



JOURNAL OF COMMUNITY MEDICINE AND PRIMARY HEALTH CARE

ORIGINAL ARTICLE

Prevalence, Determinants and Predictors of Drug Outages: Experiences of Hypertensive Patients in a Tertiary Hospital in South-South Nigeria

Aigbe IF¹, Ogbimi EM²

¹ Dept of Medicine, Delta State University Abraka Nigeria.

² Delta State University Abraka Nigeria.

Keywords

Systemic
Hypertension,
Drug Outages,
Prevalence,
Medication
Adherence.

ABSTRACT

Background: Systemic hypertension is a significant global public health issue, leading to complications like stroke and heart failure. Proper management requires regular antihypertensive medication intake, however, drug outages (DO) disrupt compliance and treatment goals. This study assessed the prevalence, associated factors, and predictors of DO experienced by hypertensive patients in a tertiary hospital in South-South Nigeria.

Methodology: This descriptive cross-sectional study was conducted from April to October, 2023. A total of 320 hypertensive patients were recruited from the medical and family medicine outpatient clinics of Delta State University Teaching Hospital, Oghara, using systematic random sampling. The main primary outcome of the study was the frequency of DO. Information was gathered through a structured questionnaire that included sociodemographic details, history of hypertension, medication usage, perceived effects of DO and sources of medication. The data was analyzed utilizing IBM SPSS 23. Ethical clearance was granted by the hospital's research and ethics committee.

Results: The mean age of respondents was 54.8 ± 16.5 years, and the majority, 179 (55.9%), were female. The prevalence of DO was 11%. Monthly income was significantly associated with DO ($p = 0.001$), with higher-income groups experiencing fewer outages. Other significant factors included hypertension duration, medication source, and monthly treatment costs. Binary logistic regression identified

hypertension duration >10 years as the sole predictor of DO.

Conclusion: DO experienced by hypertensive patients are influenced by financial constraints, hypertension duration, and medication sources. Policies ensuring drug affordability—through subsidies, stable supply, and improved patient education—are crucial, especially for long-term hypertensive individuals.

Article History:

Date Received: 09/02/2025,

Date Accepted: 10/06/2025

Correspondence to:

Dr Aigbe I Fredrick

igbenf@yahoo.com

INTRODUCTION

Systemic hypertension is a significant global public health issue, with considerable morbidity and mortality. It is estimated that around 1.28 billion adults aged 30–79 years worldwide have hypertension, with projections indicating that this number could rise to about 1.56 billion by 2050 on account of aging and population increase.^{1,2} A growing population can significantly amplify the risks and burden of hypertension in a society due to several factors, including increased urbanization, lifestyle changes, and healthcare system strain.³ In Nigeria, the prevalence of hypertension has been increasing over the past decades, with recent estimates ranging from 22 to 44%.^{4,5} Poor management of hypertension can result in serious complications, such as stroke, heart failure, myocardial infarction, chronic kidney disease, retinopathies, and other health problems.¹ These complications significantly impact the quality of life of hypertensive patients and their economic well-being.⁶

Proper management of hypertension requires, among other measures, regular ingestion of antihypertensive medication.⁷ Indeed, consistent and regular intake of these medications is the cornerstone of hypertension management.⁸ Therefore, DO (defined as unavailability of prescribed medications when needed) among hypertensive patients can lead to poor compliance, disrupting treatment goals and increasing the risk of developing complications associated with systemic hypertension.

The drivers of DO are complex and vary across regions. In resource-challenge or strained settings, systemic challenges such as high medication costs, inadequate pharmacy supply chains, and regulatory inefficiencies, as well as patient-centered issues such as poor motivation

to procure or obtain drugs, are frequently cited.^{9,10} Nigeria, with a high prevalence of hypertension and a predominantly out-of-pocket healthcare financing system, presents a unique context for examining DO.¹¹ Previous works in low- and middle-income countries (LMICs) have highlighted the impact of socioeconomic disparities on medication access.^{12,13} However, there is a dearth of literature on the specific causes and consequences of DO among hypertensive patients in this region of Nigeria. This study aimed to address this gap by assessing the prevalence, associated factors, and predictors of DO among hypertensive patients receiving care at Delta State University Teaching Hospital (DELSUTH), Oghara, Delta State. The study also explored the perceived reasons for these outages and their impact on patients' health behaviours and outcomes. The findings from this study contribute to the growing body of evidence needed to develop strategies that enhance medication availability and adherence, ultimately helping to reduce hypertension-related complications in resource-limited settings.

Methodology

This cross-sectional descriptive institutional-based study was conducted between April and October 2023 in the outpatient clinics of the Medical and Family Medicine department of DELSUTH, Oghara, Delta State, Nigeria. DELSUTH Oghara is a tertiary health institution located in Oghara, a semi-urban town in the Niger delta region of Nigeria. However, the study population was not limited to Oghara, as patients come from all over the state and beyond to seek care because DELSUTH Oghara is a tertiary referral centre with a sizeable catchment area in the South-South geopolitical zone of Nigeria.

Table 1: Socio demographic Characteristics of the Patients

Variable	Frequency (n=320)	Percent (%)
Gender		
Male	141	44.1
Female	179	55.9
Age Group (years)		
<40	61	19.1
40–59	120	37.5
≥60	139	43.4
Mean age; 54.8 ± 16.5 years		
Marital status		
Single	44	13.7
Married	272	85.0
Widowed	4	1.3
Income Group		
Low (< N30,000)	35	10.9
Middle (N30,000–N100,000)	152	47.5
High (>N100,000)	133	41.6
Education Level		
No formal education	15	4.7
Primary/Secondary	134	41.9
Tertiary	171	53.4

Study Population: The study included hypertensive patients aged 18 and older who were receiving care at this health facility and had been on antihypertensive medications for at least six months prior to enrollment. Patients with incomplete medical records or those who were unwilling or unable to provide informed consent were excluded from the study.

Sample size determination: A systematic random sampling method was used to select

participants, ensuring a representative sample. The sample size for this study was calculated using Fisher's formula for cross-sectional studies, with a 95% confidence interval and a 5% margin of error.¹⁴ Based on a hypertension prevalence rate of 29.3%, the formula yielded a sample size of 318 patients, which was rounded up to 320 patients.¹⁵ Data collection was conducted using a structured questionnaire, divided into sections, capturing details of socio-

demographic characteristics (age, gender, income, marital and educational statuses), hypertension history, drug history, perceived impacts of DO, and sources of

medication.¹⁶ Trained scientific officers of the hospital administered the questionnaire immediately after consultation during clinic visits.

Table 2: Hypertension History and Treatment Characteristics of Patients.

Variable	Frequency (n=320)	Percent (%)
Duration of Hypertension		
<5 years	162	50.6
5–10 years	77	24.1
>10 years	81	25.3
Source of Medication		
Hospital pharmacy	127	39.7
Private pharmacy	73	22.8
Hospital and Private pharmacy	120	37.5
Monthly Treatment Cost		
<₦ 5000	67	20.9
₦ 5000–₦ 10000	183	57.2
>₦ 10000	70	21.9

Data Analysis: The completed questionnaires were reviewed for completeness and consistency, then entered into an Excel spreadsheet and exported to IBM® SPSS 23 for analysis. Descriptive statistics, including frequencies and percentages, were employed to summarize categorical variables, while means and standard deviations were used to describe continuous variables. A chi-square test of independence was performed to assess the association between socio-demographic and hypertension characteristics (independent variables) and DO (outcome variable), at a

significance level set at $p < 0.05$. Binary logistic regression analysis was conducted to determine the predictors of DO at a significance level of $p < 0.05$.

Ethical consideration

Ethical clearance was obtained from the hospital research and ethical committee (HREC), DELSUTH Oghara (HREC/PAN/2022/075/0520), and the study was conducted according to the Helsinki Declaration

Table 3: Characteristics of Drug Outages among Patients

Variable	Frequency(n=320)	Percent (%)
Frequency of Drug Outages in the last 1 year		
Never	285	89.0
Rarely	5	1.6
Sometimes	9	2.8
Often	21	6.6
Perceived Reasons for Drug Outages	(N = 35)	(%)
Medication was too expensive	14	40.0
Could not afford the medication at the time	11	31.4
Forgot to refill the prescription	17	48.6
Pharmacy was out of stock	10	28.6
Exhausted stock before clinic	25	71.4
Misplaced drugs	5	14.2
Others (lost prescription, do not know, etc.)	4	11.4
Impact of Drug Outages on Patient Actions	(N = 35)	(%)
Skipped doses until the meds were available	23	65.7
Sought alternative treatments (e.g., herbal)	5	14.2
Bought the medication from another pharmacy	23	65.7
Consulted the doctor for advice	11	31.4
Did nothing (waited for clinic appointment day etc.)	8	22.8

RESULTS

The study population consisted of 320 hypertensive patients, with most being middle-aged (40–59 years: 120, 37.5%) and elderly (≥ 60 years: 139, 43.4%). The mean age was 54.8 ± 16.5 years, and the male-to-female ratio was as 1:1.27 (44.1% male, 55.9% female). Additionally, the majority of participants (85%) were married, while 53.4% had tertiary education, and 47.5% belonged to the middle-

income category (Table 1). One hundred and sixty-two patients (50.6%) had hypertension for fewer than 5 years. Most of these patients obtained their medications from hospital pharmacies (127 or 39.7%), while others relied on private pharmacies or a mix of both. Additionally, 183 patients (57.2%) spent between ₦N 5000 and ₦N 10000 per month on treatment (Table 2).

Among the patients, 285 (89.0%) never experienced DO, while 35 (11%) did experience varying severities of DO. Those who faced DO

also reported different perceived reasons, which had various impacts on their subsequent actions (Table 3).

Table 4: Determinants of Drug Outages among Respondents

Variables	No	(%)	Drug Outages Yes	(%)	Chi -test, <i>p</i> -value
Gender					
Male	130	(92.2)	11	(7.8)	2.545, .111
Female	155	(86.6)	24	(13.4)	
Age Group (years)					
Age <40 years	54	(88.5)	7	(11.5)	4.051, .132
Age 40–59 years	102	(85.0)	18	(15.0)	
Age ≥60 years	129	(92.8)	10	(7.2)	
Marital status					
Single	37	(84.1)	7	(15.9)	2.214, .331
Married	245	(90.1)	27	(9.9)	
Widowed	3	(75.0)	1	(25.0)	
Monthly Income (in naira)					
Low (<30000)	27	(77.1)	8	(22.9)	14.091, .001
Middle (30000–100000)	130	(85.5)	22	(14.5)	
High (>100000)	128	(96.2)	5	(3.8)	
Education status					
No formal education	13	(86.7)	2	(13.3)	0.127, .938
Primary/Secondary	119	(88.8)	15	(11.2)	
Tertiary	153	(89.5)	18	(10.5)	
Duration of Hypertension					
<5 years	152	(93.8)	10	(6.2)	7.820, .020
5–10 years	64	(83.1)	13	(16.9)	
>10 years	69	(85.2)	12	(14.8)	
Source of Medication					
Hospital pharmacy	120	(94.5)	7	(5.5)	26.388, .001
Private pharmacy	53	(72.6)	20	(27.4)	
Hospital and Private pharmacy	112	(93.3)	8	(6.7)	
Monthly Treatment Cost in Naira					
Monthly cost <5000 Naira	57	(85.1)	10	(14.9)	8.886, .012
Monthly cost 5000-10000 Naira	171	(93.4)	12	(6.6)	

Respondents' monthly income was significantly associated with exposure to DO ($\chi^2 = 14.091$, $p = 0.001$). Higher income groups have lower chances of experiencing DO. Patients' gender, age group, marital status and educational level did not show a statistically significant association with DO. There was a significant positive association between the duration of hypertension, source of medication, monthly treatments costs, and DO: ($\chi^2 = 7.820$, $p = .020$; $\chi^2 = 26.388$, $p = .001$; $\chi^2 = 8.886$, $p = .012$), respectively.

This suggests that a longer duration of hypertension, reliance on private pharmacies for drugs, and higher monthly treatment costs are linked to an increased likelihood of experiencing DO (Table 4).

Binary logistic regression showed that being hypertensive for more than 10 years was the sole predictor of experiencing DO. Respondents with long-term hypertension had three times the odds of encountering DO compared to those with hypertension for less than five years (Table 5).

DISCUSSION

This study assessed DO and related issues among hypertensive patients receiving care in a tertiary health facility in a semi-urban town in the Niger Delta region of Nigeria. The study group mainly included middle-aged and older adults of both genders experiencing different lengths of time being hypertensive. Most patients were married, had middle to high incomes, and had good education. This age group often shows a higher prevalence of hypertension and cardiovascular risk factors like diabetes mellitus (DM) and dyslipidemia.¹⁸

This study found that 11% of hypertensive patients experienced DO, highlighting a significant challenge in maintaining uninterrupted access to medication. The primary causes—financial constraints, forgetfulness, and pharmacy stock depletion—underscore broader issues in treatment adherence, reflecting the complex interplay of individual behavior, economic limitations, and systemic healthcare factors. These findings are consistent with previous research. A study in South Africa reported that 67.2% of hypertensive patients received all prescribed medications, while 25.5% received only some, and 7.3% had no record of dispensation from a rural pharmacy.¹⁹ Similar research from Ghana found that 93% of hypertensive patients were non-compliant, with 96% citing unaffordable drug prices as the primary reason.²⁰ While these figures indicate significant treatment disruptions, variations may stem from regional economic factors or differences in the affordability of medication. High levels of DO are not uncommon in LMICs, where most drugs are imported into the country with all the attendant challenges.²¹

In this study, patients' income ($p = 0.001$), disease duration ($p = 0.020$), reliance on private pharmacies ($p = 0.001$), and higher treatment costs ($p = 0.012$) were significantly associated with DO. Patients in the low-income group

(<30,000 Naira monthly) had the highest rate of DO (22.9%), while only 3.8% of high-income patients experienced DO. This closely followed the trend of findings from the earlier referenced study in Ghana, where 93% of hypertensive patients were non-compliant, with 96% citing unaffordable drug prices as the primary reason.²⁰ In this study, disease duration was significantly associated with DO, with hypertensive patients of over 10 years having three times higher odds of experiencing DO (AOR = 3.297, $p = 0.032$). Prior research has identified disease duration as a factor influencing medication adherence, with long-term patients sometimes exhibiting treatment fatigue and declining adherence rate.²² Private pharmacy reliance also showed a strong association with drug outage in this study, aligning with findings by Qato et al., who reported an 8–10% relative decrease in adherence to cardiovascular medications following private pharmacy closures in the United States of America.²³ This highlights how limited access through private supply channels, whether due to physical closure or stock unavailability, disrupts consistent medication use. Such patterns are particularly concerning in resource-limited settings, where reliance on private vendors is widespread.⁹ Studies on medication access in LMICs have shown that patients relying on private pharmacies often face a higher risk of DO, as these outlets lack the structured supply chains and bulk purchasing advantages of hospital pharmacies.⁹ The resulting fragmentation in access increases the risk of therapeutic interruptions, poor blood pressure control, and ultimately, adverse cardiovascular outcomes. The relationship between higher treatment costs and drug shortages reinforces broader affordability concerns. A U.S. study among individuals with diabetes and cardiovascular disease examining the association between cost-related nonadherence (CRN) and mortality, revealed

that, on average, 15% of the sample reported CRN within a year, which was linked to a 15% to 22% increase in all-cause mortality across all

conditions.²⁴ This mirrored the financial strain observed in this study, where high treatment costs were significantly associated with DO.

Table 5: Binary Logistic Regression Analysis of Factors Associated with Drug Outages in Hypertension Management among patients

VARIABLES	aOR	95% CONFIDENCE INTERVAL		p-VALUE
		LOWER	UPPER	
Age				
Young*vs Middle-aged	1.338	0.512	3.498	.549
Young*vs Elderly	0.756	0.324	1.765	.516
Gender				
Female*vs Male	0.845	0.406	1.759	.650
Marital				
Single*vs Married	3.8028968	0.000	∞	.999
Single*vs Widow	30.2994984	0.000	∞	.999
Monthly Income				
Low*vs Middle	.726	0.183	2.878	.647
Low*vs High	.947	0.436	2.056	.889
Educational status				
Nil formal*vs Primary/secondary	2.047	0.397	10.553	.401
Nil formal*vs Tertiary	1.436	0.685	3.014	.352
Duration of hypertension				
< 5 years*vs 5-10 years	1.496	0.550	4.064	.429
<5 years*vs >10 years	3.297	1.110	9.800	.032
Monthly treatment cost				
< ₦ N5000* vs ₦ N5000-10000	.965	.332	2.803	.950
< ₦ N5000* vs > ₦ N10000	.910	.373	2.223	.837
Source of medication				
Public* vs Private pharmacy	1.311	0.561	3.067	.528
Public* vs Public & Private Pharmacy	1.126	0.425	2.982	.811

*Reference category; aOR- adjusted odds ratio

The increased financial burden of managing hypertension over time is also well documented, reinforcing the economic impact of long-term treatment.^{13,25} Financial status, hypertension duration, pharmacy reliance, and treatment costs significantly impact medication access, making it increasingly challenging for hypertensive patients to avoid DO over time. These compounded challenges suggest that sustained hypertension management requires more than individual effort—it depends on stable healthcare support, reliable medication sources, and financial feasibility. Without addressing these factors, long-term hypertensive patients

may experience worsening health outcomes due to DO. While gender, age, educational level and marital status showed observable trends in DO, none demonstrated strong statistical significance. In addition, some studies consistently show that women exhibit higher rates of health-seeking behaviour, often leading to better medication adherence, while others suggest that women may face greater challenges in accessing medication due to economic constraints, care giving responsibilities, and their health-seeking behaviors.^{26,27} However, gender-based disparities in drug access are context-dependent, particularly in settings where

socioeconomic barriers outweigh behavioural differences.^{13, 28} Similarly, age has been linked to medication adherence, with older patients often demonstrating better compliance, perhaps due to greater health awareness and chronic disease management experience.²⁹ Previous studies have highlighted the role of education in improving health literacy and medication adherence.^{13,25}

However, results remain vary on whether education directly impacts medication access, especially in low-resource settings.⁹ Regarding marital status, prior research suggests that being married is associated with greater treatment adherence, possibly due to spousal encouragement and support in managing chronic illnesses and shared financial support.³⁰ However, this study did not find a significant statistical association between patients' gender, age, educational level, marital status and drug outage. This suggests that structural healthcare barriers, economic constraints, and supply chain inefficiencies may have a greater impact on drug accessibility than individual demographic traits.

However, beyond individual challenges, recurrent medication shortages raise concerns about long-term trust in healthcare systems. Patients affected by DO may resort to other interventions like herbal remedies or medication-sharing, practices noted in prior research as risky due to unregulated treatments and uncertain safety profiles.³¹ Furthermore, DO has been widely documented to negatively impact treatment continuity, patient satisfaction, and clinical outcomes.²²

One strength of this study is its comprehensive analysis of individual and systemic contributors to DO, offering a holistic perspective on medication access challenges. Additionally, patient-reported experiences provide valuable real-world insights into adherence barriers.

However, the single-center study design may limit generalizability, as findings may not fully represent broader healthcare settings. The cross-sectional nature of the study also restricts causal inference, and self-reported data introduces potential recall bias.

Conclusion

This study found that approximately 11% of hypertensive adults receiving care at this health facility experienced varying degrees of DO, influenced by financial constraints, pharmacy stock issues, and long-term treatment burden. Patients manage these outages in various ways, which can sometimes lead to compromised hypertensive healthcare and potentially adverse outcomes. It is important to consider DO not just as a matter of individual non-adherence but as a reflection of broader systemic weaknesses. To mitigate DO, policy measures should improve medication affordability; enhance drug supply chain efficiency, pharmacy stock management, and patient education, particularly for long-term hypertensive patients. Future research should expand to multi-center studies, examining regional variations in healthcare access while employing mixed-methods approaches to better understand the nuanced drivers of drug outage and supply stability.

Acknowledgement: The authors acknowledge the support and help of the scientific officers of the cardiopulmonary unit in administering the questionnaires.

Authors' Contributions: AIF contributed to conceptualization, study design, data collection, analysis, interpretation, writing the manuscript, and critical review of the manuscript. OEM contributed to the study design, data collection, analysis, interpretation, manuscript writing, and critical review of the manuscript. Both authors

read and approved the final version of the manuscript.

References

1. World Health Organization (WHO). Hypertension. [Internet]. Geneva: WHO; 2023 [cited 2025 Jan 30]. Available from: <https://www.who.int/news-room/fact-sheets/detail/hypertension>.
2. Chong B, Jayabaskaran J, Jauhari SM, Chan SP, Goh R, Kueh MTW, et al. Global Burden of Cardiovascular Diseases: Projections from 2025 to 2050. *Eur J Prev Cardiol*. 2024; zwae281. <https://doi.org/10.1093/eurjpc/zwae281>
3. Osunkwo D, Mohammed A, Kamateeka M, Nguku P, Umeokonkwo CD, Abolade OS, et al. Population-based Prevalence and Associated Risk Factors of Hypertension among Adults in Benue State, Nigeria. *Niger J Clin Pract*. 2020; 23: 944-9. DOI:10.4103/njcp.njcp_354_19
4. Odili AN, Chori BS, Danladi B, Nwakile PC, Okoye IC, Abdullah U, et al. Prevalence, Awareness, Treatment and Control of Hypertension in Nigeria: Data from a Nationwide Survey 2017. *Glob Heart*. 2020; 15(1): 47. Available at: <https://doi.org/10.5334/gh.848>
5. Adeloye D, Basquill C, Aderemi AV, Thompson JY, Obi FA, Ogah OS, et al. An Estimate of the Prevalence of Hypertension in Nigeria: A Systematic Review and Meta-Analysis. *J Hypertens*. 2015; 33(2): 230-42. doi:10.1097/HJH.0000000000000413
6. World Health Organization (WHO). Global Report on Hypertension: The Race Against a Silent Killer. [Internet]. Geneva: WHO; 2023 [cited 2025 Jan 30]. Available from: <https://www.who.int/publications/i/item/9789240081062>
7. Parati G, Agostoni P, Omboni S, Brambilla G, Malfatto G, Levenberg E, et al. New Perspectives for Hypertension Management: Progress in Methodological and Technological Developments. *Eur J Prev Cardiol*. 2023; 30(1): 48-60. doi:10.1093/eurjpc/zwac203
8. Unger T, Borghi C, Charchar F, Khan N, Poulter N, Prabhakaran D, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. *Hypertension*. 2020; 75(6): 1334-1357. doi:10.1161/HYPERTENSIONAHA.120.15026
9. Shukar S, Zahoor F, Hayat K, Saeed A, Gillani AH, Omer S, et al. Drug Shortage: Causes, Impact, and Mitigation Strategies. *Front Pharmacol*. 2021; 12: 693426. doi: 10.3389/fphar.2021.693426
10. Al-Worafi YM. Shortage of Medicines in the Developing Countries. In: Al-Worafi YM, editor. *Handbook of Medical and Health Sciences in Developing Countries*. Springer, Cham; 2024. https://doi.org/10.1007/978-3-030-74786-2_236-1
11. Aigbe IF, Oyibo PG, Ntaji IM, Adesoye OO. Assessment of Catastrophic Health Expenditure Incurred by Hypertensive Patients Attending a Semi-Urban Tertiary Hospital in South-South Nigeria. *Dutse J Pure Appl Sci*. 2024; 10(2b): 25-35. doi:10.4314/dujopas.v10i2b.25
12. de Siqueira Filha NT, Li J, Phillips-Howard PA, Pinho RR, Wade SM, Soteriades ES, et al. The Economics of Healthcare Access: A Scoping Review on the Economic Impact of Healthcare Access for Vulnerable Urban Populations in Low- and Middle-Income Countries. *Int J Equity Health*. 2022; 21: 191. <https://doi.org/10.1186/s12939-022-01804-3>
13. Ozawa S, Shankar R, Leopold C, Orubu S. Access to Medicines through Health Systems in Low- and Middle-Income Countries. *Health Policy Plan*. 2019; 34(Suppl_3): iii1–iii3. <https://doi.org/10.1093/heapol/czz119>.

14. Hazari A. Research Methodology for Allied Health Professionals: A Comprehensive Guide to Thesis & Dissertation. Singapore: Springer; 2023.
15. Umuerri EM, Aiwuyo HO. Prevalence and Correlates of Prehypertension and Hypertension among Adults in Delta State, Nigeria: A Cross-sectional Community-based Study. *Ghana Med J*. 2020; 54(1): 48-57. doi:10.4314/gmj.v54i1.8
16. Beatty PC, Collins D, Kaye J, Padilla JL, Willis GB, Wilmot A, editors. *Advances in Questionnaire Design, Development, Evaluation and Testing*. Hoboken, NJ: Wiley; 2020.
17. World Medical Association (WMA). WMA Declaration of Helsinki: Ethical Principles for Medical Research involving Human Subjects. Ferney-Voltaire: WMA; [cited 2024 Aug 25]. Available from: <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects>
18. World Health Organization. Ageing and Health [Internet]. Geneva: World Health Organization; 2020 [cited 2025 Feb 3]. Available from: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
19. Rampamba EM, Meyer JC, Helberg E, Godman B. Medicines Availability among Hypertensive Patients in Primary Health Care Facilities in a Rural Province in South Africa: Findings and Implications. *J Res Pharm Pract*. 2021; 8(4): 181-185. doi:10.4103/jrpp.JRPP_20_49
20. Buabeng KO, Matowe L, Plange-Rhule J. Unaffordable Drug Prices: The Major Cause of Non-compliance with Hypertension Medication in Ghana. *J Pharm Pharm Sci*. 2004; 7(3): 350-352.
21. Ewen M, Zweekhorst M, Regeer B, Laing R. Prices and Availability of Locally Produced and Imported Medicines in LMICs: A Comparative Study. *Bull World Health Organ*. 2017; 95(10): 735–742. DOI: 10.2471/BLT.17.199281.
22. Postma DJ, De Smet PAGM, Notenboom K, Leufkens HGM, Mantel-Teeuwisse AK. Impact of Medicine Shortages on Patients - A Framework and Application in The Netherlands. *BMC Health Serv Res*. 2022; 22: 1366. doi:10.1186/s12913-022-08765-x.
23. Qato DM, Alexander GC, Chakraborty A, Guadamuz JS, Jackson JW. Association between Pharmacy Closures and Adherence to Cardiovascular Medications among Older US Adults. *JAMA Netw Open*. 2019; 2(4): e192606. doi:10.1001/jamanetwork.open.2019.
24. Van Alsten SC, Harris JK. Cost-related Nonadherence and Mortality in Patients with Chronic Disease: A Multiyear Investigation, National Health Interview Survey, 2000–2014. *Prev Chronic Dis*. 2020; 17: 200244. doi:10.5888/pcd17.200244
25. Wirtz VJ, Hogerzeil HV, Gray AL, Bigdeli M, Joncheere CP, Ewen MA, et al. Essential Medicines Policies in LMICs: Progress and Challenges. *Lancet*. 2017; 389(10066): 1885–1896. DOI: 10.1016/S0140-6736(17) 30746-5.
26. Jalo, R.I., Bamgboye, E.A., Salawu, Akinyemi JO, Uja U, Ogah OS, et al. Gender Disparities in Hypertension Prevalence, Awareness and Healthcare Seeking Behaviour among Young Adults in Nigeria. *BMC Cardiovasc Disord*. 2025; 25: 151. doi:10.1186/s12872-025-04603-0
27. Terefe B, Workneh BS, Zeleke GA, Mekonen EG, Zegeye AF, Aemro A, et al. Uncovering Women’s Healthcare Access Challenges in Low- and Middle-Income Countries using Mixed Effects Modeling Approach: Insights for Achieving the Sustainable Development Goals. *PLOS ONE*. 2025; 20(1): e0314309. <https://doi.org/10.1371/journal.pone.0314309>

28. Biffi A, Rea F, Iannaccone T, Filippelli A, Mancina G, Corrao G. Sex Differences in the Adherence of Antihypertensive Drugs: A Systematic Review With Meta-analyses. *BMJ Open*. 2020;10(7): e036418. doi:10.1136/bmjopen-2019-036418
29. Burnier M, Polychronopoulou E, Wuerzner G. Hypertension and Drug Adherence in the Elderly. *Front Cardiovasc Med*. 2020; 7: 49. <https://doi.org/10.3389/fcvm.2020.00049>
30. Magrin ME, D'Addario M, Greco A, Miglioretti M, Sarini M, Scrignaro M, et al. Social Support and Adherence to Treatment in Hypertensive Patients: A Meta-Analysis. *Ann Behav Med*. 2015; 49(3): 307–318. doi:10.1007/s12160-014-9663-2.
31. Surana AR, Agrawal SP, Kumbhare MR, Gaikwad SB. Current Perspectives in Herbal and Conventional Drug Interactions based on Clinical Manifestations. *Futur J Pharm Sci*. 2021; 7: 103. doi:10.1186/s43094-021-00256-w.