in their hospitals, availability and cost of medications in DH. Patient adherence to the medication regimen recommended by the DH clinician was measure with the MMASS, which has been validated in multiple populations. Adherence is scored as Low (> 2), Medium (1-2), and High (0)(40,41). (Appendix A)

ii.   Aim

At 4 Rwandan DH, evaluate adherence to prescribed medication regimens by patients presenting for the management of hypertension, and investigate barriers to medication adherence, and BP control, including features of the clinical environment, clinical history, and clinical encounter, in order to facilitate future interventional programs that optimize BP control in Rwandan patients with hypertension.

iii.   Hypotheses

We hypothesize that adherence to antihypertensive medications by patients presenting for the management of hypertension to 4 Rwandan DH is associated with:

1. Sociodemographic characteristics intrinsic to patients (e.g. age, gender, level of education)

2. Professional characteristics of medical providers prescribing antihypertensive medications at the selected DH (e.g. level of training, awareness of the cost and availability of medications at DH pharmacies and of standard of care treatment guidelines)

3. Features of the clinical environment (e. g. cost and availability of prescribed medications at the selected DH)

4. Features of the clinical history (e.g. BP control (JNC 8); prior adverse side effects to prescribed medications)

5. Features of the clinical encounter consistent with Patient-Centered Care curricula (e.g. communication commensurate with the patient's level of education)

iv.   Specific objectives

1. Determine Sociodemographic characteristics of patients presenting for management of hypertension at 4 Rwandan DH

2. Determine the hypertension care characteristics of clinicians prescribing antihypertensive medications at the selected DH, including clinician knowledge of cost and availability of antihypertensive medications at DH and standard of care hypertension treatment guidelines.

3. Evaluate the clinical environment, including cost and availability of antihypertensive medications at the selected DH pharmacies

4. Evaluate the clinical history, including patient adherence to prescribed antihypertensive medications using the Modified Morisky Adherence Scale Score (MMASS), and BP control at the time of the clinical encounter.

5. Evaluate the degree to which clinical encounters pertaining to the management of hypertension at selected DH are consistent with principles of patient-centered care.

6. Assess the relationship between the MMASS and BP control at the time of the clinical encounter, and the MMASS and study parameters pertaining to the clinical environment, clinical history, and clinical encounter.

II. METHODS

This study was approved by the Scientific Board Review and Ethics Committee of the College Medicine, University of Rwanda.

i. Site Selection

In order to investigate the barriers to adequate hypertensive treatment in resource-limited setting in Rwanda, this study was conducted at 4 DH located in Gitwe, Kabgayi, Kabutare, and Ruhango. These sites are located in the southern province of Rwanda, and were selected for their accessibility to the principal investigator and for their relatively high patient volumes. Gitwe and Ruhango DH are located in relatively remote settings compared to Kabgayi and Kabutare; however, all 4 DH are staffed by general practicioners in internal medicine, and treat primarily local agricultural workers and their families. The four study sites were assigned an anonymous letter identification (A, B, C, or D) so as to minimize bias in data interpretation.

ii. Study Participants

Patients with hypertension were recruited by medical providers at each DH, who were informed about the purpose and general methodology of the study without disclosure of the primary content under investigation. Patients aged greater than 15 years, with known hypertension that was managed in an outpatient setting, and who were able to communicate with study administrators were eligible for enrollment. All eligible patients who agreed to participate in the study were included. No patient was recruited more than once. All participants underwent a written informed consent process [Appendix B and C; clinicians and patients respectively], and were neither paid nor reimbursed for travel expenses incurred during this study.

iii. Data Collection

Study data were collected via self-reported questionnaires completed by patients and clinicians, and by review of hospital pharmacy and data system records. At each of the 4 DH, data collection was performed weekly for the entire duration of the study, enrolling a total of 112 patients and 30 clinicians. For the appropriateness of answers, the investigator explained questions to patients.

Enrolled patients were asked to report numerous Sociodemographic parameters (e.g. age, gender, marital status, health insurance type and status, job, education level, transportation);

anthropometric measurements; tobacco and alcohol history; and features of their clinical history of hypertension (e.g. BP at the clinical encounter, time since initial diagnosis of hypertension). , Study participants also completed a Modified Morisky Adherence Scale Score tool to assess their adherence to prescribed medications. The investigator explained questions to patients when needed in order to ensure the accuracy and precision of answers. The medical record was reviewed for last prescription medication, current BP, height and weight; the current antihypertensive prescription was sought directly from the patient.

At Rwandan DH, vital signs, including height, weight and BP, are measured by a trained nurse before a patient enters the office to meet the clinician. In all hospitals, weight was recorded to the nearest kilogram by using a mechanical weighing bathroom scale after participants removed shoes and any heavy clothing. Height was determined in centimeters with a rigid measure against a vertical wall. Neither the nurse nor patients were briefed on the later use of measurements; rather, the investigator requested access to patients' charts following study enrollment at the end of the clinical encounter. Target BP values were considered achieved according to JNC 8 guideline, SBP<150 and or DBP<90 in elderly people above 60 years old and SBP<140 and or DBP<90 mmHg in people below 60 years old.

In order to minimize potential bias, such as changing in prescribing behaviors, clinicians who were available at the DH on the last day of data collection were asked to complete a questionnaire. Enrolled clinicians underwent a process of verbal informed consent. Sampled clinician data included age and duration of his or her clinical experience; knowledge of hypertensive drug costs and availability in hospital pharmacy in last 4 months; estimated number of his or her hypertensive patients per week and their level of control (i.e. those reaching goal value versus not); factors impairing adherence to medication regimens of patients, their most prescribed antihypertensive drug in monotherapy and in the initial management of newly diagnosed hypertension without comorbidity. The clinical encounter was evaluated for features of Patient-Centered Care, including whether or not patients received feedback on their BP, whether or not the physician inquired about medication side effects and compliance, and whether or not the clinician solicited questions pertaining to cost and availability of BP medications.

Antihypertensive medication cost and availability over the 4-month study period was recorded from the DH pharmacies' drug supply register. Clinicians were asked to estimate the cost of a 30 day prescription and availability of 6 representative antihypertensive medications (nifedipine

20 mg BID, hydrochlorothiazide 50 mg OD, furosemide 20 mg BID, captopril 25 mg TID, atenolol 50 mg OD, and aldosterone 25 mg OD) considering 10% coverage by community health insurance. Price estimates were categorized as "Do not know", "Less than 50 FRW", "Between 50 and 200 FRW", "Between 200 and 500 FRW", "Between 500 and 1000 FRW" and "More than 1000 FRW" (at the time of study 1.00 USD was exchanged at a rate of 700 FRW).

The Data Manager of each DH provided the number of the population covered by the hospital and the serial numbers of patients diagnosed and treated as hypertensive in each month for last four months.

    iv.   Data Analysis

Data from patients and clinicians was transcribed into Epidata 3.1 and analyzed separately in SPSS 16.1 software. Data from hospital pharmacies and hypertension registries were computed in MS Excel 2007. Excel was used to produce tables.

III. RESULTS

During the 4-month study period, we enrolled a total of 112 patients (80.4% female, 55.4% age > 60 years) in all 4 Rwandan DH. The majority of enrolled patients were farmers (91.1%) who are covered by community health insurance (95.5%) [Table 1].

Table 1: Sociodemographic characteristics of the study participants [Total N 112; N (%)].

Sociodemographic Characteristic		N (%)
Gender	Female	90 (80.4)
	Male	22 (19.6)
Age	Age < 60	48 (44.9)
	Age =/> 60	59 (55.1)
Marital status	Married	50 (44.6)
	Widow/er	54 (48.2)
	Separated	5 (4.4)
	Single	3 (2.6)
Hospital	A	11 (9.8)
	B	31 (27.7)
	C	29 (25.9)
	D	41 (36.6)
Alcohol Use	Yes	13 (11.7)
	No	98 (88.3)
Tobacco Use	Yes	6 (5.4)
	No	105 (94.6)
BMI	< 25	61 (66.3)
	=/> 25	31 (33.7)
Education	None	46 (41.4)
	< Primary School	19 (17.1)
	Primary School	40 (36)
	Ordinary Level	3 (2.7)
	Advanced Level	3 (2.7)
Literacy	Yes	64 (57.7)
	No	47 (42.3)
Health Insurance	None	4 (3.6)
	Community	107 (95.5)
	Premium	1 (0.9)
Occupation	Farmer	102 (91.1)
	Private Sector	1 (0.9)
	Other	9 (8.0)
Transportation to DH	Walk	47 (42)
	Bicycle	5 (44.5)
	Public	60 (53.5)
Transit Time to DH (Walking in Hours)	< 0.5	12 (25.5)
	0.5 to 1	11 (23.4)
	1 to 2	13 (27.7)
	>2	11 (23.4)

The study enrolled 30 clinicians from the 4 selected Rwandan DH. Consistent with the structure of the Rwandan medical education system, a large minority of clinicians providing care at the DH are early in their training and experience (16.7% are intern doctors; 33% of clinicians reported less than 1 year of experience). Clinicians with more than 20 patients per week are 23.3% and 16.7% estimate that their patients BP is poorly controlled [Table 2].

Table 2: Hypertension care characteristics of enrolled clinicians providing primary care at selected DH

Hypertension Care Characteristic		N (%)
Clinical Job description	Intern MD	5 (16.7)
	GP MD	25 (83.3)
Clinical experience in years	< 1	10 (33.3)
	1 to 2	5 (16.7)
	2 to 5	8 (26.7)
	5 to 10	3 (10.0)
	> 10	4 (13.3)
Number of hypertensive patients consulted per week	< 10	13 (43.3)
	10 to 20	10 (33.3)
	> 20	7 (23.3)
Estimated BP Control	Always	5 (16.7)
	Almost	20 (66.7)
	Poor	5 (16.7)

Multiple features of the clinical environment, clinical history of hypertension, and clinical encounter with medical providers at the selected DH were evaluated in this study. Notably, the majority of enrolled patients used the DH pharmacies to fill their prescriptions (92.7%). Although BP was measured in the office for 98.2% of patients, only 33% received feedback on the measurement; 70.8% of patients had not achieved target BP control (JNC 8) [Table 3]. A minority of clinicians inquired about prior use of prescribed medications (15.5%), or medication side effects (1.8%). No patients inquired about the cost or availability of prescribed medications during the clinical encounter [Table 3].

Table 3: Potential barriers to antihypertensive medication adherence related to clinical environment, clinical history, and clinical encounter [Total N 112(%)].

Features		N (%)
Known Diagnosis of Hypertension	Today	2 (1.8)
	< 1 Month	1 (0.9)
	1 Month to < 1 Year	43 (38.0)
	1 to 5 Years	32 (28.7)
	5 to 10 Years	18 (16.2)
	> 10 Years	16 (14.4)
BP Measured in Office	Yes	110 (98.2)
	No	2 (1.8)
Target BP Achieved	Yes	26 (29.2)
	No	63 (70.8)
Patient Received BP Feedback	Yes	37 (33)
	No	75 (67)
Patient received Last Medication	Yes	103 (94.5)
	No	6 (5.5)
Last Pharmacy Location	N/A	5 (4.5)
	Hospital	102 (92.8)
	Private	3 (2.7)
Used Hospital Pharmacy Today	Yes	102 (92.7)
	No	8 (7.3)
History of Anti-Hypertension Medication Side Effects	Yes	7 (6.6)
	No	103 (93.6)
MD Inquired about Medication Side Effects	Yes	2 (1.8)
	No	108 (98.2)
MD inquired about use of medication	Yes	17 (15.5)
	No	93 (84.5)
Patient aware of next appointment	Yes	83 (74.1)
	No	29 (25.9)
Patient inquired about medication cost and or availability	Yes	0 (0.0)
	No	112 (100)

Table 4: Mean BP of study participants at the time of the clinical encounter.

Parameter	Mean [SD] mm Hg
SBP	152.6 [23.7]
DBP	90.85 [14.2]

Enrolled clinicians were asked to speculate about barriers to antihypertensive medication adherence and BP control in their hypertensive patients. Clinicians predominantly attributed poor BP control to patients' inability to engage in lifestyle changes (76.7%), lack of knowledge about hypertension (76.7%), and medication nonadherence (63.3%),.Reflecting on the role of the medical provider in the control of BP, 50% of clinicians identified nonadherence to standard of care hypertension treatment guidelines as a barrier; furthermore, 41.4% of clinicians also cited clinical inertia, or the failure to tailor management when treatment goals are unmet (54), as

a barrier to BP control. The majority of clinicians agreed that medication cost (63.3%) and availability (76.7%) are also major impediments to achieving target BP.

Table 5: Clinician-perceived barriers to antihypertensive medication adherence and adequate BP control [Total N 30; *N 29]

Domain	Perceived Barriers	N (%)
Patient	Poor adherence to drug therapy	19 (63.3)
	Lack of knowledge about hypertension	23 (76.7)
	Inability to engage in lifestyle changes	23 (76.7)
	Health beliefs	7 (24.1)*
	Medication side effects	6 (20.0)
Clinician	Nonadherence to treatment guidelines	15 (50.0)
	Failure to emphasize lifestyle modifications	10 (34.5)
	Clinical inertias	12 (41.4)
Health Care System	Unavailability of prescribed medication in the hospital pharmacy	23 (76.7)
	Lack of access to care	17(56.7)
	High cost of medications	19 (63.3)
	Absence of clinical decision support systems	13 (43.3)
	High copayments	9 (30.0)

Investigating perceived barriers to BP control, clinicians were asked to identify which class of antihypertensive medication they would select in the monotherapeutic treatment of hypertension and as initial therapy in the treatment of newly diagnosed hypertension without medical comorbidity. Loop diuretics were favored in both settings (44% and 37%, respectively).

Table 6: Medication selected by clinicians most frequently in monotherapy (middle column) and in a new diagnosis of hypertension for a patient without medical comorbidity (right column) [N 30 (%)]

Drug class	Most Prescribed	New Diagnosis
Loop diuretics	13 (44%)	11 (37%)
Centrally-acting / α-2 agonist	4 (13%)	3 (10%)
Calcium channel blockers	7 (23%)	8 (27%)
Beta blockers	1 (3%)	0
ACEIs/ARBs	3 (10%)	1 (3%)
Thiazide diuretics	2 (7%)	7 (23%)

Clinical inertia was evaluated using BP values measured during the clinical encounter, and whether or not the antihypertensive medication prescription was changed at that time. Out of the total study N of 112, BP vales and a record of the hypertensive medication prescription were available for 63 patients (56.2%). Of this study subgroup, 31.6% of patients with adequate BP

control received a change in medication, while the antihypertensive medication regimen was unchanged for 52.3% of patients whose target BP was unmet (P 0.24) [Table 7].

Table 7: Relationship of BP control and variation of BP [N (%)].

	BP Target Achieved	Yes	No	Total	P value
Change in Medication	Yes	6 (31.6)	13 (68.4)	19	0.24
	No	21 (47.7)	23 (52.3)	44	
	Total	27 (42.9)	36 (57.1)	63	

Considering 10% community health insurance coverage, the costs for a 30 day prescription of common antihypertensive medications in DH pharmacies were variable but affordable; from 90 to 243 FRW, 162 to 288 FRW and 243 to 315 FRW for nifedipine, captopril and methyldopa, respectively, which were all and always available in all 4 DH in the 4 months prior to this study period. Hydrochlorothiazide was only available always in one hospital; the cost ranged from 15 to 21 FRW [Table 8]. .

Table 8. Cost of a 30-day prescription of antihypertensive medications and their availability in DH pharmacies during the 4-month study period. [*A: Always; N: Never*].

	Cost (FRW)				Availability			
District Hospital	A	B	C	D	A	B	C	D
Hydrochlorothiazide (50 mg OD)	21	21	15	15	*N*	*N*	*A*	*N*
Nifedipine (20 mg BID)	120	120	90	243	*A*	*A*	*A*	*A*
Spironolactone (25 mg OD)	132	132	153	150	*A*	*Unavailable 1 month*	*A*	*A*
R/Captopril (25 mg TID)	162	162	189	288	*A*	*A*	*A*	*A*
Furosemide (20 mg BID)	12	12	15	15	*A*	*A*	*A*	*A*
Methyldopa (250 mg TID)	315	315	297	243	*A*	*A*	*A*	*A*
Atenolol (50 mg OD)	60	60	60	60	*A*	*A*	*N*	*N*
Propranolol (20 mg BID)	24	24	24	30	*A*	*A*	*A*	*A*

Enrolled clinicians were asked to estimate the cost and availability of the same medications [Table 9]. A majority of respondents did not know the cost of each of the medications (87-97%).

Table 9: Clinician estimate of medication cost with community health insurance (10% patient cost). Price reported in FRW. Correct price shaded in grey [Total N 30; N(%)].

Medication	Unknown	< 50	50-200	200-500	500-1000	> 1000
R/Nifedipine (20mg BID)	26 (87)	0	1 (3)	*1 (3)*	0	2 (7)
R/Hydrochlorothiazide (50 mg OD)	28 (94)	*1 (3)*	0	0	0	1 (3)
R/Furosemide (20mg BID)	26 (87)	*0*	2 (7)	1 (3)	0	1 (3)
R/Captopril (25 mg TID)	25 (84)	0	2 (7)	*1 (3)*	1 (3)	1 (3)
R/Methyldopa (250 mg TID)	26 (87)	1 (3)	1 (3)	*0*	1 (3)	1 (3)
R/Losartan (50mg OD)	29 (97)	0	0	0	0	1 (3)
R/Atenolol (50 mg OD)	28 (94)	0	*0*	0	0	2 (7)
R/Spironolactone (25mg OD)	28 (94)	1 (3)	*0*	0	0	1 (3)

The MMASS was used to measure patient adherence to prescribed medication regimens. There was an overall high adherence to antihypertensive medications (76.8% Good). The majority of patients reported no difficulty remembering to take all their medicine (88.4%); few patients reported inconvenience in sticking to their treatment plans (0.9%), or stopping their medications due to the feeling that their symptoms are under control (3.6%). The majority of patients reported taking their prescribed medications the previous day (94.6%) [Table 10].

Table 10: Modified Morisky Adherence Scale Score [Total N 112; N (%)].

	Yes	No
Do you sometimes forget to take your medicine?	16 (14)	96 (86)
People sometimes miss taking their medicines for reasons other than forgetting. Thinking over the past 2 weeks, were there any days when you did not take your medicine?	9 (8.0)	103 (92)
Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?	7 (6.2)	105 (93.8)
When you travel or leave home, do you sometimes forget to bring along your medicine?	6 (5.4)	106 (94.6)
Did you take all your medicines yesterday?	106 (94.6)	6 (5.4)
When you feel like your symptoms are under control, do you sometimes stop taking your medicine?	4 (3.6)	108 (96.4)
Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	1 (0.9)	111 (99.1)
How often do you have difficulty remembering to take all of your medicine?	Never 99 (88.4) Once in a while 10 (8.9) Sometimes 2 (1.8) Usually 1 (0.9)	
Overall adherence	High 86 (76.8) Low to moderate 26 (23.2)	

Multiple socio-demographic characteristics of patients enrolled in this study were significantly associated with the MMASS. Specifically, level of education (P 0.016), literacy (P 0.01), mode of transportation to the DH (P 0.07), and time walking to DH (N 47; P 0.03) were significantly associated with MMASS results. Notably, age, gender, marital status, and substance use were not significantly associated with MMASS results [Table 11].

Table 11: Relationship between socio-demographic factors and the MMASS [Total N 112; N(%)].

Factors		N (%)	Good	Low-Mod	P
Gender	Female	90 (80.4)	68 (75.6)	22 (24.4)	0.53
	Male	22 (19.6)	18 (81.8)	4 (18.2)	
Age	Age < 60	48 (44.9)	36 (75)	12 (25)	0.88
	Age =/> 60	59 (55.1)	45 (76.3)	14 (23.7)	
Marital status	Married	50 (44.6)	38 (76)	12 (24)	
	Widow/er	54 (48.2)	41 (75.9)	13 (24.1)	0.63
	Separated	5 (4.4)	5 (100)	0 (0.0)	
	Single	3 (2.6)	2 (66.7)	1 (33.3)	
Alcohol Use	Yes	13 (11.7)	10 (76.9)	3 (23.1)	0.98
	No	98 (88.3)	75 (76.5)	23 (23.5)	
Tobacco Use	Yes	6 (5.4)	5 (83.3)	1 (16.7)	0.69
	No	105 (94.6)	80 (76.2)	25 (23.8)	
BMI	< 25	61 (66.3)	49 (80.3)	12 (19.7)	0.1
	=/> 25	31 (33.7)	20 (64.5)	11 (35.5)	
Education	None	46 (41.4)	41 (89.1)	5 (10.9)	
	< Primary School	19 (17.1)	11 (57.9)	8 (42.1)	
	Primary School	40 (36)	29 (72.5)	11 (27.5)	0.016
	Ordinary Level	3 (2.7)	1 (33.3)	2 (66.7)	
	Advanced Level	3 (2.7)	3 (100)	0 (0.0	
Literacy	Yes	64 (57.7)	44 (68.8)	20 (31.2)	0.01
	No	47 (42.3)	42 (89.4)	5 (10.6)	
Health Insurance	None	4 (3.6)	3 (75)	1 (25)	
	Community	107 (95.5)	82 (76.6)	25 (23.4)	0.856
	Premium	1 (0.9)	1 (100)	0 (0.0)	
Occupation	Farmer	102 (91.1)	78 (76.5)	24 (23.5)	
	Private Sector	1 (0.9)	0 (0.0)	1 (100)	0.132
	Other	9 (8.0)	8 (88.9)	1 (11.1)	
Transportation to DH	Walk	47 (42)	31 (66)	16 (34)	
	Bicycle	5 (44.5)	4 (80)	1 (20)	0.07
	Public	60 (53.5)	51 (85)	9 (15)	
Transit Time to DH (Walking in Hours; N 47)	< 0.5	12 (25.5)	7 (58.3)	5 (41.7)	
	0.5 to 1	11 (23.4)	9 (81.8)	2 (18.2)	0.03
	1 to 2	13 (27.7)	5 (38.5)	8 (61.5)	
	>2	11 (23.4)	10 (90.9)	1 (9.1)	

Multiple features of the clinical environment, clinical history, and clinical encounter were significantly associated with the MMASS. The DH at which enrolled patients received care (P 0.001), prior pattern of medication use (P 0.009), the pharmacy location where the patient last filled a prescription (P 0.004), whether or not the patient used the DH pharmacy on the day of the clinical encounter (P 0.06), and whether or not the patient reported a history of medication side effects (P 0.03) were significantly associated with MMASS results. Notably, whether or not the target BP was achieve was not significantly associated with results of the MMASS [Table 12].

Table 12: Relationship between MMASS results and features of the clinical environment, clinical history, and clinical encounter. [Total N 112; N (%)].

Features		N (%)	Good	Low-Mod	P
Hospital	A	11 (9.8)	7 (63.6)	4 (36.4)	
	B	31 (27.7)	18 (58.1)	13 (41.9)	0.001
	C	29 (25.9)	21 (72.4)	8 (27.6)	
	D	41 (36.6)	40 (97.6)	1 (2.4)	
Known Diagnosis of Hypertension	Today	2 (1.8)	2 (100)	0 (0.0)	
	< 1 Month	1 (0.9)	1 (100)	0 (0.0)	
	1 Month to < 1 Year	43 (38.0)	37 (86.0)	6 (14.0)	0.15
	1 to 5 Years	32 (28.7)	25 (78.1)	7 (21.9)	
	5 to 10 Years	18 (16.2)	11 (64.7)	6 (35.3)	
	> 10 Years	16 (14.4)	9 (56.2)	7 (43.8)	
BP Measured in Office	Yes	110 (98.2)	85 (77.3)	25 (22.7)	0.37
	No	2 (1.8)	1 (50)	1 (50)	
Target BP Achieved	Yes	26 (29.2)	19 (73.1)	7 (26.9)	0.52
	No	63 (70.8)	50 (79.4)	13 (20.6)	
Patient Received BP Feedback	Yes	37 (33)	25 (67.6)	12 (32.4)	0.11
	No	75 (67)	61 (81.3)	14 (18.7)	
Patient received Last Medication	Yes	103 (94.5)	82 (79.6)	21 (20.4)	0.009
	No	6 (5.5)	2 (33.3)	4 (66.7)	
Last Pharmacy Location	N/A	5 (4.5)	3 (60)	2 (40)	
	Hospital	102 (92.8)	81 (79.4)	21 (20.6)	0.004
	Private	3 (2.7)	0 (0.0)	3 (100)	
Used Hospital Pharmacy Today	Yes	102 (92.7)	82 (78.8)	22 (21.2)	0.06
	No	8 (7.3)	4 (50)	4 (50)	
History of Anti-Hypertension Medication Side Effects	Yes	7 (6.6)	3 (42.9)	4 (57.1)	0.03
	No	103 (93.6)	81 (78.6	22 (21.4)	

IV.   DISCUSSION

This study aimed to identify barriers to antihypertensive medication adherence and BP control in patients presenting for the management of hypertension at 4 Rwandan DH (Kabgayi, Gitwe, Kabutare and Ruhango). A total of 112 patients and 30 clinicians were enrolled during the 4-month study period.

As measured by the MMASS, the overall high adherence of Rwandan patients enrolled in this study to their prescribed medication regimens (76.6% "good") was comparable to MMASS results published in Chinese (36) and American populations (37). It is encouraging that MMASS results are not significantly associated with socio-demographic factors intrinsic to patients (e.g. age, gender), but are significantly associated with multiple modifiable features of the clinical environment and clinical encounter. However, it is discouraging that, despite the high availability and low cost of antihypertensive drugs, and high rates of patient adherence to prescribed medication regimens, BP control remains poor; MMASS results were not significantly associated with adequate BP control.

Lack of access to experienced clinicians might contribute to poor BP control (29) despite patient adherence to recommended medications; there is also evidence that clinician factors, knowledge and patient centered care approach in treatment decision making (42–46) , might be associated with poor BP despite good adherence of patients who may adhere to wrong regimen.

In Rwanda there is both a general shortage of clinicians and a dire lack of specialized physicians in rural areas. Inconsistencies in the management of patients with hypertension at Rwandan DH might also stem from the relative inexperience of new clinicians (16.7% intern doctors working without direct supervision; 33% of clinicians < 1 year of experience). For those physicians with longer experience, there is evidence that they are working with a still-growing fund of knowledge. Although knowledge of JNC 8 standard of care hypertension treatment guidelines were not directly tested, 43.3% of surveyed clinicians would choose a loop diuretic (Furosemide) in the monotherapeutic treatment of hypertension, and 36.7% selected the same class of medication in the initial treatment of hypertension in a patient without medical comorbidity. JNC 8 guidelines recommend thiazide type diuretics or calcium channel blockers in both of these scenarios (33). Importantly, this study demonstrated that recommended first-line antihypertensive medications, hydrochlorothiazide and nifedipine, were fully available and

economically-priced at all 4 DH during the study period, and that the majority of patients use DH pharmacies, and so have access to these medications. Regardless of the treatment guidelines used to select antihypertensive medications, inconsistencies in medication management is evident in 31.6% patients whose medication was changed despite adequate BP control and the 52.3% of patients whose medication regimen went unchanged despite BP values above target in the clinical encounter.

Features of communication within the clinical environment and clinical encounter are significantly associated with patient adherence to medications; we speculate that these features also directly influence BP control. For instance, surveyed clinicians were unaware of the cost and availability of antihypertensive medications in their DH pharmacies. Improvements in the communication between medical professionals at the same DH of information like the cost and availability of commonly prescribed medications may influence the clinician's choice of medications to better meet the preferences and resources of their patients, thus improving patient adherence to medications, and may facilitate standard of care hypertension management. Within the clinical encounter, it is concerning that clinicians evidently prescribe medications without monitoring side effects, which may be associated with increased risk to the patient and decreased adherence. Such "high-risk prescribing" was demonstrated in this study, as 6.4% patients reported side effects of their medications while clinicians inquired about side effects in only 1.8% of the study population. Other studies have shown high risk prescribing to be common and consistent with a lack of focus on medication safety (47) and, similar to our study, that the most frequent drug therapy problems are inadequate monitoring and inappropriate drugs, with either or combination of both being negatively associated with adherence (48).

Among the features of the clinical environment, clinical history, and clinical encounter captured by this study, those associated with the clinical encounter are perhaps the most easily modified to encourage patient adherence to medications. This study demonstrated features of the clinical encounter that are not consisted with principles of patient-centered care. Specifically, patient centered care has as its goal empowering patients to become active participants in their care, but requires health care providers to develop good communication skills and address patient needs effectively, to become a patient advocate and to strive to provide care that not only is effective but also safe (49) and encourages patients' responsibility for their own health status. Patient centered care has been associated with adherence in other research (50).

This study identified multiple domains of the clinical encounter that may be readily improved to increase patient adherence to medications, decrease the risks associated with those medications, and, ultimately, improve BP control in the Rwanda. The clinical encounter is a key opportunity for education about BP control; clinician should assess ability of patient to understand their explanation of his or her disease by tailoring their advice to his or her education level and literacy, and to assess other barriers to medication adherence. Patients should be counseled about their BP measurements, including goal values, and encouraged to ask questions, such as the cost and availability of prescribed medications. Fortunately, improvements in continuing medical education for clinicians and patient-centered care principles are readily modifiable factors in hypertension care that can be deployed in DH across Rwanda.

Limitations

This study employed cross-sectional design with convenience sampling and was done in a low-education-level population, mostly consisting of subsistence farmers; therefore, its findings may thus not be relevant to other African populations, especially in urban areas.

The adherence assessment tool we used, the MMASS, has not been validated in a Rwandan population and not all behavioral and health care factors associated with antihypertensive medications adherence were assessed. However the MMASS is widely recognized and has been used in multiple other studies in other populations around the world, with good evidence of validity, and we chose to measure as broad an array of potential contributions to adherence as was possible in our methodology.

As the primary outcome of this study was patient adherence to prescribed medications, availability and cost of medications; patients' measurements [(weight and height as risk factor) and (BP as end point of adherence)] taken by a trained nurse were transcripted from patients' records. To limit biases, the nurse was unaware of either later use of these measurements in the ongoing study but the skills of the nurse, and the accuracy of instruments and measurements were not addressed in the study methodology.

Clinicians knew that patients would be questioned after their encounter; this could have influenced clinicians' education of patients; as well as the observed high rate of change in prescriptions and patients' behavior towards questions related to clinicians. Patients were briefed on the future use of the information from answers of the questionnaire combined with information from others without revealing the information given by each participant. They were

explained for the positive feedback to their further treatment. Clinicians were completely unaware of the content of questions asked to patients, limiting their ability to tailor management to the study goals.

      i.   Future Directions

Multiple future research questions may expand and refine the results of this study. We demonstrated that DH was a significant determinant of patient adherence to prescribed medication; differences between hospitals should be investigated in a wider study involving more Rwandan DH. Once an effective model of hypertension care has been determined, ideally including continuing medical education and patient-centered care principles, future projects should quantify the efficacy of interventional programs aimed at improving patient medication adherence and blood pressure control in Rwandan populations. It would also be useful to determine factors associated with high prevalence of females among hypertensive patients found in Rwandan DH.

V.   CONCLUSION AND RECOMMENDATIONS

At 4 Rwandan DH, patient adherence to prescribed medication regimens as measured by the MMASS was high in 76% patients which is comparable to populations in the United States and China. Despite this high number of patients with high medication adherence, it was not significantly associated with adequate blood pressure control, but was significantly associated with multiple modifiable features of the clinical environment and clinical encounter which may explain this discrepancy.

Cost and availability of medication was not prohibitive in DH pharmacies; No recommendation save continued, excellent procurement of affordable medications.

Despite availability of medication and affordable cost in DH, clinicians did not know.

Recommendation: Inform doctors available antihypertensive drugs and their cost as this may influence drug selection to patients.

In DH in Rwanda, we found relative inexperience of medical providers at DH with evident inconsistencies in antihypertensive medication selection, etc.

Recommendation: continuing medication education especially in management of chronic non communicable disease.

In DH, there are no clear national consensus guidelines for treating hypertension and most clinicians are not aware of the existence of any guidelines.

Recommendation: adapt available international guidelines and avail them to clinicians in DH.

Patient-centered health care was assessed low with regards to clinician-patients communication and involving patients in their care; patients should know their BP value recorded on the day of visit, their BP target value agreed with clinicians, and the management plan to be followed by both the patient and their carers.

Recommendation: Investigate barriers related to poor communication between clinicians and their patients.

Institute an interventional program as a continuous clinical development for clinicians in DH in managing hypertension and plan to evaluate its clinical impact.

VI.   REFERENCES

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VII.   APPENDICES

i.   Appendix A: Morisky Medication Adherence Scale Score.

Morisky 8-Item Medication Adherence Questionnaire

Question	Patient Answer (Yes/No)	Score Y=1; N=0
Do you sometimes forget to take your medicine?		
People sometimes miss taking their medicines for reasons other than forgetting. Thinking over the past 2 weeks, were there any days when you did not take your medicine?		
Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?		
When you travel or leave home, do you sometimes forget to bring along your medicine?		
Did you take all your medicines yesterday?		
When you feel like your symptoms are under control, do you sometimes stop taking your medicine?		
Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?		
How often do you have difficulty remembering to take all your medicine? ___ A. Never/rarely ___ B. Once in a while ___ C. Sometimes ___ D. Usually ___ E. All the time		A = 0; B-E = 1
	Total score	

Scores: >2 = low adherence
1 or 2 = medium adherence
0 = high adherence
Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. Med Care. 1986;24:67-74.

Figure A-1: Modified Morisky Adherence Scale Score (36).

ii.   Appendix B: Clinician Questionnaire

DIFFICULTIES IN TREATING HYPERTENSION IN SETTING WITH LIMITED RESOURCES: A CROSS-SECTIONAL STUDY OF FOUR DISTRICT HOSPITALS IN RWANDA.

This survey is designed to find out difficulties in treating hypertension in your hospital and will target patients, physician and pharmacy store of your hospital. Analysis from all data will be communicated to the hospital. Please sign the attached consent form, then complete this survey. Thanks for your help!

Age:

Clinical job description:

      Intern doctor

      General practitioner

      Internist

      Specify your other clinical subspecialty

Experience in years

      Less than 1 year

      1-2 years

      2-5 years

      5-10 years

      More than 10 years

Exposure to HTN patients [effective number you prescribe anti hypertensive drugs per week]

      <10 patients per week

      10-20 patients/week

      More than 20 patients per week

Level of Control of HTN of your patients

     Always controlled

     Most of time controlled

     Poorly controlled [Highly variable BP recordings]

     Not at all controlled

State availability of drug class to control HTN in your hospital in last three months.

     Loop diuretics [D]

          Available always in last three months

          Rarely available

          Never available here in last three months

     Thiazide diuretics [D]

          Available always in last three months

          Rarely available

          Never available here in last three months

     Potassium-sparing diuretics [D]

          Available always in last three months

          Rarely available

          Never available here in last three months

     Aldosterone receptor blockers [D]

          Available always in last three months

          Rarely available

Never available here in last three months

Angiotensin converting enzyme inhibitors/ Angiotensin II antagonists [ACEIs/ARBs]

Available always in last three months

Rarely available

Never available here in last three months

Beta blockers [BBs]

Available always in last three months

Rarely available

Never available here in last three months

Calcium channel blockers [CCBs]

Available always in last three months

Rarely available

Never available here in last three months

Direct vasodilators

Available always in last three months

Rarely available

Never available here in last three months

Central alpha-2 agonists and other centrally acting drugs

Available always in last three months

Rarely available

Never available here in last three months

Alpha-1 blockers

Available always in last three months

Rarely available

Never available here in last three months

Which is your most favorable/used class drug to control HTN in your patients in monotherapy [Mention one]

Loop diuretics [D]

Thiazide diuretics [D]

Potassium-sparing diuretics [D]

Aldosterone receptor blockers [D]

Angiotensin converting enzyme inhibitors/ Angiotensin II antagonists [ACEIs/ARBs]

 Beta blockers [BBs]

 Calcium channel blockers [CCBs]

Direct vasodilators

Central alpha-2 agonists and other centrally acting drugs

Alpha-1 blockers

Which is your most favorable/used class drug combination to control HTN in your patients?

Centrally acting drugs and Diuretics

ACEI and BB

CCB and D

ACEI and CCB

ACEI and D

BB and CCB

BB and D

Others

Please mention causes impairing HTN control for your patients [Mark one or more of items below]

Patients' compliance/adherence

Unavailability of prescribed medication in the hospital pharmacy

Unavailable of specific hypertension management protocol in DH

Less exposure to HTN management during my training

Please specify others:…..

Mention factors determining antihypertensive drugs prescribed to your patients

Social economic status

Insurance type

Available drug to the hospital pharmacy

Level of HTN control =current reading

Please specify others:…

Mention factors associated to poor HTN control in your patients.

Nonadherence to therapy   Y or N

Diet and salt intake   Y or N

Inappropriate drug combinations   Y or N

Low dosing   Y or   N

Alcohol   Y or N

Drugs (e.g., oral contraceptives, NSAIDs, decongestants, steroids, cyclosporine, cocaine) Y or N

Please specify others:…

Do you know how much money the antihypertensive drugs cost: Y   or   N

If yes please mention 3 different class drugs prescription and their cost for a month

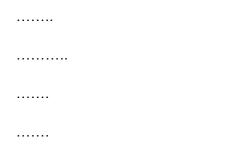iii.   Appendix C: Patient Questionnaire

1. What is your age? _ _ years

2. Are you male or Female?

   M

   F

3. What is your current marital status?

   Never married

   Married

   Widower/ Widow

   Separated

   Divorced

4. Do you have any health insurance?

   None

   Community health insurance

   RSSB or other institution related health insurance?

5. What is your current job?

   Famer

   Agent of the state

   Merchant

   Private sector

   Other

6. What is the highest level of education you have completed?

   Able to reading and write

   Less than primary school

   Primary school

   Ordinary level

   Advanced level

   At least two years of university

   More than two years of university.

7. W: ___kg   H: ____ cm

8. By which means do you come to hospital?

   Foot

Bicycle

Common transport

Self transport

9. If you come by foot, how long does it take you to arrive to hospital [duration in hours]?

Less than 30 minutes

Less than one hour

In two hours

More than 3 hours

10. When did you first find out you have hypertension?

Today

Less than one month ago

One month to one year ago

One year to five years ago

Five years to ten years ago

More than 10 years ago

11. What are anti-hypertension drugs (with doses) have you been prescribed today.

……..

………..

…….

…….

12. What drugs were you prescribed on your last visit? (include doses and frequencies)

_____   mg   1 2 3 4 times per day

_____   mg   1 2 3 4 times per day

Do not remember

13. Where did you buy your medication last time?

Not bought

Hospital pharmacy

Private pharmacy

Other

14. Did you receive all of them? Y/N

15. Did you take all medication you were prescribed on your last visit? [Y/N]

16. Today were you able to find all your prescribed drugs? [Y/N]

17. Prescribed anti HTN drug

18. Do you need to have regular follow up for your HTN? [Y/N]

19. Did your doctor asked if you are taking medications correctly

20. Did your doctor asked if you had any side effect

21. Have you experienced of any side effect

22. Did you ask your physician how much your medications will cost [Y/N]

23. Did you ask your physician if prescribed medications are available in the hospital [Y/N]

24. Do you know when you will come back to your treating physician? [Y/N]

25. Did you get feedback your BP reading today? [Y/N]

26. Do you have Self monitoring BP machine. [Y/N]

27. Do you have any written information concerning your disease? [Y/N]

28. Do you take alcohol? [Y/N]

29. Do you smoke? [Y/N]

30. Did your BP taken in office today? [Y/N]

31. Do you have a caring family member? [Y/N]

32. <u>Modified Morsky scale score</u>

a. Do you sometimes forget to take your medicine? [Y/N]

b. People sometimes miss taking their medicines for reasons other than forgetting. Thinking over the past 2 weeks, were there any days when you did not take your medicine? [Y/N]

c. Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it? [Y/N]

d. When you travel or leave home, do you sometimes forget to bring along your medicine? [Y/N]

e. Did you take all your medicines yesterday? [Y/N]

f. When you feel like your symptoms are under control, do you sometimes stop taking your medicine? [Y/N]

g. Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan? [Y/N]

h. How often do you have difficulty remembering to take all your medicine?

   A. Never/rarely

   B. Once in a while

   C. Sometimes

   D. Usually

   E. All the time

iv.   Appendix D: Consent Form (English)

TOPIC: Difficulties in Hypertension Treatment in resource poor settings. A study of three district hospitals in Rwanda.

Dear Participants,

You have been invited to take part in a research project concerning hypertension in three DH [Kabutare, Kabgayi and Rwamagana] in Rwanda. Before joining the project in question, you need to read this information form, since it contains important information to assist you in deciding whether or not signing up to participate in your best interests. We request that you ask as many questions as you wish in order to make sure that you understand the study.

If you have a question about this document that has not been sufficiently answered or explained, do not hesitate to ask one of the research team members for more information.

Your participation in this study is voluntary, you will not receive any salary for participating in this study and you will be required to participate once with the questionnaire. You may choose not to participate in this study and choosing to participate or not will not affect your treatment in any way.

We are attempting to explore opportunities to improve hypertension treatment by finding were the pitfalls reside. Hypertension is a major risk factor for many cardiovascular diseases including stroke, coronary heart disease, cardiac failure, and end stage renal disease; thus after this important study is done we will be able to give relevant information to policy makers so that they can update their policies in the long run improve patient care and management.

This study will analyze answers of the questionnaire, there is anonymous of you and information from you will remain confidential. The result of this study will be communicated to your DH where you have all right to know the outcome. If you wish to ask questions later, you may contact any of the following:

1. Dr. Jean Pierre SIBOMANA ; PI

   University of Rwanda

   College of Medicine

   Department of internal medicine

   Butare U niversity Teaching Hospital

   E-mail:jepisibo@gmail.com

   Telephone: +250788425104

2 Dr Robert McNamara;

   STUDY DIRECTOR

   Yale University

   Dr. Tim Walker;

   STUDY CODIRECTOR

   BUTH

The study is subject to approval by the University of Rwanda, College of Medicine Board Review, which is a committee whose task it is to make sure that research participants are protected from harm.

v.   Appendix E: Consent Form (Kinyarwanda)

INYANDIKO ISABA IKANASOBANURIRA UBURENGANZIRA BW'ABITABIRA UBUSHAKASHATSI MU BARWAYI B'UMUVUDUKO W'AMARASO.

Bavandimwe mwitabiriye ubushakashatsi,

Mwatumiwe kugira uruhare mubushakashatsi bugamije kongera imivurire myiza y'abarwayi bafite umuvuduko w'amaraso no gutahura impamvu zitera imivurire idahagije y'iyo ndwara. Ubu bushakashatsi buzabera mu bitaro bine [Kabutare, Kabgayi, Ruhango na Gitwe] byo mu Rwanda.

Mbere yo kwiyemeza kugira uruhare muri ubu bushakashatsi, turagusaba gusoma amabwiriza ari muri uru rwandiko rufite amakuru akenewe agufasha kwiyemeza cyangwa kwihorera kugira uruhare muri ubu bushakashatsi. Kugirango wizere neza ko wumwa agaciro ko kwitabira kugira uru ruhare muri ubu bushakashatsi urasabwa kubaza ibibazo byose wifuza. Igihe uru rwandiko rwaba rudahagije ku kumvisha no kugusobanurira ku buryo buhagije ibibazo ufite, urasabwa kuza kimenyesha igihe cyose buri wese mu bayoboye ubu bushakashatsi.

Kwinjira no kugira uruhare muri ubu bushakashatsi ni ubushake bwawe, ntagihembo. Mu miterere y'ubu bushakashatsi uzitabira inshuro imwe gusa usubiza ibibazo biri k'urupapuro uza guhabwa nyuma yo kwiyemeza kugira kugira uruhare muri ubu bushakashatsi. Guhitamo cyangwa kudahitamo ubu bushakashatsi ntangaruka bifite mubijyanye ni mivurirwe yawe ku buryo bwose. Muri ubu bushakashatsi, tuzacukumbura impamvu zatuma imivurirwe y'umuvuduko w'amaraso itagerwaho. Indwara y'umuvuduko w'amaraso utera k'uburyo budasubirwaho ukaba n'ingaruka z'indwara z'imitima, ubwonko n'impyiko n'impfu zikomoka kuri izi ndwara.

Ibizava muri ubu bushakashatsi bizagira uruhare rukomeye mu mivurirwe myiza y'abarwayi bafite indwara y'umuvuduko w'amaraso, impamvu zizewe zizagaragazwa n'ubu bushakashatsi zizagezwa kubagena imivurire bizabafasha gushyiraho imirongo isobanutse y'imivurire y'umuvuduko w'amaraso. Ubu bushakashatsi bushingiye ku bisubizo biturutse mu bibazo wasubije n'ibyo watubwiye, bityo ibisubizo n'amajwi byawe bizaguma mu ibanga rikomeye ryatuma utamenyekana. Ikusanyirizo risobanura ibyavuye muri ubu bushakashatsi ufite uburenganzira bwo kubimenya, aho uzabisanga ku bitaro wivurizaho. Igihe wagira ikibazo ushobora kubaza wifashishije indango usanga hasi:

2.	Dr. Jean Pierre SIBOMANA ; PI UR ; College of Medicine; Department of internal medicine Butare University Teaching Hospital E-mail:jepisibo@gmail.com Telephone: +250788425104	2	Dr Robert McNamara; STUDY DIRECTOR Yale University Dr. Tim Walker; STUDY CODIRECTOR UR; College of Medicine; BUTH

Ubu bushakashatsi bwemejwe na kaminuza y'u Rwanda, I shuli ry'ubuganga banashinzwe kurinda no kurengera uburenganzira bw'abitabiriye ubushakashatsi

DR Emmanuel NKERAMIHIGO. Chair, School of Medicine Reseach Ethics Committee

   0788557273; EMAIL:enkeramihigo@nur.ac.rw