Hypertension in South Africa: a growing epidemic and evolving treatment paradigms

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Abstract

Background: Hypertension is a major public health concern in South Africa, affecting 40–50% of adults, with control rates below 50% despite available treatments. It is a key driver of cardiovascular morbidity and mortality, particularly in populations with limited healthcare access, poor medication adherence, and high rates of comorbidities such as diabetes and obesity. This review examines the epidemiology, pathophysiology, diagnosis, treatment strategies, and public health approaches to hypertension in South Africa, highlighting gaps in care and opportunities for intervention.

Results: Pharmacological interventions such as fixed-dose combinations (FDCs) improve adherence but remain underutilised in public healthcare due to cost constraints. Community-based screening programmes (e.g. HealthRise South Africa) have successfully identified high-risk individuals, yet less than 30% of screened patients attend follow-ups due to referral challenges. Primary healthcare (PHC) infrastructure is overburdened, with workforce shortages, inconsistent medication availability, and weak referral systems limiting hypertension management. Public health policies targeting salt and sugar reduction have been implemented, but enforcement remains weak, and public awareness is insufficient.

Conclusion and policy implications: Addressing hypertension in South Africa requires a multi-pronged strategy focusing on:

1. Expanding access to cost-effective FDCs in public clinics to improve adherence and BP control.
2. Strengthening PHC capacity through workforce training, task-shifting, and improved referral pathways.
3. Scaling up community-based screening and linkage-to-care programmes for early detection.
4. Enhancing enforcement of dietary policies and launching nationwide awareness campaigns on lifestyle modifications.
5. Implementing national BP monitoring registries to track trends and guide policy adjustments.

A patient-centred, equity-driven approach that integrates pharmacological advances with robust public health interventions is critical to reversing the current trends of uncontrolled hypertension in South Africa.

Keywords: hypertension, South Africa, fixed-dose combinations, single-drug therapy, cardiovascular risk, primary healthcare, treatment adherence, public health

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Introduction

According to the World Health Organization (WHO), hypertension affects an estimated 1.28 billion adults aged 30 to 79 years globally, with nearly two-thirds residing in low- to middle-income countries.[1] Despite its burden, 46% of adults with hypertension are unaware of their condition**,** and less than half (42%) are diagnosed and treated**,** with only 21% achieving adequate blood pressure control. Hypertension remains a leading cause of premature mortality worldwide, prompting a global target to reduce its prevalence by 33% between 2010 and 2030.[1] In South Africa, hypertension has evolved into a widespread public health crisis, with national prevalence rates now exceeding 40% of the adult population.[2] According to South Africa Demographic and Health Survey (SADHS) (2019), the prevalence of hypertension (measured) has nearly doubled since 1998, from 25% to 46% among women and from 23% to 44% among men.[3]

The burden of hypertension in the country is compounded by socioeconomic inequalities, urbanisation, increasing obesity rates, and inadequate access to continuous healthcare, particularly in rural and peri-urban settings.[4]

Despite concerted national efforts, including the adoption of salt reduction policies and population-wide health promotion strategies, the prevalence of uncontrolled hypertension remains alarmingly high, with fewer than half of those diagnosed achieving recommended blood pressure targets.[5] Notably, poor treatment adherence, complex drug regimens, comorbid diabetes, and fragmented primary care systems present significant challenges in achieving optimal blood pressure control.[6]

Pharmacological treatment strategies in South Africa have historically focused on single-drug (monotherapy) approaches, but there is increasing recognition of the need for fixed-dose combination (FDC) therapies that address multiple

Table I: Pathophysiological mechanisms of hypertension and relevance to South Africa[1,8,12,16,17]

Mechanism	Pathophysiological impact	Relevance to South Africa
Vascular resistance and endothelial dysfunction	Reduced nitric oxide (NO) availability and increased oxidative stress lead to vasoconstriction and vascular stiffness.	Common due to high rates of obesity and metabolic syndrome.
Renin-Angiotensin-Aldosterone System (RAAS) activation	Angiotensin II causes vasoconstriction; aldosterone promotes sodium and water retention.	Worsened by obesity and salt intake prevalent in South African diets.
Sympathetic nervous system (SNS) overactivity	Increased heart rate, vasoconstriction, and sodium reabsorption. Chronic activation leads to vascular remodelling.	Elevated in low-income communities due to chronic psychosocial stress.
Sodium retention and volume overload	Excess sodium leads to increased extracellular fluid volume and cardiac output, elevating BP.	High dietary salt intake, despite salt reduction policies.
Obesity, diabetes and metabolic factors	Increase RAAS/SNS activity, cause endothelial dysfunction, and promote sodium retention.	Highly prevalent comorbidities contribute to resistant hypertension.
Genetic and environmental interactions	Genetic predisposition interacts with salt intake, inactivity, and stress.	Significant in urbanising and rural populations undergoing rapid lifestyle changes.

pathophysiological pathways and improve adherence.[7,8] While FDCs are now recommended in various treatment guidelines, including those of the Southern African Hypertension Society (SAHS), questions remain regarding their accessibility, cost implications, and suitability across different patient populations.[9]

This review aims to explore the evolving landscape of hypertension management in South Africa, highlighting the growing epidemic of hypertension, current treatment paradigms, and the role of FDCs and single agents within the broader context of public health interventions and primary healthcare (PHC). The review draws from recent South African studies and guidelines to present a comprehensive understanding of this multifaceted health issue.

Epidemiology of hypertension in South Africa

Hypertension is a significant public health problem in South Africa, affecting an estimated 43% to 50% of adults, depending on the population studied and the methodology employed.[2-3] This high prevalence reflects a growing trend over the past two decades, driven largely by rapid urbanisation, lifestyle transitions, and demographic shifts, including population aging.[10] The South African National Health and Nutrition Examination Survey and other regional studies have repeatedly underscored the magnitude of this burden, identifying hypertension as a major contributor to cardiovascular disease (CVD), stroke, and renal failure.[11]

Regional disparities in hypertension prevalence are striking, with provinces such as Northern Cape (55.7%), Eastern Cape (52.8%), Free State (52.4%), and Mpumalanga (50.7%) exhibiting significantly higher rates compared to others.[12] These variations are influenced by sociodemographic factors, including poverty, limited healthcare access, and higher rates of comorbid conditions such as diabetes and obesity.[11] The South African Demographic and Health Survey (2016) confirmed these trends, with higher hypertension rates found in rural areas, where limited access to PHC services exacerbates the burden.[3]

In terms of risk factors, hypertension in South Africa is strongly associated with obesity, diabetes mellitus, and aging.[11] For example, Onwukwe et al. [12] reported that 67.8% of hypertensive patients were either overweight or obese, while 54.0% had coexisting diabetes.Obesity and diabetes compound hypertension's clinical course, increasing the risk of cardiovascular complications and rendering blood pressure (BP) control more difficult.[11] Additionally, as the population ages, the prevalence of hypertension rises, highlighting the need for targeted interventions in elderly populations.[13] Despite the high prevalence of hypertension, awareness, treatment, and control remain inadequate.[13]

Ferro et al.[14] demonstrated that while treatment rates have improved over time, less than two-thirds of hypertensive patients achieve adequate BP control even when on treatment. This finding is consistent with other studies showing low rates of diagnosis and poor adherence to prescribed antihypertensive regimens, particularly in low-resource and rural settings.[12]

The economic impact of uncontrolled hypertension is profound, contributing to the rising burden of non-communicable diseases (NCDs) and placing additional strain on South Africa's healthcare system.[15] Costs are incurred not only through direct medical expenses but also through productivity losses due to hypertension-related morbidity and premature mortality.[15] Addressing hypertension at a population level thus remains an urgent priority for South African healthcare and policy frameworks.[15]

Pathophysiology of hypertension

Hypertension is a multifactorial disorder characterised by persistent elevation of arterial BP, resulting from a complex interaction of vascular, neurohormonal, renal, metabolic, and environmental factors.[1,8,12,16,17] In South Africa, the high burden of hypertension is compounded by obesity, diabetes, and socioeconomic stressors that influence these pathophysiological mechanisms.[18]

Diagnosis of hypertension

Hypertension is confirmed when elevated blood pressure readings are consistently observed. According to both international and South African guidelines, BP should be measured using validated devices under standardised conditions to ensure accuracy.[9,16]

Table II: Current South African Hypertension Society Guidelines of hypertension[9,16]

Blood Pressure Category	Systolic Blood Pressure (SBP) mmHg	Diastolic Blood Pressure (DSP) mmHg
Normal	Less than 120	and less than 80
Optimal	120–129	and below 80
High-Normal (Pre-Hypertensive)	130–139	or 80–89
Hypertension — Grade 1 (Mild)	140–159	or 90–99
Hypertension — Grade 2 (Moderate)	160–179	or 100–109
Hypertension — Grade 3 (Severe)	180 or higher	or 110 or higher
Isolated Systolic Hypertension	140 or higher	and less than 90

Table III: First line treatment agents for hypertension

Drug class	Examples	Notes on use
Thiazide-like diuretics	Hydrochlorothiazide, indapamide	Effective in reducing plasma volume; widely used.
Calcium channel blockers (CCBs)	Amlodipine	Well-tolerated, especially in Black African patients.
ACE inhibitors (ACEIs)	Enalapril, perindopril	Preferred in diabetes and renal disease.
Angiotensin receptor blockers (ARBs)	Losartan, valsartan	Alternative to ACEIs if intolerant; also, renal-protective.

Note: Therapy should be individualised based on age, race, comorbidities (e.g. diabetes, renal impairment), and cardiovascular risk.[9]

Special populations

Certain populations require unique considerations due to physiological differences and comorbidities. These include:

Pregnant women

Hypertension during pregnancy, including gestational hypertension and preeclampsia, requires careful management to prevent complications.[19] Preeclampsia is typically diagnosed when hypertension arises after 20 weeks of gestation, often accompanied by proteinuria, acute kidney injury, liver dysfunction, neurological signs, or foetal growth restriction. Careful management, including the use of methyldopa and close monitoring, is crucial to minimising complications.[20]

Elderly patients

Hypertension management in elderly patients requires individualised and comprehensive assessments, such as age-related frailty, organ damage, and reduced physiological reserve complicate treatment decisions.[21] The authors emphasise that while lowering BP reduces cardiovascular risks, adjustments to treatment targets are necessary to minimise adverse effects like falls, cognitive decline, and worsening frailty, highlighting the need for cautious and tailored approaches to antihypertensive therapy in older adults.[21]

According to South African Heart and Stroke Foundation nearly 8 in 10 South Africans over the age of 55 have hypertension, so effective management of hypertension is needed to reduce risk for other cardiovascular diseases such as heart failure and stroke and other complications such as cognitive dysfunction.[21]

Patients with diabetes and chronic kidney disease

Stricter BP control is recommended to reduce the risk of targeted organ damage and reduce the mortality as patients with hypertension and coexisting comorbidities have a higher mortality rate due to the combined effects of organ damage.[22,23]

Pharmacological treatment approaches for hypertension

Effective pharmacological management of hypertension is essential to prevent cardiovascular events, stroke, and renal complications.[1] In South Africa, a stepwise approach to therapy is recommended, often starting with single-drug therapy (monotherapy) and advancing to FDCs when necessary.[8] Given the high rates of comorbid diabetes, obesity, and poor adherence, combination therapy is increasingly prioritised to improve BP control.[17]

First-line antihypertensive agents

First-line agents recommended by the South African Hypertension Practice Guideline include the following:[9]

Fixed-dose combinations (FDCs)

FDCs combine two or more antihypertensive agents in a single pill, targeting multiple mechanisms to optimise BP control.[7,16] These are increasingly recommended as first-line or step-up therapy due to benefits in adherence and efficacy.[16]

Fixed-dose combinations advantages and challenges

FDCs offer several advantages in the management of hypertension. They simplify treatment regimens, thereby improving patient

Table IV: Fixed dose combination therapy

Common FDCs available in South Africa	Combination of classes
Perindopril + Amlodipine	ACEI + CCB
Enalapril + Hydrochlorothiazide	ACEI + Diuretic
Losartan + Hydrochlorothiazide	ARB + Diuretic
Valsartan + Amlodipine	ARB + CCB

Table V: Indications for monotherapy in hypertension

Indications for monotherapy	Details
Newly diagnosed patients with mild hypertension (BP < 150/90 mmHg)[9]	First-line for low-risk individuals
Patients intolerant to multi-drug regimens[9]	Due to side effects or drug interactions
Elderly or frail patients[2]	Where careful adjustment is necessary

adherence to medication.[7] By targeting multiple mechanisms simultaneously, FDCs generally result in better BP control compared to monotherapy.[16] Additionally, they may minimise adverse effects through the use of lower doses of each individual agent, making them more tolerable for patients.[7] Over time, FDCs may also prove to be cost-effective by reducing the risk of complications associated with poorly controlled hypertension.[7] However, there are notable limitations to their use. FDCs offer limited flexibility, making titration and individualisation of treatment more challenging.[16] Although they may save costs in the long term, their initial cost can be higher than single-agent therapies, which may impact accessibility.[7] Furthermore, their availability remains limited within the public healthcare system in South Africa, posing additional barriers to widespread implementation.[7]

Monotherapy (Single-Agent Therapy) (Table V)

While FDCs are ideal for many patients, monotherapy remains important for low-risk patients or those intolerant to combination therapy.[8]

Monotherapy challenges

Monotherapy presents several challenges in the effective management of hypertension. It is frequently inadequate for achieving optimal BP control, particularly among individuals with comorbid conditions such as diabetes, chronic kidney disease, or those at elevated cardiovascular risk.[16] In addition, when more than one medication is needed, patients are often required to take multiple single agents, which can lead to poor adherence – a significant contributor to uncontrolled hypertension, especially in resource-limited settings.[7,16] These limitations highlight the need to consider combination therapies for better BP management in complex or high-risk patients.

Summary of pharmacological treatment options (Table VI)

Alternative treatments for special populations

Pregnant women

Alpha-2 agonists like methyldopa, with labetalol, and nifedipine are preferred due to their safety profiles.[18] Emergency treatment of preeclampsia includes intravenous administration of Ringers lactate at 80 ml/hour, together with 5 g magnesium sulphate administered intramuscularly in each buttock.[24]

Elderly patients

Diuretics are often used as first line treatment with calcium channel blockers. ACE inhibitors like enalapril can also be used but the elderly are started on a small dose and slowly titrated up with continuous monitoring as this treatment may cause excessive hypotension. They, however, can still be used as they have organ protective effects.[21]

Diabetes and hypertension

For patients with diabetes and chronic kidney disease, ACE inhibitors or ARBs are recommended to help preserve kidney function and reduce disease progression, as emphasised in the KDIGO 2020 guidelines.[22,23]

Public health interventions and policy approaches

Effective hypertension control in South Africa requires complementary public health strategies alongside pharmacological treatment to address key risk factors and health system limitations.[1,8]

National dietary policies: salt and sugar regulation

South Africa leads in dietary interventions with mandatory salt reduction (2016) and a sugar-sweetened beverage tax (2018) aimed at lowering population-level risk for hypertension and related diseases.[17] While salt content in processed foods has been reduced, enforcement and public education remain challenges.[17] The sugar tax targets obesity and diabetes, with indirect benefits for hypertension control.[25]

Community-based screening and early detection

Programmes like HealthRise South Africa utilise community caregivers (CCGs) and ward-based outreach teams (WBOTs) for local hypertension and diabetes screening.[26] According to one study, nearly 30% of over 10 000 individuals screened were hypertensive.[26] However, linkage to formal care remains weak,

Table VI: Pharmacological treatment options[16]

Strategy	When used	Key points
Monotherapy	Low-risk, mild hypertension, elderly, intolerant patients	May not achieve target blood pressure in high-risk patients
Fixed-dose combinations (FDC)	Moderate to high-risk, poor adherence, uncontrolled blood pressure	Improve adherence and blood pressure control; limited availability
Stepwise combination therapy	When monotherapy fails, control blood pressure within 4 to 8 weeks	Add second agent rather than increasing the dose of the first agent

with fewer than one-third attending follow-up, highlighting the need for better referral systems.[26]

Primary health system limitations and chronic disease integration

Primary care clinics are overburdened, especially in rural areas, limiting hypertension care due to staff shortages, medicine stock-outs, and focus on infectious diseases like HIV and TB.[27] The Integrated Chronic Disease Management (ICDM) model aims to streamline care by combining NCD, HIV, and TB services, supporting task-shifting to nurses and community workers.[27] Despite its promise, ICDM remains inconsistently implemented and requires further investment.[27]

Despite existing efforts, hypertension control in South Africa remains inadequate, underscoring the need for targeted priorities to improve outcomes. One critical priority is the stricter enforcement of existing salt and sugar reduction regulations to mitigate key dietary risk factors.[17,25] Additionally, there is a pressing need to expand community-based screening initiatives and enhance referral systems to ensure that individuals identified with elevated BP are effectively linked to care.[26] Strengthening PHC by addressing staffing shortages and ensuring consistent availability of essential antihypertensive medications is also crucial.[27] Equally important is improving public education to foster better adherence to treatment regimens and promote healthier lifestyle choices, particularly regarding diet, physical activity, and medication use.[17,26] These actions collectively represent essential steps toward improving hypertension management and reducing CVD burden in South Africa.

Despite the availability of effective therapies and national guidelines, BP control rates in South Africa remain inadequate, particularly among patients with comorbid diabetes, obesity, and in low-resource settings, due to poor treatment adherence, socioeconomic barriers, and limited healthcare system capacity. Although some rural community interventions have shown improvements in BP control, overall management remains fragmented, highlighting the urgent need for better follow-up, integrated care models, and targeted public health strategies to address persistent gender, regional, and socioeconomic disparities.[28,29,30,31]

Lifestyle interventions and pharmacist's role

Pharmacists play a crucial role in managing hypertension through patient education, medication adherence support, and lifestyle modification counselling.[32]

Lifestyle modifications

Diet

Reduce sodium intake (< 2 g per day).[33]

Higher potassium intake, primarily from fruits and vegetables, is recommended as part of dietary strategies to lower BP and enhance cardiovascular health.[34]

Follow the DASH (Dietary Approaches to Stop Hypertension) and Mediterranean diet which focuses on reducing sodium intake while increasing consumption of fruits, vegetables, whole grains, lean proteins, and low-fat dairy.[33]

Limit processed foods that contain high amounts of unhealthy fats and sodium as well as caffeine intake.[33]

Reduce stress

Practice deep breathing exercises, engaging in meditation, yoga and progressive muscle relaxation.[35]

Ensuring sufficient sleep at least seven to eight hours per night.[36]

Exercise

Engage in at least 150 minutes of moderate-intensity exercise per week.[37]

Include aerobic training such as walking, jogging, cycling or swimming and resistance training e.g. weightlifting, push ups, etc. Aerobic and resistance training should be done together for maximum benefits.[37]

Weight management

Achieve a healthy BMI through dietary changes and physical activity with a healthy BMI for adults being between 18.5–24.9.[38]

Smoking cessation and alcohol reduction

Reduce tobacco, electronic smoking devices and alcohol consumption to lower cardiovascular risks.[39]

Conclusion

Hypertension remains a critical driver of cardiovascular morbidity and mortality in South Africa, with control rates remaining unacceptably low despite the availability of effective treatments and national guidelines. Key challenges include limited access to essential medications (particularly fixed-dose combinations), poor adherence, fragmented care pathways, and inadequate healthcare provider capacity. Additionally, low awareness and engagement among patients, particularly in underserved areas, further contribute to poor hypertension control.

However, targeted interventions can bridge these gaps. Expanding cost-effective FDC access, strengthening PHC capacity, scaling up community-based screening and education programmes, and fully integrating hypertension care within the ICDM model are critical steps forward. Further, enhanced public health education and dietary policies can play a key role in reducing hypertension incidence.

Achieving meaningful improvements in hypertension management requires a coordinated, multi-sectoral response that includes the following: Policy reforms to ensure equitable access to antihypertensive medications; workforce training and multidisciplinary, team-based care; community-driven education and outreach to enhance adherence and early detection and

robust monitoring systems to track progress and refine interventions.

A patient-centred, equity-driven approach—integrating pharmacological advances with public health interventions—is essential to reversing the rising burden of hypertension in South Africa and improving long-term cardiovascular outcomes.

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References

1. World Health Organization (WHO). Hypertension [Internet]. 2021. Available from: https://www.who.int/news-roomz/fact-sheets/detail/hypertension. Accessed 14 March 2025.
2. Rudasingwa G, Cho S, Ishimwe NC. Regional prevalence and spatial modeling of hypertension in South Africa. Open Health. 2024;5:20230030. https://doi.org/10.1515/ohe-2023-0030.
3. Department of Health. South Africa Demographic and Health Survey (SADHS). 2019. Report, National Department of Health (NDoH), Statistics South Africa (Stats SA), South African Medical Research Council (SAMRC), and Inner-City Fund (ICF). https://dhsprogram.com/pubs/pdf/FR337/FR337.pdf.
4. Sliwa K, Acquah L, Gersh BJ, Mocumbi AO. Impact of socioeconomic status, ethnicity, and urbanization on risk factor profiles of cardiovascular disease in Africa. Circulation. 2016;134(14):1199-211. https://doi.org/10.1161/CIRCULATIONAHA.114.008730.
5. Eksteen G, Mungal-Singh V. Salt intake in South Africa: A current perspective. Journal of Endocrinology, Metabolism and Diabetes of South Africa. 2015;20(1):9-13. https://doi.org/10.1080/16089677.2015.1030878.
6. Van Pinxteren M, Mbokazi N, Murphy K, Mair FS. Effects of precarity on patients' capacity to manage their treatment burden: A comparative qualitative study between urban and rural patients with multimorbidity in South Africa. Frontiers in Medicine. 2023;10:1061190. https://doi.org/10.3389/fmed.2023.1061190.
7. Schellack N, Malan L. An overview of fixed-dose combinations of antihypertensive drugs in South Africa. S Afr Pharm J. 2022;89(5):10-6.
8. Al-Makki A, DiPette D, Whelton PK, et al. Hypertension pharmacological treatment in adults: A World Health Organization Guideline Executive Summary. Hypertension. 2022;79(1):293-301 https://doi.org/10.1161/HYPERTENSIONAHA.121.18192.
9. Seedat YK, Rayner BL, Veriava Y. South African Hypertension Practice Guideline 2014. Cardiovasc J Afr. 2014;25(6):288-94. https://doi.org/10.5830/CVJA-2014-062.
10. Chiwandire N, Zungu N, Mabaso M, Chasela C. Trends, prevalence and factors associated with hypertension and diabetes among South African adults living with HIV, 2005-2017. BMC Public Health. 2021;21:1139. https://doi.org/10.1186/s12889-021-10502-8.
11. Mutyambizi C, Chola L, Groot W, Pavlova M. The burden and determinants of diabetes and cardiovascular disease comorbidity in South Africa - results from the South African National Health and Nutrition Examination Survey ((SANHANES-1). BMC Public Health. 2017;17:745. https://doi.org/10.1186/s12889-017-4792-8.
12. Onwukwe SC, Ngene NC. Blood pressure control in hypertensive patients attending a rural community health centre in Gauteng Province, South Africa: A cross-sectional study. S Afr Fam Pract. 2022;64(1):a5403. https://doi.org/10.4102/safp.v64i1.5403.
13. Mupfuti R, Kabudula CW, Francis JM. Alcohol use and optimal chronic diseases' treatment outcomes among adults aged 40 years and above in rural South Africa. Scientific Reports. 2025;15:91704. https://doi.org/10.1038/s41598-025-91704-7.
14. Ferro EG, Abrahams-Gessel S, Kapaon D, et al. Significant improvement in blood pressure levels among older adults with hypertension in rural South Africa. Hypertension. 2023;80(8):1614-23. https://doi.org/10.1161/HYPERTENSIONAHA.122.20401.
15. Kohli-Lynch CN, Erzse A, Rayner BL, Hofman KJ. Hypertension in the South African public healthcare system: a cost-of-illness and burden of disease study. BMJ Open. 2022;12(2):e055621. https://doi.org/10.1136/bmjopen-2021-055621.
16. Rayner B, Jones E, Veriava Y, Seedat YK. South African Hypertension Society commentary on the American College of Cardiology/American Heart Association hypertension guidelines. Cardiovasc J Afr. 2019;30(3):184-7. https://doi.org/10.5830/CVJA-2019-025.
17. Uwimana-Nicol J, Hendricks L, Young T. Population-level interventions targeting risk factors of diabetes and hypertension in South Africa: A document review. BMC Public Health. 2021;21:2283. https://doi.org/10.1186/s12889-021-11910-6.
18. Masilela CM. Investigation of socio-demographic, clinical and genetic factors associated with blood pressure and glycaemic control among indigenous South African adult patients. University of the Western Cape. 2021. Available from: https://uwcscholar.uwc.ac.za/bitstreams/d3885a7d-161b-4835-86f5-12a6a5c53386/download.
19. Magee LA, Von Dadelszen P. Management of hypertension in pregnancy. Maternal-Fetal Medicine. 2021;3(2);124-35. https://doi.org/10.1097/FM9.0000000000000095.
20. Naidoo M, Pattinson RC. An approach to hypertensive disorders in pregnancy for the primary care physician. S Afr Fam Pract. 2020;62(1):a5117. https://doi.org/10.4102/safp.v62i1.5117.
21. Lin T-C, Lu Y-H, Chao C-T, et al. Comprehensive assessment and management of hypertension in elderly patients: Addressing frailty and target organ damage. Journal of the Formosan Medical Association. 2024. https://doi.org/10.1016/j.jfma.2024.10.023.
22. Ndumele CE, Rangaswami J, Chow SL, et al. Cardiovascular-kidney-metabolic health: a presidential advisory from the American Heart Association. Circulation. 2023;148(20):1606-35. https://doi.org/10.1161/CIR.0000000000001184.
23. De Boer IH, Caramori ML, Chan JCN, et al. KDIGO 2020 Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease. Kidney International. 2020;98(4S):S1-S115. https://doi.org/10.1016/j.kint.2020.06.019.
24. Naidoo M, Pattinson RC. An approach to hypertensive disorders in pregnancy for the primary care physician. S Afr Fam Pract. 2020;62(1):a5095. https://doi.org/10.4102/safp.v62i1.5095.
25. Stacey N, Tugendhaft A, Hofman K. Sugary beverage taxation in South Africa: Household expenditure, consumption and simulated BMI reductions in adults. BMC Public Health. 2017;17:810. https://doi.org/10.1016/j.ypmed.2017.05.026.
26. Madela S, James S, Sewpaul R, Madela S, Reddy P. Early detection, care and control of hypertension and diabetes in South Africa: A community-based approach. Afr J Prm Health Care Fam Med. 2020;12(1):a2160. https://doi.org/10.4102/phcfm.v12i1.2160.
27. Ameh S, Klipstein-Grobusch K, D'Ambruoso L, et al. Quality of integrated chronic disease care in rural South Africa: user and provider perspectives. Health Policy Plan. 2017;32(2):257-66. https://doi.org/10.1093/heapol/czw118.
28. McCrombe G, Lim J, van Hout MC, et al. Integrating care for diabetes and hypertension with HIV care in sub-Saharan Africa: a scoping review. Int J Integr Care. 2022;22(1):5. https://doi.org/10.5334/ijic.5839.
29. Genade LP, Webb fEM, Wolvaardt JE, Janse Van Rensburg C. The clinical outcomes of patients with diabetes and hypertension in a peri-urban area, Johannesburg, South Africa. Prim Care Diabetes. 2021;15(3):212-7. https://doi.org/10.1016/j.pcd.2020.08.010.
30. Makukule A, Modjadji P, Thovhogi N, Mokgalaboni K, Kengne AP. Uncontrolled hypertension, treatment, and predictors among hypertensive out-patients attending primary health facilities in Johannesburg, South Africa. Healthcare. 2023;11(2783). https://doi.org/10.3390/healthcare11202783.
31. Mohamed S, Uthman OA, Mutua MK, et al. Uncontrolled hypertension among people with comorbidities in Sub-Saharan Africa. PhD Thesis, University of Warwick. 2021. https://doi.org/10.1136/bmjopen-2020-045880.
32. Saleem F, Hassali MA, Shafie AA, et al. Pharmacist intervention in improving hypertension-related knowledge, treatment medication adherence and health-related quality of life: a non-clinical randomized controlled trial. Health Expect. 2015;18(5):1270-81. https://doi.org/10.1111/hex.12101.
33. Verma N, Rastogi S, Chia YC, et al. Non-pharmacological management of hypertension. The Journal of Clinical Hypertension. 2021;23(7):1275-83. https://doi.org/10.1111/jch.14236.
34. Xu X, Zeng L, Jha V, et al. Potassium-enriched salt substitutes: A review of recommendations in clinical management guidelines. Hypertension. 2024;81(3). https://doi.org/10.1161/HYPERTENSIONAHA.123.21343.
35. Pathan FKM, Pandian JS, Shaikh AI, et al. Effect of slow breathing exercise and progressive muscle relaxation technique in individuals with essential hypertension: A randomized controlled trial. Medicine (Baltimore). 2023;102(24):e112.
36. Javaheri S, Redline S. Insufficient sleep and hypertension: a systematic review. Curr Hypertens Rep. 2017;19(11):59.
37. WHO Guidelines on Physical Activity and Sedentary Behaviour. World Health Organization. 2023. Available from: https://www.who.int/publications/i/item/9789240015128.
38. Pandey A, LaMonte M, Klein L, et al. Relationship between physical activity, body mass index, and risk of heart failure. J Am Coll Cardiol. 2017;69(9):1124-32. https://doi.org/10.1016/j.jacc.2016.11.081.
39. O'Donnell MJ, Chin SL, Rangarajan S, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. Lancet. 2016;388(10046):761-75. https://doi.org/10.1016/S0140-6736(16)30506-2.