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Compliance to hypertensive prescribing guidelines and blood pressure control in elderly patients in Namibia: findings and implications

Shylet Mashozhera[1], Samuel Kayode Bamitale[1], Brian Godman[3,4,5], and Dan Kibuule[2,*]

[1]Department of Pharmacology and Therapeutics, School of Pharmacy, Faculty of Health Sciences, University of Namibia, Namibia,
[2]Department of Pharmacy Practice & Policy, School of Pharmacy, Faculty of Health Sciences, University of Namibia, Namibia,
[3]Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, U K,
[4]Division of Clinical Pharmacology, Karolinska Institute, Karolinska University Hospital Huddinge, Stockholm, Sweden and
[5]School of Pharmacy, Sefako Makgatho Health Sciences University, Ga-Rankuwa, Pretoria, South Africa

*Correspondence: Dan Kibuule, School of Pharmacy, University of Namibia, Box 13301, 340 Mandume Ndemufayo Avenue Pioneers Park, Windhoek, Namibia. Tel: +264-0-816280835; Email: dkibuule@unam.na.

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Abstract

Objective Resources-limited countries in sub-Saharan Africa are facing a crisis of hypertensive-related morbidity, mainly due to poor blood pressure (BP) control. The study aimed to evaluate BP control and hypertensive prescribing for elderly patients in a resource-limited setting.

Methods Hospital-based survey assessing hypertensive prescribing practices among elderly patients (age, ≥60years) at a leading ambulatory care clinic in Namibia. The primary and secondary outcomes were compliance with prescribing guidelines, prescribing patterns and BP control respectively. Data were collected using patient exit interviews and a review of their prescription records. Data were analyzed using descriptive statistics using SPSS v25.

Key findings Of the 189 elderly patients recruited, 69.3% were females, mean age was 70.3 ± 8.5 years and 2.6% had HIV. 61.4% of the prescriptions complied with the prescribing guidelines in terms of treatment choice and 78.3% (n = 148) had a poor BP control. 61.4% had at least one comorbidity, mainly diabetes mellitus (32.2%) or cardiac disease (20%). On average, 4.5 medicines were prescribed per patient and 4.8% were out of stock. Prevalence of non-INN prescribing was 64%. Diuretics, renin-angiotensin inhibitors were the most prescribed antihypertensive, 73.9% (n = 138/189) and 51.9% (n = 98/189) respectively. 90% of patients with good BP control were on ≥3 medicines compared to 77% for patients with poor BP controlled.

Conclusion Whilst compliance with prescribing guidelines is modest, the sub-optimal BP control, high prevalence of co-morbidities and over prescribing with non-INN products is discouraging. Pharmacist-led medication audits could improve hypertensive prescribing and BP control among elderly patients, and we will be following this up

Keywords: elderly; hypertension; prescribing; treatment guidelines; namibia

Introduction

Each year it is estimated that more than 18 million people worldwide will die from cardiovascular disease (CVD), a third of all total deaths, with more than half of CVD deaths due to hypertension at an estimated 10 million per year.[1–3] CVD currently accounts for a third of all global deaths, greater than for all infectious diseases combined, with this proportion of total deaths likely to grow with increasing prevalence of CVD especially among low- and middle-income countries (LMICs) including sub-Saharan Africa (SSA).[1, 2, 4, 5] Most of the estimated 1.13 billion people world-wide with hypertension live in LMICs, with the highest prevalence rates seen in Africa.[6–8] The prevalence of hypertension in Africa is estimated at 46% among adults (age, ≥25 years), between 55.2% to 57.0% among older adults (age, ≥50 – ≥ 55years) and 66.7% among the elderly (age, ≥60 years) respectively, which is the highest globally.[4, 7–11] In 2016, over 900 000 people died from hypertension-related cardiovascular events in Africa, and this is projected to triple by 2030.[5, 7, 10, 11] In Namibia the prevalence of hypertension in is estimated at 57% in Windhoek, the capital city,[12] up from 46% generally across Namibia.[12, 13] This is a concern, given that uncontrolled high BP is the main risk factor for cardiovascular events, the leading cause of death in SSA.[5–7, 12, 14–17] Mortality due to hypertension is highest among elderly patients given current poor adherence rates and the multiplicity of co-morbidities among this population.[3, 17, 18]

The World Health Organization's (WHO) 2013–2020 global action plan seeks to reduce the burden of hypertension-related mortality by 25% by 2025, which requires optimizing of BP control, prescribing appropriate medicines and medication adherence.[4, 19, 20] However, the poor compliance to prescribing guidelines as well as adherence to prescribed medicines remains a significant challenge among African countries towards achieving the WHO's goal.[18, 21–25] Indeed, optimal hypertension prescribing practices significantly reduces the incidence of adverse drug reactions and cardiovascular-related deaths among the elderly.[15, 18, 26] Compliance to hypertension prescribing guidelines is generally suboptimal across Africa, for instance in Namibia it is estimated at 14.4%.[19, 21, 27] BP control in elderly patients is complicated by polypharmacy and associated adverse effects especially with high rates of co-morbidities.[18, 28, 29]

Moreover, there is conflicting evidence on the effectiveness of antihypertensive treatment among elderly patients, particularly those aged 79 years and above.[20, 30–32] Some studies recommend the use of a low dose of thiazide diuretic as the first line in hypertensive elderly,[30, 32] while others recommend Angiotensin Converting Enzyme (ACE) inhibitors in combination with diuretics and/or calcium channel blockers (CCBs).[33, 34] Several studies in Africa report inappropriate hypertensive prescribing, with varying rates of compliance to prescribed medicines and limited guidance on its impact on BP control among the elderly population, who are most at risk to cardiovascular events.[35–37]

Consequently, we sought to assess the compliance to prescribing guidelines, BP control and prescribing practices in the management of hypertension in elderly patients in ambulatory care in Namibia. This builds on earlier papers discussing ways to improve adherence to hypertensive medicines in Namibia and research assessing compliance to guidelines generally in Namibia as well as suggesting that adherence to guidelines is a critical area for assessing the quality of prescribing.[6, 17] We have chosen Namibia for this research as the country currently has one of the highest rates of hypertension in Africa.[12]

Methods

Study design and population

A cross-sectional survey of hypertensive prescribing practices in elderly patients attending an ambulatory care clinic in a leading public healthcare facility in Namibia. This was Katutura Intermediate Hospital (KIH), which serves a catchment population of 360,000 people with Windhoek, the capital city. Quantitative outcomes on prescribing practices, compliance with guidelines and BP control were determined using exit interviews among patients attending ambulatory care clinics in KIH. We chose KIH initially as it is a leading hospital in Namibia and antihypertensive therapy is typically initiated at a hospital level in Namibia with subsequent refills and assessments conducted at Primary Healthcare Clinics (PHCs). In addition, drug therapy is typically only initiated in patients with stage II (moderate) hypertension, i.e. BP ≥ 160/100 mmHg. A sample size of 189 elderly patients was determined using Kish Leslie and Cochrane methods for a finite population.[38]The study only included elderly patients (age ≥60years), diagnosed with hypertension and on antihypertensive therapy for at least the past six months.

Hypertension program in Namibia

The hypertension program in Namibia is administered under the Ministry of Health and Social Services (MoHSS) guided by the primary health care concept. There are currently 35 public hospitals and 250 PHC facilities in Namibia.[39] In 2012, the MoHSS implemented its first comprehensive Namibia Standard Treatment Guidelines (NSTGs) at all public health facilities. The NSTG describes the clinical management and drug therapy for hypertension in public healthcare.[40] The current guidelines recommend starting with monotherapy at the lowest dose and titrated based on BP response and/or comorbidities. The first choice for initial therapy is monotherapy with a thiazide diuretic, preferably hydrochlorothiazide-amiloride. Subsequently, with poor response, ACEIs, e.g. perindopril and CCBs are added as second-line and third-line agents respectively. Fourth-line agents are used in cases where BP remains uncontrolled on adequate doses of three antihypertensive including, with includes either a β-adrenergic blocker (BB), α-blocker (AB), or a direct vasodilator. Minoxidil is used as a fifth line agent.[40]

There is universal healthcare in Namibia; consequently, patients do not have to pay for their antihypertensive medicines compared with a number of African countries.[17, 25, 41]

Case definitions

Hypertension is defined as the systolic BP greater than or equal to 140 mmHg or diastolic BP of greater than or equal to 90 mmHg.[20] In this study, BP control was determined by two criteria, Namibian STG and the Eighth Joint National Committee (JNC8).[42, 43] The goal BP in the Namibian STG is set at <140/90 mmHg for all patients irrespective of their age, and ≤130/80 mmHg in the presence of compelling indications such as diabetes and heart disease, cardiovascular events and renal impairment.[40] The JNC8 guidelines recommend a mild BP target for elderly patients age of 60 years at ≤150/90 mmHg without comorbidity and ≤140/90 mmHg for those with comorbidities. It is important to note that the current Namibia NSTG is based on JNC 7 and therefore outdated. The blood pressure recommendation in JNC is no longer considered realistic and achievable compared to a more liberal recommendations in JNC 8, i.e. 140/90 mmHg (when comorbidity is present) and 150/90 mmHg in the absence of comorbidity for the elderly.

Procedure

189 elderly patients were recruited in the study using simple random sampling based on daily registers at the ambulatory care pharmacy. In KIH, hypertensive patients are scheduled for a review and medication refills every month. Following this, patient exit interviews were conducted among elderly patients (May-August) 2019, and their prescribing records (health passports) assessed for compliance to prescribing guidelines as well as BP control. After obtaining written informed consent from the patients, data were abstracted by the research team (MS, BKS) from health passports using a validated tool adopted from Akpabio *et al.*. **(Supplement A)**.[44] The tool was face-validated by a pharmacist and physician for accuracy and to reduce redundant items. Patient exit interviews were conducted mainly in English and translated to Oshiwaambo, Damara or Africans when required, to assess for stock-outs, adherence and challenges pertaining to antihypertensive medication. Patient demographic data (age and sex), clinical data (BP control and co-morbidities) and treatment data were collected from the health passports or directly through interviews.

Data analysis

Data were subsequently double entered in Epidata version 3.1 software for management and export to Statistical Package for Social Services (SPSS) version 25 for quantitative analysis. The level of compliance with prescribing guidelines, prevalence of BP control, and prescribing indicators (average number of medicines and International Nonproprietary Name – INN - prescribing based on WHO criteria) and prescribing rates by class of antihypertensive were determined using descriptive statistics, i.e. the percentage of antihypertensive prescriptions that comply with treatment guidelines measured by drug choice, dosage and duration of treatment. The level of compliance was determined in terms of appropriateness of the regimen and dosage schedule. BP control was determined according to two criteria; the Namibia STGs and JNC8 guidelines. Factors associated with compliance with prescribing guidelines and BP control were determined using the chi-square test for categorical variables and student t-test for continuous variables. The level of significance α was set at 0.05 for a 95% confidence interval (CI).

Ethics

The study was approved by the Research and Ethics Committees of the School of Pharmacy, University of Namibia and Ministry of Health and Social Services (MOHSS/MS-2019) and from IHK to carry out the survey at the facility. All participants gave written informed consent. Their identity was anonymized by the use of codes to maintain confidentiality and the data protected with secured storage using passwords.

RESULTS

Characteristics of the respondents

A total of 189 elderly hypertensive patients (≥60 years) were recruited, giving a response rate of 100%. On average, patients were aged 70.3 ± 8.5 (range: 60–99) years, mostly female (69.3%) and 65.5% (n = 124) had compelling indications, mainly Type II diabetes mellitus (Table 1). Secondly, 7.9% of the patients ever defaulted on their hypertensive medication and 4.8% reported that at least one of the prescribed medication was out of stock.

Blood pressure control among elderly hypertensive patients

Of the 189 patients, 78.3% (n = 148) and 55.6% (n = 105) had poor BP control according to the Namibia STG and JCN8 guidelines, respectively. Of the 74 patients with BP control according to the NSTG, 48.6% (n = 37) were prescribed three or more medicines generally. The significant predictors of BP control were absence of compelling indications, ≤3 medicines per prescription and the prescribing of ACEIs/ARBs ($P < 0.005$). Patient demographic characteristics such as age and sex, as well as use of diuretics and experience of ADRs, were not significantly associated with BP control Table 1.

Prescribing in elderly patients in hypertensive care

Overall, 850 medicines were prescribed giving an average number of 4.5 (range:1–9) medicines per prescription. The number of medicines per prescription was significantly higher among patients in the 60–69 year age category compared to 70–79 years and 80–89 years, i.e. 6.04 vs. 3.03 vs 1.72 medicines respectively ($P < 0.05$). The majority of the prescriptions (80.1%) had more than two antihypertensive drugs prescribed (Figure 2).

A total of nine classes of antihypertensive drugs were prescribed. These included thiazide diuretics (TD, WHO/ATC class = C03), angiotensin converting enzyme inhibitors (ACEI, WHO/ATC class = C09), angiotensin receptor blocker (ARB), β blockers (BB, WHO/ATC class = C07), calcium channel blockers (CCB, WHO/ATC class = C08), α_1 blocker (AB), loop diuretics (LP), potassium sparing diuretics (PSD), α_2 agonist/ central acting class of drug (A_2A/CA, WHO/ATC class = C02A) (Figure 2). Of the 189 patients, 73% (n = 138) received thiazide diuretics (co-amiloride 114, indapamide 24), 64% (n = 121) ACEIs mainly perindopril, 30.2% (n = 57) ARBs and 21.7% (n = 41) BBs (carvedilol or atenolol). The least prescribed antihypertensive drugs were methyldopa 1.6% (n = 3) and CCBs at 1.1% (n = 2) (Figure 1, Table 1). The prevalence of ADRs among elderly patients was 4.3% (n = 7/189), particularly persistent dry coughs with ACEIs, impotence and somnolence, among others.

Compliance to prescribing guideines in hypertensive care for elderly patients

Overall, 60.8% (n = 115/189) of prescriptions complied to the Namibian STG with regards to the correct drug of choice. The majority of the prescriptions (97.4%, n = 184) also complied with dosage requirements, i.e. correct dose and frequency. However, 64% (n = 121/189) patients had at-least one antihypertensive medicine prescribed with non INN names i.e. branded medicines including branded generics (Table 1).

A total of 16 antihypertensive regimens (combinations) were prescribed. Of the 189 patients, 28% (53) were on monotherapy, 56.6% (107) on dual therapy,14.3% (27) on triple therapy and 1.1% (2) on quadruple therapy. A dual combination of ACEIs/ARB with a diuretic was the most prescribed regimen (Figure 2); however the majority had sub-optimal BP control (66.7%, n = 54/81). In addition, ACEIs/ARBs or diuretics were the most prescribed monotherapy. It appears regimens with an α_2 agonist included resulted in better BP control (Figure 2).

Discussion

We believe this is the first study in Namibia to establish hypertensive prescribing practices among elderly patients, which is important as SS is a region with a disproportionately high burden of

Table 1 Characteristics and BP control among the elderly respondents ($n = 189$)

Covariate	Total (%)	Namibia STGs			JCN8		
		BP control (%)	cOR (95% CI)	P-value	BP control (%)	cOR (95% CI)	*P*-value
Overall		74(39.2)			105(55.6)		
Sex							
Male	58(30.7)	26(44.8)	0.7(0.4,1.3)	0.288	35(60.3)	0.8(0.4.1.4)	0.379
Female	131(69.3)	48(36.6)	1		70(53.4)	1	
Patient's age							
60–69 years	105(55.6)	37(35.2)	0.7(0.3,1.5)	0.346	55(52.4)	0.7(0.3,1.6)	0.355
70–79 years	55(29.1)	24(43.6)	0.9(0.4,2.4)	0.917	32(58.2)	0.9(0.3,2.1)	0.730
>80 years	29(15.3)	13(44.8)	1		18(62.1)	1	
Compelling indications							
No	65(34.4)	9(13.8)	0.2(0.1,0.3)	0.000*	27(41.5)	0.4(0.2,0.7)	0.005*
Yes	124(65.5)	65(52.4)	1		78(62.9)	1	
# medicines							
≤ 3 medicines	81(42.9)	38(46.9)	5.0(0.9,27.0)	0.062	56(69.1)	7.2(0.8,62)	0.012*
> 3 medicines	108(57.1)	36(33.3)	1		49(45.4)	1	
Out of stock							
Yes	9(4.8)	2(22.2)	0.4(0.1,2.1)	0.299	2(22.2)	4.7(0.9,23)	0.058
No	180(95.2)	72(40.0)	1		103(57.2)	1	
Thiazide diuretic							
Yes	138(73.0)	51(37.0)	1.4(0.7,2.7)	0.031*	73(52.9)	1.5(0.8,2.9)	0.228
No	51(27.0)	23(45.1)	1		32(62.7)	1	
On ACE/ARB							
Yes	147(75.1)	50(34.0)	2.6(1.3,5.2)	0.008*	73(49.7)	3.2(1.5,7.1)	0.003*
No	42(25.9)	24(57.1)	1		32(76.2)	1	
Beta-blocker prescribed							
Yes	148(78.3)	58(39.2)	1.4(0.7,2.7)	0.310	83(56.1)	0.7(0.3,1.3)	0.228
No	41(21.7)	16(39.0)	1		22(53.7)	1	
Ever defaulted							
Yes	14(5.4)	4(28.6)	0.8(0.2,2.3)	0.631	5(35.7)	2.4(0.8,7.5)	0.130
No	175(94.6)	70(40)	1		100(57.1)	1	
Branded drugs							
No	68(36.0)	28(41.2)	0.9(0.4,1.6)	0.669	37(54.4)	1.1(0.6,2.0)	0.812
Yes	121(64.0)	46(38.0)	1		68(56.2)	1	
Side effects							
Yes	7(4.3)	2(28.6)	1.9(0.5,6.5)	0.320	2(28.6)	3.2(0.6,16.9)	0.163
No	181(95.7)	71(39.2)	1		102(56.4)		
Compliance to STGs							
Yes	115(60.8)	41(35.7)	1.5(0.8,2.6)	0.220	62(53.9)	1.2(0.7,2.1)	0.571
No	74(39.1)	33(44.6)	1		43(58.1)	1	

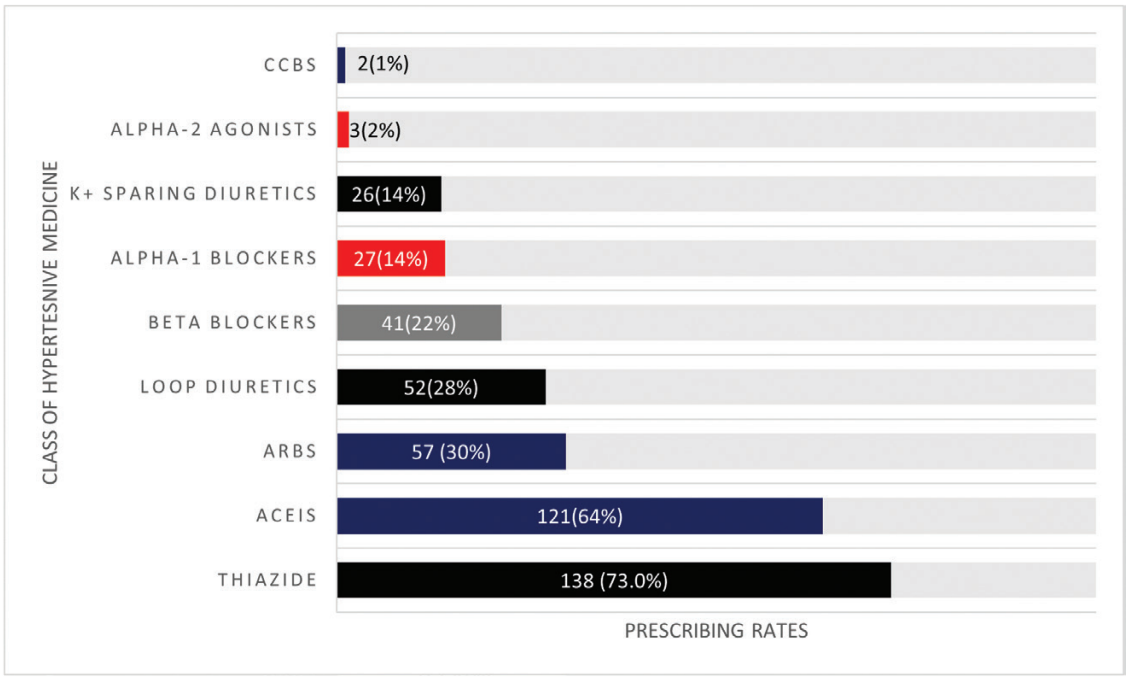

Figure 1 Prescribing rates of antihypertensives in elderly patients ($n = 189$)

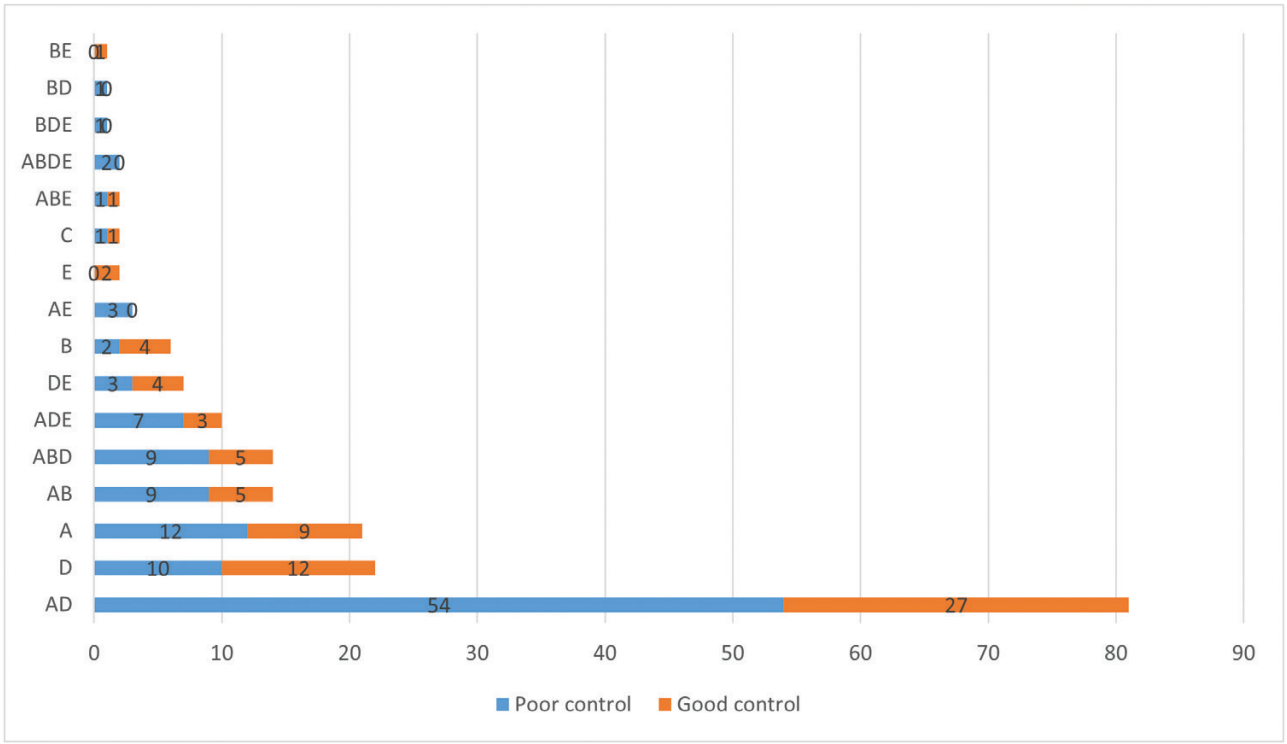

Figure 2 Antihypertensive regimens and BP control in elderly patients Key: A = ACEIs/ARBs, B = β blocker, C = calcium channel blocker, D = Diuretic, E = α agonists

non-communicable diseases including hypertension. We have seen a high rate of antihypertensive prescribing, typically non-INN medicines, sub-optimal compliance to prescribing guidelines and a high prevalence of uncontrolled BP among elderly patients. This is a public health concern, given that the previous study in Namibia reported poor adherence rates to antihypertensive medication attributed to limited resources to access care.[13, 17] This needs to be urgently addressed to reduce morbidity and mortality related to hypertension in Namibia.

We found a high prevalence of uncontrolled BP among elderly patients. This was six in every 10 patients according to the Namibian STG and five in every 10 patients according to JNC eight guidelines

(Table 1). In the future, the differences in the determination of rates of BP control with the two guidelines, NSTGs and the JNC eight guides, needs to be harmonized to avoid confusion,[30, 40, 45] which we have seen in other disease areas in Namibia.[13, 18, 36] The poor BP control was significantly higher among patients with compelling indications, typically type 2 diabetes mellitus as well as polypharmacy (i.e. ≥3 medicines per prescription), which is a concern. However patient sociodemographic such as age and sex were not significant predictors of BP control in elderly patients in our study. Indeed, uncontrolled BP in the elderly, which predisposes then to cardiovascular accidents,[19, 29] needs to be addressed. Similar studies report poor BP control among the elderly, particularly those aged >80 years, which is mainly due to multiple consultations with doctors in their care. This impacts on appropriate monitoring of the patients and adherence to appointments and medication.[29, 46, 47] Preston attributed poor compliance to guidelines in hypertensive care to comorbidities giving a higher risk for polypharmacy.[48, 49] Moreover, in this study a significant number of elderly patients had ever defaulted on their hypertensive medication, partly due to out of stock of the prescribed medicines at public health facilities. This needs to be addressed.

Secondly, there was sub-optimal hypertensive prescribing practices among the elderly patients in our study, i.e. low rate of compliance to hypertensive prescribing guidelines, a high number of medicines prescribed per prescription (~4.5) and the majority of the patients either on dual or triple combination of antihypertensive medicines. In addition, the rate of prescribing of non-INN medicines was high (Table 1). Irrational prescribing of medicines is associated with a high prevalence of adverse drug reactions and poor adherence.[47, 50] Similar to our study, Reiner *et al.* reported low rates of compliance with prescribing guidelines in the treatment of hypertension patients in Namibia.[17, 27] Niaz *et al.* and Reiner *et al.* describe the drivers of poor compliance to guidelines in Namibia, typically due limited capacity and access to objective and up-to-date prescribing resources.[27, 36] This is a concern, given a significant number of elderly patients in this study with poorly controlled BP which needs to be urgently addressed. Nashilongo *et al.* attribute the poor BP control among hypertensive patients to low adherence to medication, mainly due to limited financial support to meet transport costs to clinics and loss of income with attendance at public health facilities.[17] Elderly patients often have limited resources to access health care, given the high transport costs in Namibia.[51] Ohishi *et al.*, suggests that the use of one drug only does not necessarily produce favorable results in reducing hypertension, but a combination of medicine does.[52] However, our study reported that up to 66.7% of patients with poor control were on three or more medications. This may mean that adherence rates decline once multiple medicines are used to treat hypertension, which has to be monitored and addressed.

The most prescribed antihypertensives were dual and triple combinations, typically consisting of ACEIs/ARBs and or diuretics. This in line with the Namibia STGs and the JNC8 guidelines that recommend a low doses of a diuretic as initial therapy,[40, 50] Other guidelines recommend use of CCBs as the preferred first-line agent in antihypertension even among the elderly.[26, 53] The over use of diuretics in elderly patients in Namibia is a concern given the risk for Type 2 Diabetes, osteoporosis and hyperlipidemia. This needs to be addressed as the study did not find significant benefit on BP control (Table 1 and Figure 2). On the other hand, whilst it's not recommended to use of ACEIs among the black patients in JN8 guidelines, in this study the use of ACEIs/ARBS was a predictor for good BP control.[54] We are not sure of the reasons for this, and will be following this up in future research. We also observes the use of BB for management of hypertension among elderly patients. This is a concern as published studies suggest that β adrenergic blockers offer less benefit compared with the other classes of antihypertensive medicines,[33, 43] and again we will be exploring this further in future research.

Limitations

The authors are aware of several limitations with this study. Firstly, the study was conducted at a single center and used patient records to determine prescribing indicators and BP control. Secondly, it was conducted in a hospital ambulatory care clinic and not among PHCs for the reasons discussed, i.e. treatment is typically initiated in ambulatory care clinics in hospitals in Namibia. Nevertheless, we believe that the methods used are robust and that this first study in the elderly indicates poor BP control and sub-optimal prescribing among a high risk population. The findings are critical in strengthening hypertensive programs in resource-limited settings, particularly sub-Saharan Africa.

Conclusion

Compliance to prescribing guidelines for hypertension in elderly patients is sub-optimal in Namibia with a high prevalence of uncontrolled BP despite perceived overuse of antihypertensive medication. This calls for universal access to quality hypertensive care among elderly patients and monitoring through clinical audits and medication reviews. Programmes to enhance medication review and adherence to multiple medications may be critical to improving BP control and hypertensive prescribing practices among elderly patients in Namibia, and we will be implementing these in the future. This includes a comparative analysis of the high use of βBB among elderly patients in our study.

Author Contributions

S.M., S.K.B., and D.K. conceptualized and implemented the study. S.M., D.K. and B.G. performed the data analysis and scientific write-up of the manuscript. All authors appraised the study throughout the stages of publication.

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Data Availability Statement

Data will be available on request from the authors, given the ethical approval restrictions in sharing data without initial approval by the Ministry of Health and Social Services of Namibia.

References

1. World Heath Organization. *Noncommunicable Diseases Country Profiles 2018*. World Health Organization, 2018. https://www.who.int/publications/i/item/9789241514620 (10 June 2020, date last accessed).
2. World Health Organization. *A global brief on Hypertension - World Health Day 2013*. World Health Organization, 2013. https://www.who.int/cardiovascular_diseases/publications/global_brief_hypertension/en/ (9 June 2020, date last accessed).

3. Roth GA, Johnson C, Abajobir A *et al*. Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015. *J Am Coll Cardiol* 2017; 70: 1–25.
4. Cappuccio FP, Miller MA. Cardiovascular disease and hypertension in sub-Saharan Africa: burden, risk and interventions. *Intern Emerg Med* 2016; 11: 299–305.
5. Campbell NR, Lemogoum D. Hypertension in sub-Saharan Africa: a massive and increasing health disaster awaiting solution. *Cardiovasc J Afr* 2015; 26: 152–4.
6. Mills KT, Bundy JD, Kelly TN *et al*. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. *Circulation* 2016; 134: 441–50.
7. Ataklte F, Erqou S, Kaptoge S *et al*. Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. *Hypertension* 2015; 65: 291–8.
8. Frieden TR, Jaffe MG. Saving 100 million lives by improving global treatment of hypertension and reducing cardiovascular disease risk factors. *J Clin Hypertens (Greenwich)* 2018; 20: 208–11.
9. Opie LH, Seedat YK. Hypertension in sub-Saharan African populations. *Circulation* 2005; 112: 3562–8.
10. Kaze AD, Schutte AE, Erqou S *et al*. Prevalence of hypertension in older people in Africa: a systematic review and meta-analysis. *J Hypertens* 2017; 35: 1345–52.
11. Hendriks ME, Wit FW, Roos MT *et al*. Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. *PLoS One* 2012; 7: e32638.
12. Kaputjaza A MD. *An Epidemiological Investigation of Risk Factors for Hypertension in Windhoek, Khomas Region Namibia [Internet]*. Windhoek, 2017. http://repository.unam.edu.na/handle/11070/2069
13. Craig LS, Gage AJ, Thomas AM. Prevalence and predictors of hypertension in Namibia: a national-level cross-sectional study. *PLoS One* 2018; 13: e0204344.
14. Poulter NR, Prabhakaran D, Caulfield M. Hypertension. *Lancet* 2015; 386: 801–12.
15. Putnam HWI, Jones R, Rogathi J *et al*. Hypertension in a resource-limited setting: is it associated with end organ damage in older adults in rural Tanzania? *J Clin Hypertens (Greenwich)* 2018; 20: 217–24.
16. Konin C, Adoh M, Coulibaly I *et al*. Black Africans' compliance to antihypertensive treatment. *Arch Mal Coeur Vaiss* 2007; 100: 630–4.
17. Nashilongo MM, Singu B, Kalemeera F *et al*. Assessing adherence to antihypertensive therapy in primary health care in Namibia: findings and implications. *Cardiovasc Drugs Ther* 2017; 31: 565–78.
18. Russo G, Liguori I, Aran L *et al*. Impact of SPRINT results on hypertension guidelines: implications for "frail" elderly patients. *J Hum Hypertens* 2018; 32: 633–8.
19. Dzudie A, Rayner B, Ojji D *et al*.; PASCAR task force on hypertension. Roadmap to achieve 25% hypertension control in Africa by 2025. *Cardiovasc J Afr* 2017; 28: 262–72.
20. WHO. Global action plan for the prevention and control of noncommunicable diseases 2013–2020. *World Heal Organ* 2013. https://www.who.int/publications/i/item/9789241506236 (21 December 2020, date last accessed).
21. Chou CC, Lin WS, Kao TW *et al*. Adherence to available clinical practice guidelines for initiation of antihypertensive medication in patients with or without diabetes mellitus and other comorbidities in Taiwan. *J Clin Pharmacol* 2012; 52: 576–85.
22. Huebschmann AD, Bublitz C, Anderson RJ. Are hypertensive elderly patients treated differently? *Clin Interv Aging* 2006; 1: 289–94.
23. Macquart de Terline D, Kane A, Kramoh KE *et al*. Factors associated with poor adherence to medication among hypertensive patients in twelve low and middle income Sub-Saharan countries. *PLoS One* 2019; 14: e0219266.
24. Rampamba EM, Meyer JC, Godman B *et al*. Evaluation of antihypertensive adherence and its determinants at primary healthcare facilities in rural South Africa. *J Comp Eff Res* 2018; 7: 661–72.
25. Mbui JM, Oluka MN, Guantai EM *et al*. Prescription patterns and adequacy of blood pressure control among adult hypertensive patients in Kenya; findings and implications. *Expert Rev Clin Pharmacol* 2017; 10: 1263–71.
26. Ogihara T, Matsuzaki M, Umemoto S *et al*. Combination therapy for hypertension in the elderly: a sub-analysis of the Combination Therapy of Hypertension to Prevent Cardiovascular Events (COPE) Trial. *Hypertens Res* 2012; 35: 441–8.
27. Reiner Z, Sonicki Z, Tedeschi-Reiner E. Physicians' perception, knowledge and awareness of cardiovascular risk factors and adherence to prevention guidelines: the PERCRO-DOC survey. *Atherosclerosis* 2010; 213: 598–603.
28. Addo J, Smeeth L, Leon DA. Hypertension in sub-saharan Africa: a systematic review. *Hypertension* 2007; 50: 1012–8.
29. Seedat YK. Why is control of hypertension in sub-Saharan Africa poor? *Cardiovasc J Afr* 2015; 26: 193–5.
30. James PA, Oparil S, Carter BL *et al*. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA* 2014; 311: 507–20.
31. de Denus S, Hardy AM, Olson KL *et al*. Key articles and guidelines in the management of hypertension. *Pharmacotherapy* 2004; 24: 1385–99.
32. Borghi C, Tartagni E. The older patient with hypertension: care and cure. *Ther Adv Chronic Dis* 2012; 3: 231–6.
33. Kaiser EA, Lotze U, Schäfer HH. Increasing complexity: which drug class to choose for treatment of hypertension in the elderly? *Clin Interv Aging* 2014; 9: 459–75.
34. Benetos A, Strandberg T, Petrovic M. Response by Benetos *et al* to letter regarding article, "Hypertension management in older and frail older patients". *Circ Res* 2019; 125: e3–4.
35. Ukwe CV, Ubaka CM. Antihypertensive drug prescribing in a tertiary hospital in eastern Nigeria. *Trop J Pharm Res* 2012; 11: 297–305.
36. Niaz Q, Godman B, Campbell S *et al*. Compliance to prescribing guidelines among public health care facilities in Namibia; findings and implications. *Int J Clin Pharm* 2020; 42: 1227–36.
37. Kudzinesta M, Mubita M, Kalemeera F *et al*. Utility of medicines information leaflets in hypertensive care in a setting with low health literacy: a cross-sectional study. *Med Access @ Point Care* 2020; 4: 2399202620910031.
38. Kish L. Analytical uses of sample surveys. In: *Statistical Design for Research*, 2005: 27–31.
39. [Namibia] M of H and SS (MoHSS). *Macro I. Namibia Health Facility Census (HFC) 2009*. 2011; 1–600. http://www.measuredhs.com/pubs/pdf/SPA16/SPA16.pdf (9 June 2020, date last accessed).
40. Republic of Namibia Ministry of Health and Social Services. *Namibia Standard Treatment Guidelines [Internet]*. Windhoek; 2012. http://www.healthnet.org.na/documents.html (10 June 2020; date last accessed).
41. Akunne OO, Adedapo ADA. Antihypertensive prescription among black patients without compelling indications: prescription, effectiveness, quality and cost of medication. *BMC Health Serv Res* 2019; 19: 373.
42. Joseph AC, Karthik MS, Sivasakthi R *et al*. JNC 8 versus JNC 7 – understanding the evidences. *Int J Pharm Sci Rev Res* 2016; 36: 38–43.
43. Page MR. The JNC 8 hypertension guidelines: an in-depth guide. *Am J Manag Care* 2014; 20: E8.
44. Akpabio E, Sagwa E, Mazibuko G *et al*. *Assessment of Compliance of Outpatient Prescribing with the Namibia Standard Treatment Guidelines in Public Sector Health Facilities*. Windhoek: MSH-Namibia; 2014. http://siapsprogram.org/publication/assessment-of-compliance-of-outpatient-prescribing-with-the-namibia-standard-treatment-guidelines-in-public-sector-health-facilities/ (21 December 2020, date last accessed).
45. Gebreselassie KZ, Padyab M. Epidemiology of hypertension stages in two countries in Sub-Sahara Africa: factors associated with hypertension stages. *Int J Hypertens* 2015; 2015: 959256.
46. Chowdhury MA, Uddin MJ, Haque MR *et al*. Hypertension among adults in Bangladesh: evidence from a national cross-sectional survey. *BMC Cardiovasc Disord* 2016; 16: 22.
47. Gosmanova EO, Kovesdy CP. Adherence to antihypertensive medications: is prescribing the right pill enough? *Nephrol Dial Transplant* 2015; 30: 1649–56.

48. Materson BJ, Preston RA. Combination therapy in the treatment of hypertension. In: *Hypertension: Principles and Practice*. Boca Raton, FL: CRC Press, 2005, 547–60.
49. Hill MN, Miller NH, Degeest S *et al*.; American Society of Hypertension Writing Group. Adherence and persistence with taking medication to control high blood pressure. *J Am Soc Hypertens* 2011; 5: 56–63.
50. Mohd AH, Mateti UV, Konuru V *et al*. A study on prescribing patterns of antihypertensives in geriatric patients. *Perspect Clin Res* 2012; 3: 139.
51. Seedat YK. Why is control of hypertension in sub-Saharan Africa poor? *Cardiovasc J Afr* 2015; 26: 193–5.
52. Ohishi M, Yoshida T, Oh A *et al*. Analysis of antihypertensive treatment using real-world Japanese data—the retrospective study of antihypertensives for lowering blood pressure (REAL) study. *Hypertens Res* 2019; 42: 1057–67.
53. Wang AL, Iadecola C, Wang G. New generations of dihydropyridines for treatment of hypertension. *J Geriatr Cardiol* 2017; 14: 67.
54. Yazdanshenas H, Bazargan M, Orum G *et al*. Prescribing patterns in the treatment of hypertension among underserved African American elderly. *Ethn Dis* 2014; 24: 431–7.