HYPERTENSION GUIDELINE IMPLEMENTATION AND BLOOD PRESSURE CONTROL IN PRIMARY CARE FACILITIES, MATLOSANA SUB-DISTRICT, NORTH WEST PROVINCE

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DECLARATION

I, Dr Keolebile Irene DITLHABOLO declare that this research report is my own unaided work, except where due acknowledgement for assistance has been made. It is being submitted for the degree of Master of Family Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted previously for any other degree or examination at this or any other University.

Signed

(Signature of candidate)

Dr KI DITLHABOLO

Date: 23 March 2024

Signed …… (Signature of primary supervisor)

Dr HC LION-CACHET

Date: March 2024

DEDICATION

In memory of my father

Leshoko John DITLHOBOLO

(1953–2015)

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NOMENCLATURE

ACEI	**:**	Angiotensin converting enzyme inhibitor
AIDS	:	Acquired immunodeficiency syndrome
BMI	**:**	Body Mass Index
BP	**:**	Blood Pressure
CCB	:	Calcium channel blockers
CHC	**:**	Community health centre
CPG	**:**	Clinical Practice Guidelines
CKD	**:**	Chronic Kidney Disease
CVD	**:**	Cardiovascular Disease
CVDs	:	Cardiovascular Diseases
DM	:	Diabetes Mellitus
DPB	**:**	Diastolic blood pressure
ECG	**:**	Electrocardiogram
EDL	**:**	Essential Drug List
GBD	**:**	Global Burden of disease
HAST	**:**	Human immunodeficiency, Acquired immunodeficiency, sexually transmitted infections, and tuberculosis.
HCTZ	:	Hydrochlorothiazide
HCW	**:**	Health Care Worker

HIV	:	Human immunodeficiency virus
OR	:	Odd ratios
PHC	**:**	Primary Health Care
SA	**:**	South Africa
SAHPG	:	South African Hypertension Practice Guidelines
SBP	**:**	Systolic blood pressure
STG	**:**	Standard Treatment Guideline
SSA	:	Sub-Saharan Africa

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An article submitted according to the style guide and requirements of the South African Family Practice Journal (SAFPJ).

Abstract

Background: High systolic blood pressure remains a leading modifiable risk factor for cardiovascular diseases worldwide and in South Africa. Information about the extent of guideline implementation and blood pressure control is lacking in Matlosana Sub-district, North West province, South Africa. The study aimed to assess implementation of the South African hypertension practice guideline and blood pressure control in adults attending primary care facilities in Matlosana.

Methods: A cross-sectional study was conducted, using 523 randomly sampled medical records. Data collected included demographic information, recorded blood pressure readings, anthropometry, screening for target organ damage, hypertension complications, comorbidities, lifestyle advice, and drug therapy.

Results: According to the reviewed records the mean age of the participants was 56.77 years with a standard deviation of 12.4 years and 376 (71.9%) records belonged to females. Blood pressure control was documented in 229 (43.8%) of the medical records, with better control recorded in a group with comorbid HIV than groups with other comorbidities.

Conclusions: The study found poor documentation of the South African hypertension practice guideline recommendations among patients with hypertension. According to the patient records blood pressure control was suboptimal, the most common documented comorbid illness was HIV, and screening for target organ damage was generally poorly documented.

Recommendations: Programs that audit and improve the quality of hypertension guideline implementation and blood pressure control in primary care, require ongoing support and research.

Keywords: Hypertension, guideline implementation, blood pressure control, primary care

INTRODUCTION

Globally, high systolic blood pressure (BP) remains a leading modifiable risk factor for premature cardiovascular deaths, accounting for 10.8 million (95% CI: 9.15-12.1 million) cardiovascular deaths and 11.3 million (95% CI: 9.59-12.7 million) deaths in 2021.[1] An estimated 874 million people worldwide had a systolic blood pressure (SBP) of 140 mmHg or more in 2015, with this figure projected to increase.[2] According to the World Health Organisation (WHO) an estimated 1.28 billion adults aged 30-79 years worldwide have hypertension, with two thirds living in low and middle income countries.[3] The highest prevalence of hypertension was observed in sub-Saharan African countries, accounting for two thirds of the world's burden of disease.[4] South Africa among other sub-Saharan African countries, has experienced a surge in cardiovascular disease (CVD) burden and its associated risk factors including hypertension.[5] According to the WHO four of every five people with hypertension are not adequately treated.[6] The highest prevalence of uncontrolled hypertension (≥140/90 mmHg) is reported in sub-Saharan African countries, where treatment for hypertension is unacceptably low.[7] In South Africa, BP control varies, and the prevalence of uncontrolled hypertension ranges from 13.5% to 75.5%,[8,9] with variations attributed to sociodemographic and clinical factors impacting on the control of hypertension.[9]

The United Nations Sustainable Development Goals (SDGs) call for 80% control rates by 2030, highlighting the urgent need for improvement in hypertension control.[10] The 2021 WHO guideline on the pharmacological treatment of hypertension recommends achieving optimal BP targets in order to reach the SDGs.[11] The main goal of BP control is to reduce hypertension target organ damage (TOD).[11] There are various clinical practice guidelines (CPGs) available nationally and internationally to assist healthcare practitioners manage hypertension.[11,13-15] The CPGs are evidence-based documents developed to reduce disparities in clinical practice.[16] They are defined as a set of recommendations generated from systematic reviews of current clinical evidence, assessment of risks, and benefits of options available for the diagnosis and treatment of diseases.[16] The role of CPGs is to standardise medical care, by ensuring that patients receive the same treatment regardless of their geographical location or clinician expertise, thereby improving the quality of healthcare.[16]

In primary health care (PHC) in SA there are standard treatment guidelines (STGs) that guide the diagnosis, monitoring, drug-therapy, screening for cardiovascular risks, lifestyle modification, and screening for TOD according to the particular CPG.[13] The South African hypertension practice guideline (SAHPG), formulated for the management of hypertension in this country, has set the BP control target to a BP reading of less than 140/90 mmHg regardless of the cardiovascular risk, in order to simplify hypertension management.[14] The SAHPG has also set out recommendations regarding TOD to screen for in hypertensive patients, routine investigations, lifestyle modification, antihypertensive therapies, and the compelling indications for these antihypertensive therapies.[14] As in South Africa, most international guidelines recommend lifestyle modification before antihypertensive therapy.[11,15] Lifestyle change has been shown to reduce BP by as much as 3.5 mmHg by maintaining a healthy lifestyle, thereby reducing cardiovascular risks by approximately 30% before adding antihypertensive therapy to the treatment.[12] Lifestyle modification includes reducing salt intake, reducing weight if overweight or obese, physical activity, smoking cessation, and reducing alcohol intake.[14] The commonly used classes of antihypertensive therapies are diuretics, calcium channel blockers (CCB), angiotensin converting enzyme inhibitors (ACEI), angiotensin receptor blockers, alpha-blockers, beta-blockers, and vasodilators.[14]

There is also an ideal clinic framework which emphasises integrated clinical service management, and supports the availability of the guidelines in each consultation room.[17] Ideal clinic is a framework that sets out the standards to which PHC facilities must align with in order to ensure the provision of good-quality health services.[17] This is achieved by ensuring that the clinic has good infrastructure, adequate staff members, medicines, supplies and bulk supplies, as well as sound administrative processes. According to the ideal clinic checklist of elements, at least 80% of the clinic records audited for the priority health conditions, including hypertension and diabetes, should be guideline compliant.[17]

The STGs and essential medicines list for South Africa is available on the Knowledge Hub website as a pdf document which can be downloaded to a cellular phone for convenience of use whenever needed.[11] The Knowledge Hub is an electronic learning platform, hosted by the South African Department of Health, that provides access to personalised professional development opportunities and resources including online and blended learning courses, face-

to-face workshops, guidelines and many other resources.[18] The SAHPG is also accessible from the on the internet for the comprehensive management of hypertension.[14] Previous studies showed that the target for the management of hypertension is barely achieved,[19,20] due to poor uptake of CPG recommendations.[21] Similarly, in another study poor CPG uptake was attributed to a lack of familiarity with the guideline, individual perception about the guideline, lack of access to the guideline itself, and resistance to change.[22]

BP control varies widely in SA settings,[19,20] and information about the extent of guideline implementation and BP control is lacking in the Matlosana Sub-district. This study aims to determine the extent of SAHPG implementation and of BP control achieved in adults with HTN attending primary healthcare facilities in Matlosana Sub-District. The association between BP control with demographic factors, comorbidities, TOD, antihypertensive therapy prescribed, and lifestyle advice provided in Matlosana Sub-district primary healthcare facilities were explored.

METHODOLOGY

Study design

A cross-sectional study was conducted using data collected from the active medical records of patients consulting at four primary care clinics.

Study setting

The study was conducted in Matlosana Sub-district, one of the four sub-districts in Dr Kenneth Kaunda District, situated southwest of Johannesburg, South Africa. Based on the population census Matlosana Sub-district had a population of 431 231 people in 2017.[23] There are 18 PHC facilities in the sub-district, comprising four community health centres (CHCs), and 14 PHC day-clinics that operate between 07:00 hours to 16:00 hours. All facilities in the sub-district

use paper based medical records. According to the CHC registers and daily hypertension medical record counts taken by the researcher in August 2020, there was an estimated 2 730 medical records of hypertensive patients seen at the four CHCs monthly (Figure 1). All the CHCs are situated in different townships in the sub-district, with each CHCs supporting the PHC day-clinics in the same demarcation area for services not available in the day-clinics such as electrocardiogram (ECG), ultrasound services, doctors' availability in the CHCs every day, and after 16:00 hour coverage. All CHCs operated 24 hours a day, had full-time nurses for 24 hours and daily doctors' coverage during the week until 16:00. At the time of the study not all day-clinics had daily doctor coverage due to the shortage of doctors in the sub-district; some had a doctor twice a week and others three times a week. The CHCs provided a full range of services including antenatal care, women and children's health, mental health, HIV/AIDS, sexually transmitted infections (STIs) and tuberculosis (TB) (HAST) program, Adolescent and Youth Friendly Services, acute care, chronic care, as well as the promotive and preventive services. The study was conducted in all four CHCs in the sub-district to obtain a representative sample and generate findings that are generalizable to the sub-district.

The study population and sampling strategy

The target population were all adult patients living with hypertension who were followed up in the four CHCs in Matlosana Sub-district. The inclusion criteria used included: hypertensive patients 18 years and above who consented to the utilization of their medical records for the study; who had hypertension follow-up visits at the same facility and documented in the same paper based medical record due to the unavailability of electronic medical records; who had more than two hypertension follow-up visits in the past year to assess BP control at the first two visits and compare BP control at the third visit; and the patients had to be on at least one recorded prescribed antihypertensive treatment to be eligible for the study. The exclusion criteria used included: documented pregnancy with the utilization of a different hypertension guideline during pregnancy; antenatal care follow-up duration of less than a year; pregnant patients' medical records or medical records of hypertensive patients after 16:00 due to the shortage of staff at night (with only two professional nurses and one assistant/enrolled nurse on duty at night this resulted in no assistance with obtaining the patients informed consent); and patients who needed emergency care management.

According to the CHC daily hypertension medical record counts performed by the researcher in August 2020 at the four facilities, there was an estimate of 2 730 medical records of hypertensive patients seen at the four CHCs monthly (Table 1). A minimum sample size was calculated using the formula:

$$n = \frac{N}{1 + N(e)^2}$$ [Eqn 1].[24]

Where n is the sample size, N is the population size estimated at 2 730, and assuming a margin of error of 0.05, a sample size of 345 was calculated at a confidence interval of 95%. This number was increased by 50% to account for missing data from the medical records, which enlarged the sample size to 523. To ensure that all the facilities in the study were well represented, the sample size calculated was distributed according to the estimated proportion of hypertensive patients counted at each of the facilities (Table 1). Patients were conveniently recruited during their clinic visits and all the medical records of patients who signed the consent forms were identified to be screened for inclusion in the study. All the medical records that met the inclusion criteria were selected using random sampling without replacement (Figure 1).

Table 1: Population size, sample proportion, and sample size number at each of the four community health centres

CHC	**Population Size Per facility**	**Sample Proportion (%)**	**Calculated Sample Size per facility**
GM-CHC	1040	38.1	199
J-CHC	884	32.4	170
T-CHC	416	15.2	79
B-CHC	390	14.3	75

Total	2730	100	523

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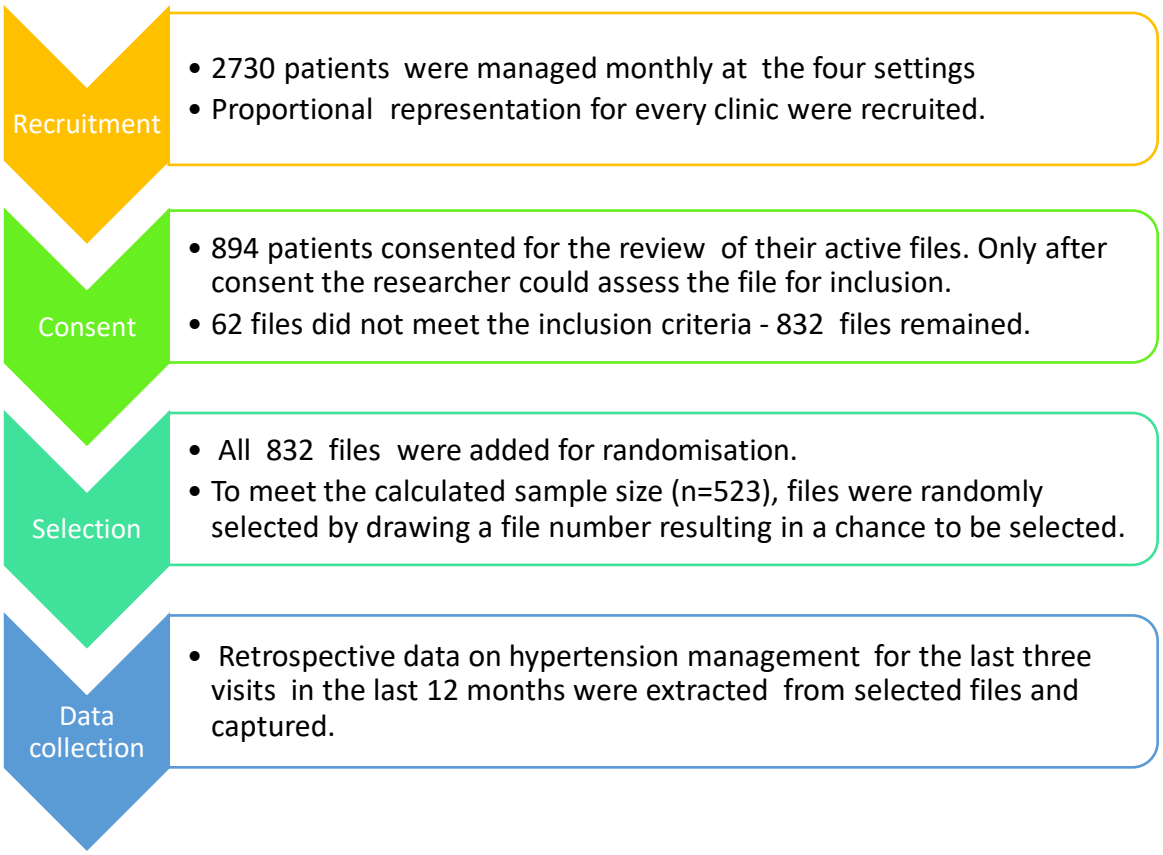

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150 **Figure 1. Flow diagram describing the steps followed from population sampling,**
151 **recruitment, obtaining consent, to file selection and data extraction**

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Pilot study

A pilot study was conducted using forty participants to determine the feasibility and suitability of the methodology to achieve the objectives of the study. Informed consent to conduct the pilot study was obtained from the participants. There were no adjustments required to the measurement tool after the pilot study because the measuring tool was feasible. The medical records reviewed during the pilot study were not included in the main study because the registry clerk and clinicians were not yet familiar with the process.

Measurement tool and data collection

The researcher developed a measurement tool using the SAHPG.[14] The measurement tool had five parts. The first part of the measurement tool comprised the demographic information of participants which included age, sex, and employment status. Age affects the course and progression of a disease and is important in determining the correct course of treatment.[25,26] In this study age was categorized into three groups (<50, 50-60, >60 years). The second part of the tool assessed the implementation of the hypertension guideline. The guideline elements included were anthropometry (weight, height, and body mass index (BMI)), BP measurements at the last three follow-up visits, documented urine dipstick test at least once a year, documented random blood glucose at least once a year if nondiabetic, creatinine and estimated glomerular filtration rate at least once a year, and random cholesterol once a year. The BP measurements at the last three consecutive follow-up visits were collected from the medical records. BP control was categorised into three groups: controlled if BP was < 140/90 mmHg at all three visits; equivocal control if BP was < 140/90 at either one or two follow-up visits; and uncontrolled if BP was ≥140/90 mmHg at all three visits. In this study, the BP control target was defined as a BP < 140/90 mmHg with a diastolic blood pressure (DBP) of < 90 mmHg and a systolic blood pressure (SBP) of < 140 mmHg.[14] The BP reading at visits 2 and 3 were used to assess BP control, where BP was controlled if the BP reading at both visits 2 and 3 were < 140/90 mmHg, and uncontrolled if BP was ≥140/90 mmHg at either visits 2 or 3 or both visits. BP control at the last two visits (visits 2 and 3) was further compared to BP control achieved when all three visits (visits 1, 2, and 3) were used to assess BP control.

The BMI was defined as a person's weight in kilograms divided by the square of their height in meters.[27] The BMI was also collected under anthropometry to assess guideline implementation and the association between BP control and BMI. The BMI was categorised into underweight if < 18.5 kg/m^2, normal if ranging from 18.5 kg/m^2 to 24.9 kg/m^2, overweight if ranging from 25 kg/m^2 to 29.9 kg/m^2, and obese if > 30 kg/m^2.[27]

The third part of the guideline assessed for the presence of comorbidities (diabetes mellites, dyslipidaemia, HIV, gout, and asthma) and the screening of TOD (ischaemic heart disease, heart failure, and kidney disease). The fourth part of the tool assessed for lifestyle advice and the type of lifestyle advice given. The fifth part of the measurement tool assessed for the drug therapy prescribed and the total number of drug therapies prescribed. During the recruitment of participants to screen for the eligibility criteria, two of the facilities were visited in the morning between 07:00 and 09:00 and the other two facilities were visited in the afternoon between 14:00 and 16:00. The researcher alternated morning and afternoon visits between the facilities for five days a week. The researcher informed the patients who were sitting in the waiting area about the study, and an information sheet was given to each patient to read. Patients were informed that participation in the study was voluntary, and that their refusal would not affect the care they were going to receive. Those who were interested then signed a consent form for the utilization of their medical records with the clinicians at each of the CHCs at the end of the consultation. There were no recent pre-existing registers of hypertensive patients in the CHCs, therefore, medical records that met the inclusion criteria for the study were kept separate for the researcher to create a single register list, and thereafter, the records were immediately returned to the records room. Participants were recruited from 1 August 2022 to 6 October 2022. Medical records were randomly selected from the list using simple random sampling without replacement.[28] Medical record numbers were marked on a paper according to the register list, then folded, and placed in a bowl. The numbers were blindly stirred after each selection was made and the corresponding medical record was identified until 523 medical records were selected for sampling. Each medical record stood an equal chance to be selected once. The registry clerks, who were not part of the study, were requested to retrieve the selected medical records using the patient medical record numbers. These numbers were provided to them by the researcher. The medical records were immediately returned to the clerks for back-

filing after data collection. Data on the dependent variables (BP control assessed by collecting BP recorded at the last three consecutive visits) and independent variables (demographic information, anthropometry, documented comorbidities and TOD, screening for TOD, and antihypertensive therapy) were collected. The register list of medical record numbers was destroyed by using a shredding machine after the data collection.

Data analysis

The manually collected data were captured in Microsoft Excel and analysed using STATA version 16 (Stata Corp, College Station, Texas, United States).[29] The researcher used descriptive statistics to describe the categorical and continuous variables. Categorical variables were summarised using frequencies and percentages. Continuous variables were summarised as median and interquartile range if the data were non-normal or mean and standard deviation if the data were normally distributed. The categorical variables were sex, employment status, BMI, documented urine dipstick test, documented urine protein, documented blood glucose test, documented random cholesterol, and ECG done. The continuous variables were age, recorded BP reading, number of antihypertensive therapies prescribed and number of documented comorbidities. A histogram plot was used to assess normality. A bivariate analysis was used to assess the correlation between the BP control status, demographic, and clinical factors. To determine the factors associated with BP control, a logistic regression was performed, and odds ratios calculated. A p-value < 5% was considered statistically significant.

Ethical considerations

Permission to conduct the study was obtained from the [information redacted to maintain the integrity of the review process]. Due to the utilization of active files an informed consent was obtained from all the participants before the study. The patients' confidentiality and anonymity were ensured by keeping the data collection sheets anonymous and by deleting any identifiers that link the patients' medical records to the questionnaire. The data collection sheets will be securely stored for two years after publication of the results, after which they will be discarded

by using a shredding machine. The electronic data were anonymised and stored under password protection and will be deleted two years after publication of the study.

RESULTS

Documented demographic characteristics

Table 2 presents the sociodemographic information extracted from the review of the documented medical records. Majority of the participants were females 376(71.9%). Among the three age groups, the bigger group was 214(40.9) of those who were older than 60 years.

Table 2: Patient demographic characteristics (n = 523) extracted from the medical records

Category	Frequency n (%)	BP controlled n (%)	BP uncontrolled n (%)	OR (95% CI)	*p*-value
Age (years)					
< 50 years	142 (27.15)	60 (42.25)	82 (57.75)	–	–
50–60 years	167 (31.93)	81 (48.50)	86 (51.50)	1.29 (0.82–2.02)	0.118
> 60 years	214 (40.92)	88 (41.12)	126 (58.88)	1.21 (0.53–2.78)	0.653
Sex					
Unspecified	1 (0.19)	1 (0.19)	0	–	
Male	146 (27.97)	57 (39.04)	89 (60.56)		
Female	376 (72.03)	171 (45.48)	205 (54.52)	1.31 (0.88–1.92)	0.177
Employment status					
Unemployed	257 (49.14)	111 (43.19)	146 (56.81)	–	
Employed	33 (6.31)	20 (60.61)	13 (39.39)	2.02 (0.62–4.24)	0.062
Not specified	233 (44.55)	98 (42.06)	135 (57.94)	0.95 (0.67–1.37)	0.800

Documented BP and BMI

The results in Table 3 showed that the achievement of BP control at visit 2 and 3 was documented in 229 (43.8%) medical records (Table 2). However, when including visit 1, with BP control assessed for all three visits, there was a drop in BP control achieved in 126 (24.09%) medical records. Furthermore, it was found that BMI was not recorded in 284 (54.3%) of the medical records.

Table 3: Record review of documented BP levels and BMI (n = 523)

Variable	Category of BP	Controlled n (%)	Uncontrolled n (%)	Control equivocal
Summary of BP control (last 2 visits)				
	Visit 2	229 (43.79)	294 (56.21)	–
	Visit 3	229 (43.79)	294 (56.21)	–
Summary of BP control (3 visits)				
	Recorded BP	126 (24.09)	161 (30.78)	236 (45.12)
Recorded BMI in 3 groups according to BP control				
	Not specified (n = 284)	80 (28.17)	84 (29.58)	120 (42.25)
	Underweight (n = 8)	7 (87.50)	0	1 (12.5)
	Normal (n = 69)	23 (33.82)	11 (16.18)	35 (50.72)
	Overweight (n = 69)	22 (31.15)	16 (18.03)	31 (50.82)
	Obese (n = 93)	18 (19.57)	25 (26.88)	50 (54.35)

Recorded hypertension comorbidities, TOD and BP control

The results in table 4 describes the documented screening tests performed for TOD, hypertension comorbidities, and BP control. From the 523 medical records reviewed data were collected for documented urine analysis, urine protein, random blood glucose, random cholesterol, serum creatinine, serum potassium level, and ECG. No association was found between BP control and the screening for TOD. There were 341 (65.2%) medical records with documented comorbid conditions that included diabetes mellitus, dyslipidaemia, HIV, asthma and gout; while the recorded TOD included heart failure, stroke, and ischemic heart disease. The three most common comorbidities found were HIV 218 (41.7%) followed by dyslipidaemia 133 (25.4%) and diabetes mellites 85 (16.3%). There were 18 (3.44%) medical records with documented asthma and 2 (0.38%) medical records with documented gout comorbidities. Furthermore, comorbidities overlapped between the groups. In the dyslipidaemia group there were 59 (44.4%) medical records with documented comorbid diabetes mellitus and 35 (16.1%) with documented comorbid HIV. In the diabetes mellites group there were 20 (23.5%) medical records with documented comorbid HIV and 59 (69.4%) with comorbid dyslipidaemia. Diabetes mellitus often existed with other comorbidities as documented in 79 (92.9%) records. Lastly, the patients' files in the comorbid HIV group had 1.59 times (OR = 1.59; 95% CI: 1.12-2.26, p = 0.009) increased odds of having better documented BP control than the patients' files with no comorbid HIV.

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309 **Table 4:** Recorded TOD screening, hypertension comorbidities, and BP control (n = 523**)**

Variable	**Category**	**Frequency** **523 (%)**	**BP controlled** **%**	**BP uncontrolled** **%**	**Odds ratios**	***p*-value**
Screening done						
	Urine dipstick	120 (22.9)	56 (25.5)	64 (21.8)	0.14 (0.8-1.64)	0.469
	Urine protein	92 (17.6)	44 (47.8)	48 (16.3)	0.82 (0.52-1.29)	0.39
	Random blood glucose	245 (46.8)	107 (43.8)	138 (47.2)	0.99 (0.7-1.4)	0.961
	Creatinine/eGFR	398 (76.1)	182 (79.5)	216 (73.5)	1.19 (0.97-1.45)	0.067
	Potassium	126 (24.09)	59 (25.8)	67 (22.8)	0.85 (0.57-1.27)	0.43

	Random cholesterol	399 (76.3)	183 (79.9)	216 (73.5)	1.44 (.95-2.17)	0.086
	ECG	12 (2.3)	7 (3.1)	5 (1.7)	0.55 (0.17-1.75)	0.304
Recorded comorbidities						
	Diabetes mellites	85 (16.3)	34 (40.0)	51 (60.0)	0.61 (0.21-1.73)	0,442
	Dyslipidaemia	133 (25.4)	51 (38.35)	82 (61.65)	0.56 (0.19-1.64)	0.144
	Ischemic heart disease	1 (0.19)	0	1 (100)	-	-
	Heart failure	4 (0.76)	4 (100.0)	0	-	-
	HIV	218 (41.7)	110 (50.46)	108 (49.54)	1.42 (0.98-2.05)	0.009
	Gout	2 (0.38)	1 (50.0)	1 (50.0)	-	-
	Asthma	18 (3.44)	11 (61.11)	7 (38.89)	-	0.997
	Stroke	1 (0.19)	0	1 (100)	-	-

Number of medical records with recorded comorbidities						
	0 HPT comorbidity	182	75 (41.21)	107 (58.79)	-	-
	1 HPT comorbidity	243	111 (45.68)	132 (54.32)	-	0.39
	2 HPT comorbidities	79	34 (43.04)	45 (56.96)	-	0.36
	3 HPT comorbidities	19	9 (47.37)	10 (52.63)	-	0.78

*Hypertension (HPT)

*Glomerular filtration rate(eGFR)

Recorded monitoring and screening for TOD

Table 5 shows the documented proportion of screening tests performed for TOD. These recorded screening tests were compared between six groups including the HIV, dyslipidaemia, and diabetes mellitus groups. It was found that the screening tests performed included urine analysis for proteinuria, serum creatinine and glomerular filtration rate, serum potassium, random cholesterol and glucose, and ECG tracings. In addition, urine testing for protein and blood glucose was performed in the diabetes mellitus and dyslipidaemia groups using a statistically significant frequency. It was also discovered that serum creatinine and total cholesterol testing were performed significantly more often in the comorbid HIV group. Furthermore, it was determined that screening test for TOD in patients with documented comorbid HIV were recorded at a statistically significant frequency than in patients with no comorbid HIV.

328 **Table 5: Recorded screening for TOD in relation to documented comorbidities (n = 523)**

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Category of screening recorded	**Screening frequency (n = 523) %**	**Diabetes mellites (n = 85) % (*p*-value)**	**Dyslipidaemia (n = 133) % (*p*-value)**	**HIV (n = 218) % (*p*-value)**	**Asthma (n = 18) % (*p*-value)**	**Gout (n = 2) % (*p*-value)**	**IHD (n = 1) % (*p*-value)**
	TOD	**Comorbidities**					
Urine dipstick	120 (22.94)	37 (43.53) **(*p* < 0.001)**	47 (35.34) **(*p* < 0.001)**	50 (22.94) (*p* = 0.997)	7 (38.89) (*p* = 0.102)	2 (100) (*p* = 0.362)	1 (100) (*p* = 0.585)
Urine protein	92 (17.59)	32 (37.64) **(*p* < 0.001)**	36 (27.07) **(*p* < 0.001)**	37 (16.97) (*p* = 0.754)	7 (38.89) **(*p* = 0.016)**	0 (*p* = 0.513)	0 (*p* = 0.644)
Creatinine/eGFR	398 (76.01)	68 (80.0) (*p* = 0.357)	109 (81.96) (*p* = 0.067)	217 (99.54) **(*p* < 0.001)**	15 (83.33) (*p* = 0.464)	2 (100) (*p* = 0.427)	1 (100) (*p* = 0.074)

Potassium	126 (24.09)	45 (52.94) **(*p* < 0.001)**	49 (36.84) **(*p* < 0.001)**	55 (25.23) (*p* = 0.607)	7 (38.89) (*p* = 0.135)	1 (50.0) (*p* = 0.391)	0 (*p* = 0.573)
Random cholesterol	399 (76.29)	68 (80.0) (*p* = 0.549)	75 (56.39) (*p* = 0.123)	218 (100) **(*p* < 0.001)**	16 (88.89) (*p* = 0.201)	2 (100) (*p* = 0.431)	1 (100) (*p* = 0.073
Random blood glucose	245 (46.85)	62 (72.94) **(*p* < 0.001)**	108 (81.20) **(*p* = 0.011)**	109 (50.0) (*p* = 0.222**)**	11 (61.11) (*p* = 0.201	2 (100) (*p* = 0.131	0 (*p* = 0.317)
ECG	12 (2.29)	4 (4.71) (*p* = 0.105)	5 (3.76) (*p* = 0.237)	7 (3.21) (*p* = 0.191)	1 (5.56))	0 **(***p* = 0.828)	0 (*p* = 0.828)

*****Electrocardiogram (ECG)

*Glomerular filtration rate(eGFR)

Antihypertensive therapy prescribed and lifestyle advice in reviewed medical records

The results in table 6 showed that lifestyle advice was documented in 521 (99.2%) of the medical records. In addition, all the medical records had at least one documented prescription of antihypertensive therapy; 124 (23.7%) medical records had a single documented antihypertensive therapy prescribed; and 399 (76.29%) medical records had more than one documented antihypertensive therapy prescribed. An increase in the number of antihypertensives prescribed by one drug reduced the odds of having controlled BP by 25% (OR = 0.75; 95% CI: 0.61-0.94). Patients on enalapril medication were 39% less likely of having controlled BP (OR = 0.61; 95% CI: 0.43-0.88) compared to those not on enalapril. Patients on drug combinations were 52% less likely of having controlled BP (OR = 0.48; 95% CI: 0.33-0.74) compared to patients on a single antihypertensive. In the adjusted regression model, patients on antihypertensive combinations had 47% reduced odds of having controlled BP (AOR = 0.53; 95% CI: 0.45-0.1) compared to those on a single antihypertensive therapy.

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347 **Table 6: Drug therapy and lifestyle advice documented in patient records (n = 523)**

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Prescribed treatment	**Frequency of treatment prescribed n (%)**	**BP controlled n (%)**	**BP uncontrolled n (%)**	**Odds ratio (**95% CI**)**	***p*-value**
HCTZ	484 (92.54	212 (43.80)	272 (56.20)	1.01 (0.52-1.95)	0.98
Amlodipine	230 (43.98)	90 (39.13)	140 (60.87)	0.71 (0.51-1.01)	0.058
Enalapril	341 (65.20)	135 (39.59)	206 (60.41)	0.61 (0.43-0.88)	**0.008**
Atenolol / carvedilol	18 (3.44)	8 (44.44)	10 (55.56)	1.03 (0.39-2.64)	0.954
HCTZ + Enalapril	174 (33.2)	70 (40.23)	104 (59.77)	0.80 (0.56-1.16)	0.247
HCTZ + amlodipine	67 (12.8)	26 (38.8)	41 (61.2)	1.07 (0.68-1.69)	0.767
Single antihypertensive	124 (23.7)	71 (57.3)	53 (42.7)	0.19 (0.05.0.33)	-
Drug class combinations	399 (76.29)	158 (39.60)	241 (60.40)	0.48 (0.33-0.74)	**0.001**

Lifestyle modification	521 (99.62)	228 (43.93)	293 (56.24)	0.96 (0.89-1.03)	0.74

*Furosemide, carvedilol and methyldopa were excluded due to a few of these antihypertensive prescribed.

DISCUSSION

Guideline implementation on documented screening for TOD

The study found poor compliance with various aspects of the SAHPG concerning the documentation of demographic information, anthropometry, and screening for TOD. Demographic factors including age, race, employment, and education are known to influence BP control,[30] and the decision on which antihypertensive therapies to prescribe. Lowering BMI, thereby losing weight, can reduce BP levels, thus improving BP control.[12,31] In this study BMI was documented in just over half the medical records, which reflects a gap in the day-to-day practice in primary healthcare. According to the guidelines weight should be measured at every visit and height at least once at baseline to be able to calculate BMI at every visit.[11,12,14,15]

A study conducted in Lesotho reported an increase in left ventricular modelling and renal impairment among patients with elevated BP[32] showing the importance of TOD screening. In this study, screening for TOD was poor as the urine analysis and the ECG tests used to screen for kidney disease and left ventricular remodelling, respectively, were insufficient. Although the urine dipstick, potassium, and random blood glucose test were not done frequently, these screening tests were performed significantly more often in the diabetes mellites and dyslipidaemia groups than in the medical records of patients with other comorbidities. The screening tests that were regularly documented included random cholesterol and serum creatinine measurements. Omissions in screening for TOD may have serious implications for hypertensive patients with unidentified coexisting comorbidities.[33] Another study found that, among other challenges, overwhelming patient numbers seen in primary care facilities compromise the quality of care.[34]

Recorded BP control in the medical records of hypertensive patients

In this study the proportion of medical records with BP control was suboptimal with target BP documented in less than half the reviewed files. Similarly, studies in other provinces of South Africa, such as the Mpumalanga and Gauteng provinces, also found that overall BP control was below target.[20,35] On the other hand, there are studies that have reported BP control achieved in more than 50% of participants,[36,37] meaning that there is the potential to achieve better levels of BP control. However, some South African studies have reported much lower levels of BP control than this study.[38,39] Suboptimal BP control is a reason for concern due to the known increased risks for all-cause and cardiovascular disease mortality.[40] The risk of cardiovascular events, strokes, and kidney disease is closely related to increased levels of BP. These complications may, therefore, lead to an increase in the burden of disease and economic costs.[41]

Comorbidities in a cohort of hypertensive medical records: BP control and management

The three most common comorbid conditions in our study were HIV, dyslipidaemia, and diabetes mellitus (Table 3). The proportion of files indicating patients as being HIV positive was unexpectedly high, with levels above numbers nationally recorded and per district.[42,43] Notably in this study, BP control in the HIV group was significantly better than in the other groups of hypertension comorbidities. In the majority of records of the HIV group the documented age was above 50 years, likely the result of freely available antiretroviral therapy in South Africa.[44] A study by Lebina et al. found a 30% prevalence of hypertension in a virally suppressed cohort of HIV patients above the age of 40 years.[45] This is consistent with increasing hypertension prevalence with age.[46] In addition, the group with comorbid HIV was more likely to have a controlled BP, compared to groups with other comorbid conditions. This could be because clinicians were more likely to implement HIV guideline recommendations in this cohort of hypertensive patients. Under the South African HIV treatment program, where regular annual monitoring is supported by audits, it is a requirement that BP is controlled in a cohort of comorbid HIV patients before referral to a facility based or external repeat prescription pick-up point.[47]

Recorded clinician management of hypertension and BP control

Lifestyle advice forms an integral part of the management of patients with hypertension, and it is recommended as a first line therapy by several guidelines.[11,12,14] Studies show that high BP can be lowered by maintaining a healthy lifestyle.[12,31] In this study, lifestyle advice was documented as offered in almost all the medical records reviewed. However, there was no mention of whether the lifestyle advice offered was tailored to the needs of the patient.

All the medical records had at least one documented antihypertensive therapy prescribed, but the proportion of files with controlled BP remained suboptimal. This finding is similar to a study done in Gauteng that found BP control low, despite the appropriate antihypertensive classes prescribed.[36] A thiazide diuretic was the most frequently prescribed antihypertensive agent in the study, in line with the guidelines, and indicating it as the agent of choice secondary to lifestyle advice.[11,13,14,15] The ACEI was the second most prescribed antihypertensive agent, which although appropriately prescribed as a second line in this study, had reduced odds of achieving a controlled BP. Another study found that when a CCB was prescribed with either a thiazide diuretic or an ACEI that the combination of a CCB and thiazide diuretic resulted in better BP control than with a thiazide diuretic and an ACEI.[47] In addition, our study also found significantly reduced odds of having BP controlled when the number of antihypertensive classes prescribed were increased to more than two antihypertensives. Studies support the use of a single drug fixed dose combination of antihypertensive for better tolerance,[48] which is not yet available in the public sector in South Africa.

Strengths and limitations

This was a review of patient records and therefore prone to information bias. Due to the study reviewing active patient files, the ethical requirement meant that only the medical records of patients who signed an informed consent were reviewed. The study is therefore prone to selection bias. In addition, the information regarding race, marital status, and educational level was not documented from the demographic information section of the patient files and thus the association between BP control and demographic profiles were not assessed. Furthermore, the

association between the BMI and BP control could not be assessed in the study due to the infrequent recording of height and calculation of BMI. The poor documentation of screening for target organ complications may be interpreted as screening that was not done. Furthermore, as medical records were reviewed in CHCs located at the peripheries of the town, the sample may not be representative of the South African population. The draining areas served by the CHCs are limited geographically, being not representative of the entire Matlosana Sub-District. Despite the above limitations this study provides an insight into the quality of hypertension management in the sub-district and the findings provide an opportunity for quality improvement projects and continuous medical education on hypertension guidelines.

CONCLUSION AND RECOMMENDATIONS

This study found that documentation regarding the implementation of the SAHPG recommendations among patients with hypertension in the study setting was poor and BP control was suboptimal. The most common documented comorbid illness was HIV. Where HIV was confirmed, better BP control than in other groups of comorbidities were noted. Screening for target organ damage was generally poorly documented in this study. Health care workers need to be aware of the finding of poor documentation of SAHPG recommendations and suboptimal control of BP in this study setting. Programs that audit and improve the quality of hypertension guideline implementation and blood pressure control in primary care, require ongoing support and further research.

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Data availability statement

Data sharing is not applicable to this article, as no new data were created or analysed in this study.

Disclaimer

The opinions and views of this article are those of the authors and do not reflect the official policy or position of any affiliated agency of the authors.

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Data sharing is not applicable to this article, as no new data were created or analysed in this study.

Disclaimer

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APPENDICES

Appendix 1: Data collection tool

ALLOCATED STUDY NUMBER: .....

Table 2a: Demographics

Age	
Sex	
Employment status	

Table 2b: Hypertension guideline

	Guidelines	Yes	No	Actual documented measurement/comorbidities where applicable
Anthropometry documented:				
Weight	Every visit			
Height	At first visit			
Blood pressure	At every visit			
Blood pressure done (document reading if yes)	Every visit			
1st BP of the last 3				
2nd BP of the last 3				
3rd BP of the last 3				
Urine dipstick documented	At baseline and yearly if normal			
Protein	Every visit			
Blood	Yearly if normal			
Blood glucose	Repeat at next visit if abnormal			
Blood test done	First visit then yearly			
Creatinine/EGFR	Yearly if normal			
Potassium	Yearly if normal			
Fasting glucose	Yearly if normal			
Random total cholesterol	Yearly if normal			
ECG done	Yearly if normal			

Table 2c: Comorbidities and hypertension related complication (target organ damage)

Comorbidities or complication	Yes	No
Diabetes mellitus		
Dyslipidaemia		
Ischemic heart disease		
Heart failure		
Human immunodeficiency virus		
Stroke		
Gout		
Asthma		

Table 2d: Lifestyle modification

Lifestyle advised	Yes	No	If answer yes document the lifestyle advised
Weight loss if overweight			
Restrict salt intake			
Restrict fat intake			
Smoking cessation			
Avoid excess alcohol intake			

Table 2e: Therapy

Number of drug classes prescribed	
Drug and dosage prescribed	
Hydrochlorothiazide 12.5mg/25mg	
Enalapril 10mg/20mg or Losartan 50/100mg	
Amlodipine 5mg/10mg	
Atenolol 50mg/100mg or Carvedilol 3.25mg/6.5mg/12.5mg/25mg 12 hourly	

Appendix 2: Patient information sheet

M21/11/116

STUDY INFORMATION DOCUMENT

Study title: Hypertension guideline implementation and blood pressure control in the primary care facilities in Matlosana sub district, North-West province.

Greeting Sir/ Madam:

Introduction:

We, KI Ditlhabolo and team are doing research on high blood pressure treatment and its control in our health centre. The study is for the purpose of M Med degree from the University of Witwatersrand. Research is a process used in seeking new knowledge. In this study we want to learn whether guidelines are utilized optimally when treating patients with high blood pressure and we also want to know how controlled the blood pressure is among our adult patients who are on treatment at our community health centres in Matlosana sub district. This study is a research project, and it is not part of routine care. The study will fill a knowledge gap and suggest recommendations for future research to improve blood pressure control for hypertensive patients.

Invitation to Participate: We are kindly asking you for permission to use your medical records in this research project.

What is involved in the study? This could include but would not necessarily be limited to such features as:

1. The study involves collecting information regarding your high blood pressure care from your medical records (patient file) regarding the previous follow-up visits at the facility.
2. The study will continue until the desired number of participants' medical records has been obtained.
3. The researcher will be using a form that is drawn from the guideline with all that the health care worker is expected to do when caring for a patient who has high blood pressure at a health care facility.
4. The researcher will collect this information from your medical records. On the form there is weight, height, blood pressure done, urine test done, blood test done, and other information related to high blood pressure care. The researcher will tick a yes when the health care worker has done a test or measurement and a no if the health care worker did not do the test or measurement.
5. The researcher will collect information at the facility where the patient comes for their follow-up visit. A new form will be used to collect information from each medical record.

1. For those who agree to participate, all the information required to complete the form will be obtained from their medical records.
2. No blood samples will be taken from the participants.

Risks of being involved in the study: There is no anticipated risk to the potential participants. The researcher will be using data collection sheets to capture the information obtained from the medical records. The researcher will be using codes to number the data collection sheet and this numbers will not be linked to the medical records.

Benefits of being in the study: There are no direct benefits to the Participant; however, the longer-term objective is the possibility of better treatment for all patients with high blood pressure.

Participation is voluntary, refusal to participate will involve no penalty or loss of benefits to which the Participant is otherwise entitled, as, for example, a hospital patient; that the Participant may discontinue participation at any time without penalty, or loss of benefits to which the Participant is otherwise entitled; that there is no requirement to provide a reason for withdrawing and any data collected on such a person will in default be destroyed, unless the Participant specifically consents to its retention.

Confidentiality: The information obtained from all the patients records will be treated in the strictest confidence and will only be available to the Principal Investigator (PI) and his/her supervisor, in the case wherein the PI is a postgraduate student. The only exceptions - and all of them are rare - would normally be:
1. personal information may be disclosed if required by law
2. the Human Research Ethics Committees of the University may exceptionally require personal data to respond to a formal complaint, or for a compliance audit
3. the South African Health Products Regulatory Authority (SAHPRA), which is the successor body to the South African Medicines Control Council (SAMCC), might conceivably require access to personal data, if conducting an investigation into a drug trial.

Anonymity: The participant's information will be kept anonymous by not putting any names or any information that identifies the participants on the form.

Contact details of researcher/s: to enable prospective or actual Participants to get further information an e-mail address and telephone contact details of the Principal Investigator Dr KI Ditlhabolo is 082 531 0705 or by email on keolibile@yahoo.com and her supervisor is Dr HC Cachet who may be contacted on 083 39576 37 or by email on clcachet@gmail.com.

Outputs: The outputs of the study will be available once the study is completed, and a results summary will be shared with everyone who requests it.

Contact details of HREC administrator and chair:

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.
If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Date: May 2022

26 May 2022

Appendix 3: Protocol approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

DEPARTMENT OF FAMILY MEDICINE

11th October 2021

The Postgraduate Office,

Faculty of Health Sciences

Confirmation of corrections required by the Assessor group on MMED (Family medicine) Research protocol: Dr KI Ditlhabolo, Student number: 2327257

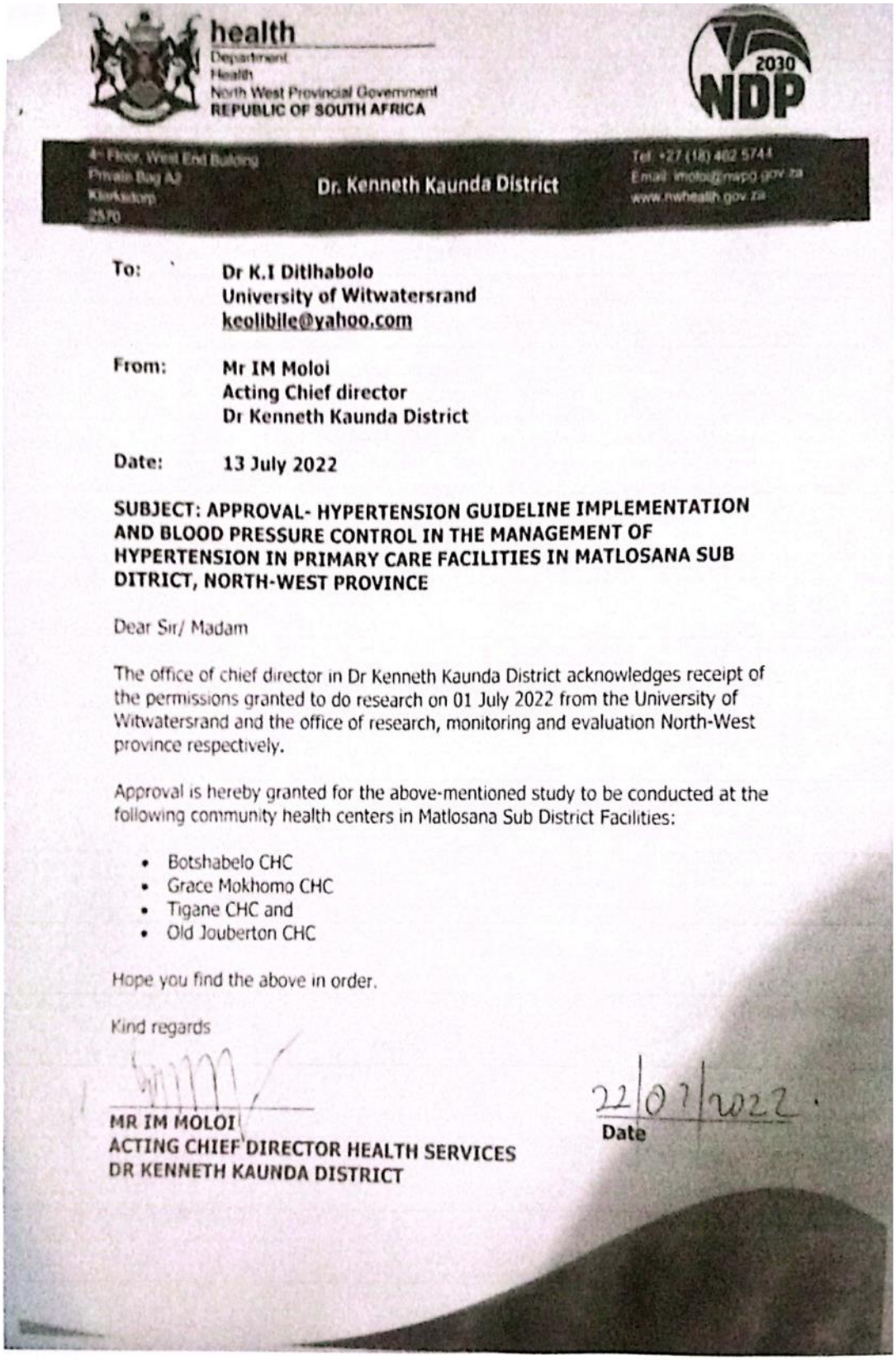
This serves to confirm that the above student has satisfactorily made the corrections required by the Assessor group in the research project Titled "**Guideline implementation and blood pressure control in Primary care facilities in Matlosana sub district, North West province**".

Dr Ditlhabolo may submit to the Postgraduate office.

Prof OB Omole

Academic Head and Chair of the Assessor group: Division of Family medicine

Appendix 4: Dr Kenneth Kaunda District approval



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To: **Dr K.I Ditlhabolo**
University of Witwatersrand
keolibile@yahoo.com

From: **Mr IM Moloi**
Acting Chief director
Dr Kenneth Kaunda District

Date: **13 July 2022**

SUBJECT: APPROVAL- HYPERTENSION GUIDELINE IMPLEMENTATION AND BLOOD PRESSURE CONTROL IN THE MANAGEMENT OF HYPERTENSION IN PRIMARY CARE FACILITIES IN MATLOSANA SUB DITRICT, NORTH-WEST PROVINCE

Dear Sir/ Madam

The office of chief director in Dr Kenneth Kaunda District acknowledges receipt of the permissions granted to do research on 01 July 2022 from the University of Witwatersrand and the office of research, monitoring and evaluation North-West province respectively.

Approval is hereby granted for the above-mentioned study to be conducted at the following community health centers in Matlosana Sub District Facilities:

- Botshabelo CHC
- Grace Mokhomo CHC
- Tigane CHC and
- Old Jouberton CHC

Hope you find the above in order.

Kind regards

MR IM MOLOI
ACTING CHIEF DIRECTOR HEALTH SERVICES
DR KENNETH KAUNDA DISTRICT

22/07/2022.
Date

Appendix 5: Ethics Approval Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research and Innovation)

TO:	Dr KI Ditlhabolo School of Clinical Medicine Department of Medicine Division of Family Medicine Medical School University E-mail: keolibile@yahoo.com
CC:	Supervisor: Dr C Lion-Cachet and Professor E Variava <clcachet@gmail.com> and <HREC-Medical Research Office@wits.ac.za>
FROM:	Mr Iain Burns Human Research Ethics Committee (Medical) Tel: 011 717 1252 E-mail: Iain.Burns@wits.ac.za
DATE:	2022/06/10
REF:	R14/49
PROTOCOL NO:	**M2111116** (This is your ethics application reference number. Please quote it in all enquiries, oral or written, relating to this study.)
PROJECT TITLE:	*Hypertension guideline implementation and blood pressure control in primary care facilities in Matlosana sub-district, North-West Province*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to Government funding of the University.

25

MSWorks2000/Iain0007/Clearscan.wps

Appendix 6: Copy Editor's Letter

Appendix 7: Turnitin Report

Appendix 8: Research Protocol

Version 4

RESEARCH PROTOCOL

Hypertension guideline implementation and blood pressure control in primary care facilities in Matlosana sub district, North-West Province

STUDENT NAME:	KI DITLHABOLO
STUDENT NUMBER:	2327257
COURSE NAME:	MMED in Family Medicine
DEPARTMENT:	FAMILY MEDICINE FACULTY OF HEALTH SCIENCES UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SUPERVISOR: DR HC LION-CACHET 6 Feb 2022

CO-SUPERVISOR/S: PROF E VARIAVA

DATE OF SUBMISSION: 10/09/2020

Table of contents

1. INTRODUCTION

According to the international reports, twenty-six percent of the world population has hypertension (HTN) and the prevalence is postulated to increase to 29 percent by 2025 (1). Hypertension affects about 86 million adults above the age of 20 years in the United States of America (USA), and the World Health Organization (WHO) records estimate that 1.13 billion people worldwide have HTN (1). The rapid increase in prevalence globally is attributed to an increase in figures in the low- and middle-income countries (LMIC) with two thirds of the people living with HTN said to be coming from these countries (1).

Hypertension is a major risk for cardiovascular disease and if left untreated, it could lead to complications such as stroke, coronary artery disease (CAD), heart failure (HF) and chronic kidney disease (CKD) (2,3).Effective drug therapies are available including diuretics, calcium channel blockers (CCBs), angiotensin converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), alpha-blockers, beta-blockers and vasodilators (3) among those commonly used. Lifestyle modification is also vital in the effective management of hypertension (3), however studies show that it is often not incorporated into care (2,5-6). Management of HTN to target is possible but it is barely achievable (5), due to poor adherence to clinical practice guidelines (CPGs) (7-13).

The CPGs are evidence-based documents developed to reduce disparity in clinical practice (14). They are defined as a set of recommendations generated from systematic reviews of current clinical evidence, assessment of risks and benefits of options available for diagnosis and treatment of diseases (14). The role of CPGs is to standardize care, aiming to improve the quality of healthcare (14). In primary health care (PHC), the HTN standard treatment guidelines (STGs) are used to guide the diagnosis, monitoring, drug-therapy, screening for cardiovascular risks, lifestyle modification and screening for comorbidities (13).

The guideline(s) outline a stepwise management of HTN, aiming to achieve a target blood pressure (BP) of 140/90mmHg and lower in adults dependent on comorbidities or target organ damage (3,13,16,19).This is contrary to the Joint National Committee 8 (JNC-8) hypertension guideline that recommends a target of 150/90 mmHg in adults who are 60 years and above. Similarly, in adults below 60 years the JNC-8 recommends a target BP of below140/90 mmHg which is in accordance with other guideline recommendations (3,13,16,17,19). According to the international diabetes guideline (21), a lower target BP of 130/80 to 140/80mmHg is recommended for younger patients with type II Diabetes Mellitus (DM) and cardiovascular risk factors or macrovascular complications (20). However, other guidelines recommend against lower targets of below 130/80 mmHg due to an increased risk of all-cause mortality (3,17,21).

In South Africa at PHC, the STGs and essential drug list (EDL) are made available for use as printed copies bound into a booklet (13) and training is made available. The STGs can also be downloaded as a cellular phone application (APP) for convenience when needed. Both public and private practice has access to the guidelines (3). The South African Hypertension Practice Guidelines was developed to provide a comprehensive management of hypertension in South Africa (3).

Despite on-going effort to update guideline documents and to ensure the availability thereof, some studies have reported that clinicians have not been using the guidelines appropriately when managing patients with HTN (8,11). Some studies have attributed the resistance in the guideline uptake to attitude, perceptions and the experiences of the health practitioners (8,19), where younger (less experienced) clinicians demonstrate better adherence to guidelines (10,12).The cornerstone in the management of hypertension is to achieve optimal blood pressure control aiming to reduce early development of target organ damage (1,3). The process of achieving this goal is well articulated in a number of guidelines (3,13,18,19).

1.1 Rationale for the study and research questions

Rationale

Although blood pressure control is reported to still be suboptimal in a number of settings in South Africa (3,4,11), information about blood pressure control and guideline implementation is still lacking in our setting. Given this paucity of information a record review will be conducted to assess the appropriateness of antihypertensive therapy, lifestyle advised, processes of care implemented and the extent of blood pressure control in the four community health centres in Matlosana.

Research questions

1. To what extent do healthcare practitioners at primary health care in Matlosana effect treatment guidelines in the management of patients with hypertension?
2. To what extent is blood pressure controlled to target among patients with hypertension in Matlosana sub district?

2 AIM AND OBJECTIVES

2.1 Aim

The aim of the study is to determine the extent of South African Hypertension Practise Guidelines implementation and level of BP control achieved in adults with HTN attending community health centres in Matlosana.

This aim will be reached through the following objectives:

1. To determine the proportion of patients with optimal blood pressure controlled in the last two follow-up visits;
2. To determine the appropriateness of treatment prescribed;

3. To specify the proportion of patient screened for cardiovascular risks factors, comorbidities and target organ damage according to the South African Hypertension Practice Guidelines recommendations; and
4. To explore factors associated with blood pressure control with regard to demographic factors, comorbidities, cardiovascular risk factors, target organ damage, antihypertensive therapy and provision of lifestyle advises.

3 METHODOLOGY

3.1 Study design

This is a cross-sectional study, conducted using retrospective review of medical records of hypertensive patients treated and followed-up at the four community health centres in Matlosana. Data will be collected over a specified period of the study depending on when the desired sample size will be attained. There will be no follow-up done, and multiple variables that affect hypertension management will be observed in a specified population (20).

3.2 Study setting

Matlosana sub district has four community health centres (CHCs) abbreviated (GM-CHC, T-CHC, B-CHC and J-CHC) respectively. All CHCs offer a full range of curative, preventative and promotive services. In each facility there are nurses and at least one doctor per facility who provide primary care to the population. The CHCs also provide 24-hour services including emergency and maternity care. The four CHCs all function differently and they all have different management processes. Therefore, all four CHCs will participate in the study.

3.3 Study population

According to the audit done by the researcher, a total of about 2730 hypertensive patients are seen at the four CHCs on a monthly basis for their follow-up and collection of treatment. The number includes 30 percent of hypertensive patient who are registered to receive their

treatment through Centralized Chronic Medicines Dispensing and Distribution (CCMDD) who come for follow-up at the CHCs.

3.4 Sampling

1. Sample size

A sample size of 523 is required for the study, which was calculated using the formula below (23).

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size of the participants visiting the four CHCs (N = 2730) on a monthly basis, e is the sampling error postulated at (5%), the sample is calculated at a 50% non-response rate, to reduce the possibility of type II error. A sample is distributed proportionally to the size of the population at each facility as shown in Table 1.

Table 1: Population and sample size at the four community health centres

CHC	Population Size	Sample Proportion (%)	Calculated Sample Size per facility
GM-CHC	1040	38.1	199
J-CHC	884	32.4	170
T-CHC	416	15.2	79
B-CHC	390	14.3	75
Total	2730	100	523

2. Sampling strategy

Random sampling method will be used to select patient records legible for sampling and for inclusion in the study. Computer generated numbers will be used to select a sample of medical records required for the study at each facility under study. All the medical records that are reviewed will be marked with a sticker to prevent duplication of data collection. The records will be kept anonymous to preserve patient confidentiality, and no numbers will link a medical record to the patient. Once permission to conduct the study has been granted, the principal investigator will have a meeting with the staff at each of the four community health centres about the study. The researcher will request the clinicians to put aside all the medical records

of hypertensive patients seen in each consultation room in an allocated container. The administration clerks will be informed to not remove the medical records from the allocated containers in the consultation rooms for the duration of the study.

3.5 Inclusion and exclusion criteria

1. *Inclusion criteria*

For medical records to be included in the study patients should be:

- Adults aged 18 years and above and be diagnosed with HTN;
- Followed-up at the chosen facility for at least 12 months;
- On antihypertensive treatment for 12 months and more; and
- Having at least two follow-up visits for hypertension at the same facility.

2. *Exclusion criteria*

- The records of pregnant women diagnosed with HTN for the first time in the index pregnancy will be excluded, as the duration of care will be less than 12 months and the treatment guidelines also differ.
- Patients with HTN emergencies will be excluded as they need to be stabilized first and they may also need to be transferred to the hospital for in-hospital care.
- Hypertensive patients who are seen after hours including after sixteen hundred hours, over the weekend and on holidays will be excluded. The registrar may not be at work during this specified period for data collection.

3.6 Measurement tool

1. Questionnaire (Appendix A).

Table 2a: The questionnaire was developed *de novo* using the South African Hypertension Guideline of 2014 (3) and another tool designed locally (10).

The first part of the tool gathers information on the demographics of the patient including age, sex, education and employment status.

Table 2b: Compares the HCPs practice to the South African Hypertension guideline recommendations**.** The table has five processes of care and that include anthropometry, BP readings, blood tests, urine dipstick and electrocardiograph (ECG).

Anthropometry is the study of the measurement of the human body in terms of the dimensions of bones, muscles and adipose tissues (24). The Body Mass Index (BMI) are commonly used anthropometric measures to assess weight status in kilograms per meter square. For adults the cut-off criteria are underweight (BMI below 18.5), normal (BMI is 18.5-24.9), overweight (BMI 25.0-29.9) and obesity (BMI above 30.0).

A 12 lead ECG is used to assess for left ventricular hypertrophy (LVH). The Lyon-Sokolow criteria (S wave in V1 plus R in V5/V6), and it is positive if the sum is above 38mm (25).

Blood pressure is the pressure exerted by blood against the wall of the artery (26). Blood pressure is high if the systolic value is above 140mmHg and the diastolic is above 90mmHg. In a hypertensive individual blood pressure is controlled if below 140mmHg systolic and 90mmHg in this study using the South African hypertension guidelines (3).

Blood test references ideally total cholesterol, creatinine and (eGFR) depending on comorbidities (3,13).

Table2c: Shows the screening for comorbidities and complications related to HTN. HIV is included because of the interaction between calcium channel blockers and protease inhibitors. Asthma and gout are also included due to adverse reactions that can arise from beta-blocker and thiazide diuretics respectively.

Table 2d: Recommended lifestyle modification include salt reduction, healthy diet, healthy drinks, moderation of alcohol consumption, weight reduction, smoking cessation, regular physical activity 30 minutes at least five times a week, reduced stress and induced

mindfulness (6,16). This includes the lifestyle advised during consultation for visits under study.

Table 2e: Data related to therapy, and this includes the number of drugs prescribed, drug name and dosage. Doctor's visit is included under documented follow-up visits.

2. Recommended standards for the processes of care in hypertension

- The target blood pressure cut-off is 140mmHg systolic and below, and diastolic is 90 mmHg and below.
- Blood pressure must be measured at every visit.
- Height must be measured at first visit, weight at every visit and BMI should be calculated at every visit.
- Waist circumference should be measured at every visit.
- Blood test must be done yearly if the results are normal.
- Urine dipstick must be done at first visit followed by yearly if normal.
- Blood sugar is tested at first visit, to be repeated at the next visit if abnormal at first visit.
- ECG to look for evidence of left ventricular hypertrophy and if normal, it should be done yearly.
- The following medications should be prescribed dependent on the presence of compelling indications:
  - Heart failure (Angiotensin converting enzyme inhibitor (ACEI), Carvedilol, Spironolactone);
  - CVA (hydrochlorothiazide (HCTZ) and ACEI);
  - Angina (Beta-blocker or calcium channel blocker (CCB);
  - Prior myocardial infarction (B-blocker or CCB);
  - Diabetes Mellitus (ACEI combined with diuretic);
  - Chronic kidney disease (ACEI with diuretic);

- Isolated systemic hypertension (HCTZ and Amlodipine);
- Left ventricular hypertrophy (LVH) on ECG - (ACEI) Asthma B blockers are contraindicated.

- Lifestyle modification must be advised at every visit.

3.7 Data collection

The researcher will collect data at two of the CHCs in the morning between 07:00 and 09:00 and for the other two CHCs in the afternoon between 14:00 to 16:30. This is to ensure that service delivery is not affected during data collection. Information from patient records and clinical details will be collected manually to a data collection sheet attached to the research protocol (Appendix A). One data collection sheet will be used for each patient record. The data will be collected daily until the desired sample size is attained to further be exported to Microsoft Excel spreadsheet to relook for errors and duplication. Once a relook is done data will be transferred to Stata software for analysis**.** The Research Electronic Data Capture will be used for storing data. The data collection sheet with data already collected will be kept in a safe lockup cabinet only accessible to the researcher to be made available only when needed by the supervisors and the assessors. The information on the spreadsheet and that on Stata software will be kept in a computer that is password protected to prevent access by unauthorized persons.

3.8 Data analysis

- Frequencies, proportions and means will be used to describe the participants according to demography, comorbidities, presence of cardiovascular risk factors, treatment regimen, processes of care implemented and target organ damage.
- The extent of HCPs adherence to treatment guidelines will be assessed by determining the proportion of HCPs that implemented each process of care. Overall adherence/implementation can be defined as the proportion of patients treated by HCPs

according to guideline recommendations, which often represents evidence-based or best practice care (27,28). In this study, the South African hypertension practice guidelines will be used as reference to measure the degree to which patients with hypertension are managed according to the guideline recommendations (3).

- Group differences will be explored for between those with BP controlled to target and those without regarding demography, presence of comorbidies and target organ damage using the Chi square or student test
- Logistic regression will be used to explore the relationship of blood pressure control with demographic variables, comorbidities and presence of target organ damage.

3.9 Pilot study

A pilot study will be conducted before the actual study to assess the feasibility of the study in the acceptable time frame, with the available resources and the timing of data collection at each facility.

4 THE SOURCES OF BIAS, STRENGTHS AND LIMITATIONS.

When using convenient sampling there is a possibility of selection bias: a Type II error is anticipated in this study but will be eliminated by employing a larger sample. With cross-sectional studies it is difficult to make assumptions between the outcome and exposure because both are observed at the same time. The other limitation is that the record review will be conducted in a semi-urban setting, and generalization to include rural setting in the sub district may be a challenge. Drug shortages, urine dipsticks, and lack of ECGs may also limit the study. In terms of strengths, the study will fill a knowledge gap and recommendations for future research to improve blood pressure control for HTN patients.

5 ETHICAL CONSIDERATIONS

This research is subject to prior approval from the following departments: Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg; North West Department of Health Policy, Planning, Research Monitoring and Evaluation; and Dr Kenneth Kaunda District Research Ethics Committee.

6 TIME FRAME

The time frame for this research study is planned as follows:

- the estimated duration of the study is one year;
- it begins immediately after ethical approval;
- data collection, data analysis, writing a report;
- submission of the final report; and
- Publication.

The time frame for this research study is adapted from the Gant Chart in months as follows:

Key activities	1	2	3	4	5	6	7	8	9	10	11	12
Data collection												
Data analysis												
Writing up the report												
Report submission												
Final submission												
Publication												

BUDGET AND FUNDING

Parameter	Motivation	Estimated cost
Transport	Travelling between facilities where data will be collected	R 1,500.00
Phone cost	For calling the supervisor, participants, editor, statistician and team	R 100.00
Stationery	Buying paper, pens, stapler, files, highlighters	R 500.00
Router and data	Online search, internet connection, email	R 500.00
Printing	Printer, cartridges and printer maintenance	R 1000.00
Editor's cost	For proof-reading and editing	R 2,000.00
Statistician	Cost of statistician's time, for data analysis for five days (use of university services required)	R 0
Administrative cost	Arranging visits, interviews, liaising with team	R 0
Publication fee	For publishing cost	R10,00.00
Approximate total		R 16,600.00

The researcher will apply for funding of this research study from different institutions.

7 CHALLENGES

The study is an audit of medical records in PHC, and it will be conducted at the four CHCs situated in the Matlosana sub district. If there are any challenges regarding the site and the

sample size, the alternative plan will be to utilize the family medicine clinic situated at Tshepong Hospital. Necessary permission will be requested to utilize the facility.

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APPENDIX A: DATA COLLECTION TOOL

ALLOCATED STUDY NUMBER: .....

Table 2a: Demographics

Age	
Sex	
Employment status	

Table 2b: Hypertension guideline

	Guidelines	Yes	No	Actual documented measurement/comorbidities where applicable
Anthropometry documented:				
Weight	Every visit			
Height	At first visit			
Blood pressure	At every visit			
Blood pressure done (document reading if yes)	Every visit			
1stBP of the last 3				
2ndBP of the last 3				
3rdBP of the last 3				
Urine dipstick documented	At baseline and yearly if normal			
Protein	Every visit			
Blood	Yearly if normal			
Blood glucose	Repeat at next visit if abnormal			
Blood test done	First visit then yearly			
Creatinine/EGFR	Yearly if normal			
Potassium	Yearly if normal			
Fasting glucose	Yearly if normal			
Random total cholesterol	Yearly if normal			
ECG done	Yearly if normal			

Table 2c: Comorbidities and hypertension related complication (target organ damage)

Comorbidities or complication	Yes☑	No☒
Diabetes mellitus		
Dyslipidaemia		
Ischemic heart disease		
Heart failure		
Human immunodeficiency virus		
Stroke		
Gout		
Asthma		

Table 2d: Lifestyle modification

Lifestyle advised	Yes ☑	No ☒	If answer yes document the lifestyle advised
Weight loss if overweight			
Restrict salt intake			
Restrict fat intake			
Smoking cessation			
Avoid excess alcohol intake			

Table 2e: Therapy

Number of drug classes prescribed	
Drug and dosage prescribed	
Hydrochlorothiazide 12.5mg/25mg	
Enalapril 10mg/20mg or Losartan 50/100mg	
Amlodipine 5mg/10mg	
Atenolol 50mg/100mg or	

Carvedilol 3.25mg/6.5mg/12.5mg/25mg 12 hourly	

NOMENCLATURE

APP	:	Application
AHA	:	American Heart Association
BMI	:	Body Mass Index
BP	:	Blood Pressure
CVA	:	Cerebrovascular accident
CKD	:	Chronic Kidney Disease
DM	:	Diabetes Mellitus
DPB	:	Diastolic blood pressure
ECG	:	Electrocardiogram
EDL	:	Essential Drug List
GBD	:	Global Burden of disease
HCW	:	Health Care Worker
HTN	:	Hypertension
HSFSA	:	Hypertension and Stroke Foundation South Africa
ISH GHPG:		International Society of Hypertension Global Hypertension Practice Guideline
JNC	:	Joint National Committee
PHC	:	Primary Health Care
RSA	:	Republic of South Africa
SAHS	:	Southern African Hypertension Society
SAHP	:	South African Hypertension Practice Guidelines
SPB	:	Systolic blood pressure

STG : Standard Treatment Guideline

TIA : Transient ischemic attack

USA : United States of America

WHO : World Health Organization

DEFINITIONS OF KEY CONCEPTS

Adherence to guidelines is defined as a degree of conformity between the knowledge, cognition and action of an agent with the recommendation of a guideline.

Appropriateness according to Cambridge dictionary is defined as the quality of being especially suitable or fitting, whereas **treatment** in medical care is the use of drugs, exercises and other interventions to cure a person of an illness or injury.

Treatment appropriateness in this study means prescribing suitable treatment and offering lifestyle advice consistent with the South African Hypertension Practise Guidelines

recommendations taking into consideration presence of comorbidities and compelling indications.

Overall adherence/implementation can be defined as the proportion of patients treated by HCPs according to guideline recommendations, which often represents evidence-based or best practice care.

Hypertension is defined as a systolic blood pressure of 140/90 mmHg or more or taking blood pressure medication.

Health care worker is a person who delivers care and services to the sick and ailing either directly as a doctor or a nurse or indirectly as an aide, helper, lab technician or even medical waste handler.

Health practitioner is a person registered or licensed to practice under a certain board of an accredited council.

Primary health care refers to essential health care that is based on scientifically sound and socially acceptable methods and technology.

Clinical guidelines are systematically developed recommendations that assist practitioners and patients to make health care decisions in specific clinical circumstances.

Compliance is defined as a process whereby the patient follows the prescribed regimen as intended by the prescriber or the dispenser.

Optimal blood pressure control is defined as achieving a systolic blood pressure of less 140mmHg and a diastolic blood pressure of less than 90mmHg.