Cost Variation Analysis of Antihypertensives and Antidiabetic Medicines in North-Central Nigeria

Dauda Audi Dangiwa [1], Josiah Nanpon Dangun [2], Isaac Hezekiah Achwai [2], Timothy Olugbenga Ogundeko [3], Enoch Gback Dangiwa[4], Damaris Kyoni Dangiwa [4], John Kayode Falana [1]

[1] *Federal University of Applied Sciences*
Kachia, Kaduna State, Nigeria

[2] *College of Health Technology*
Zawan, Plateau State, Nigeria

[3] *Bingham University*
Bingham University, Km 26 Abuja - Keffi Express Way Kodope, Nasarawa State, Nigeria

[4] *University of Jos*
P. M. B 2084, Jos, Nigeria

DOI: 10.22178/pos.127-1

LCC Subject Category: RS1-441

Received 26.01.2026
Accepted 25.02.2026
Published online 28.02.2026

Corresponding Author:
Timothy Olugbenga Ogundeko

Abstract. Hypertension and diabetes mellitus are major non-communicable diseases associated with significant morbidity, mortality, and long-term economic burden, particularly in low- and middle-income countries. Medication costs remain a critical determinant of access, adherence, and therapeutic outcomes. This study assessed the cost variation, availability, and affordability of commonly prescribed antihypertensive and antidiabetic medicines in selected states of North-Central Nigeria, comparing generic, branded, and international reference prices.

A cross-sectional descriptive study was conducted across 40 registered pharmacy premises using a pretested, structured questionnaire and a price-collection tool. Researchers analysed medicine prices for generic and branded products and derived international reference prices from the International Medical Products Price Guide and National Health Insurance Scheme price lists. They analysed the data using IBM SPSS version 20 and presented the results as means, standard deviations, and comparative ratios.

Antihypertensive medicines were more widely available than antidiabetic medicines across pharmacy premises ($p < 0.05$). Branded antihypertensive medicines consistently had higher unit prices than their generic equivalents, while several international reference prices exceeded both local generic and branded prices, reflecting exchange rate volatility. For oral antidiabetic medicines, price differences between branded and generic products were minimal; however, branded insulin preparations were substantially more expensive than generic and international reference prices.

Significant cost variation exists among antihypertensive and antidiabetic medicines in North-Central Nigeria. While generic antihypertensives offer more affordable options, high prices of branded products—particularly insulin—pose challenges to sustained access and adherence. Policy measures promoting generic substitution, price regulation, and local pharmaceutical manufacturing are essential to improve affordability and health outcomes.

Keywords: Antihypertensives; Antidiabetics; Cost variation; Medicine affordability; Nigeria; Pharmacoeconomics.

INTRODUCTION

Hypertension and diabetes mellitus are chronic non-communicable diseases (NCDs) that account for a substantial proportion of global morbidity and premature mortality. Their prevalence is rising rapidly in low- and middle-income countries, including Nigeria, where health systems face persistent financing and access constraints. Evidence indicates that hypertension affects approximately one-third of the adult population globally. In contrast, diabetes mellitus affects nearly one in ten adults, with projections showing continued growth driven by urbanisation, lifestyle changes, and population ageing. Hypertension and diabetes mellitus are chronic disease conditions reputed as leading causes of preventable deaths [1-3]. In poor economies, the diseases are generally undiagnosed, untreated, or poorly controlled because of abject poverty. Healthcare providers can prevent many of the related deaths through early detection and adequate management. Poor management of diseases is associated with related complications and other non-health-related implications, such as social and economic instability [4, 5]. Hypertension and diabetes mellitus are regarded as non-communicable diseases with a heavy financial burden. Hypertension is a common condition that affects 1 in 3 adults, while about 9% of adults haveiabetes mellitus [6, 7]. Medication management of hypertension helps in preventing complications such as stroke, myocardial infarction, and heart failure [8-11].

Effective pharmacotherapy significantly reduces the risk of complications such as stroke, myocardial infarction, renal failure, neuropathy, and premature death. However, the long-term nature of treatment results in sustained out-of-pocket expenditures for patients, particularly in settings with limited health insurance coverage. In Nigeria, where out-of-pocket payments remain the dominant mode of health financing, medicine costs are a major barrier to adherence and continuity of care. The pharmacotherapy of hypertension offers various drug classes that can be employed to effectively treat and manage the condition [8, 11]. They include the thiazide diuretics, calcium channel blockers, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, loop diuretics, potassium-sparing diuretics, beta-adrenergic receptor blockers, etc. [10, 11]. Some oral agents for the management of diabetes mellitus include sulfonylureas, biguanides, thiazolidinediones, alpha-glucosidase inhibitors, meglitinides, oral glucagon-like peptide-1 receptor agonists, dopamine agonists, bile acid sequestrants, etc. Insulin is an injectable preparation used to manage diabetes mellitus [12].

Various pharmacoeconomic studies have shown that pharmacotherapy for hypertension and diabetes mellitus is beneficial and cost-effective. Obviously and practically speaking, medication treatment of hypertension and diabetes mellitus is far more beneficial and effective than not treating them at all. The treatment results in a good clinical outcome, prevents complications, and offers a favourable prognosis [13, 14].

Several factors, both intrinsic and extrinsic, influence the cost variation of antihypertensive and antidiabetic medicines. In general, some of the factors include the use of branded or generic drugs, the blood pressure level of the patients in question, age of the patients, comorbidity status of the patients drug dosage forms, insurance coverage, effects of fixed dose combination drugs, market competition among generic brands government regulations and policies, varying prices among different pharmacies and the bargaining power of the patients or clients [15-17].

Antihypertensive therapy encompasses several drug classes, including diuretics, calcium channel blockers, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, beta-blockers, and centrally acting agents. Similarly, diabetes management involves oral hypoglycemic agents—such as biguanides, sulfonylureas, DPP-4 inhibitors, SGLT2 inhibitors—and injectable therapies, notably insulin. The availability of multiple brands and generic versions creates a wide price spectrum, often without a clear correlation to therapeutic advantage.

Previous pharmacoeconomic studies have demonstrated that generic medicines provide equivalent clinical outcomes at significantly lower cost than branded products. Nonetheless, price variation persists due to factors such as import dependence, currency fluctuations, market competition, supply chain inefficiencies, regulatory gaps, and differential pricing strategies. In Nigeria, over 70% of medicines are imported or rely heavily on imported raw materials, making medicine prices highly sensitive to exchange rate instability.

This study, therefore, aimed to evaluate the availability and cost variation of commonly used antihypertensive and antidiabetic medicines in

North-Central Nigeria, comparing generic, branded, and international reference prices, with a view to informing policy and practice on medicine affordability and access.

METHODS

Study Design and Setting. A cross-sectional descriptive study was conducted across selected urban and rural areas of North-Central Nigeria. Forty pharmacy premises, including community pharmacies and hospital-based outlets, were purposively sampled based on accessibility and service volume.

Data Collection. Data were collected using a pretested structured questionnaire and a medicine price collection form. Information obtained included pharmacy characteristics, availability of medicines, dosage forms, strengths, and unit prices for generic and branded products. Researchers obtained international reference prices from the International Medical Products Price Guide and the Nigerian National Health Insurance Scheme price list. They adjusted them for exchange rates and the consumer price index.

Data Analysis. Data were analysed using IBM SPSS version 20. The researchers used descriptive statistics to summarise availability and price data. They computed mean prices, standard deviations, and comparative price ratios, and applied chi-square tests to assess differences in availability, setting $p < 0.05$ as the threshold for statistical significance.

RESULTS AND DISCUSSION

Antihypertensive medicines were significantly more available across pharmacy premises than antidiabetic medicines. The majority of outlets were licensed, pharmacist-owned, and located in urban areas, reflecting the concentration of pharmaceutical services in cities.

Price analysis revealed marked variation between generic, branded, and international reference prices. For antihypertensive medicines, branded products were consistently more expensive than generics, sometimes by several-fold. In contrast, international reference prices for certain agents—particularly newer or less commonly stocked medicines—were higher than both local generic and branded prices.

Among antidiabetic medicines, oral agents such as metformin, sulfonylureas, and selected newer agents showed relatively small price differences between branded and generic products. However, insulin preparations exhibited substantial price disparities, with branded insulin being markedly more expensive than generic equivalents and international reference prices.

Table 1 – Characteristics of the Pharmacy Premises Studied, N = 40

Variables	n (%)	χ^2 (df)	p - value
Premises Licensure			
Licensed	39 (97.5)	36.1 (1.0)	0.000*
Not Licensed	1 (2.5)		
Total	40 (100.0)		
Premises Location			
Urban	34 (85.0)	19.6 (1.0)	0.000*
Rural	6 (15.0)		
Total	40 (100.0)		
Premises Ownership			
Pharmacist	31 (77.5)	12.1 (1.0)	0.001*
Non-Pharmacist	9 (22.5)		
Total	40 (100.0)		
Pharmacist Availability			
Pharmacist Available	36 (90.0)	25.6 (1.0)	0.000*
Pharmacist Not Available	4 (10.0)		
Total	40 (100.0)		
Medicines Studied			
Antihypertensives	28 (65.1)	3.93 (1)	0.047*
Antidiabetics	15 (34.9)		
Total	43 (100.0)		

Notes: χ^2 = chi square; df = degree of freedom; * significant difference within the variable distribution at $p<0.05$

Table 2 – Availability of Medicines in Each Pharmacy Premise Evaluated, N = 1,720

Variable	Availability – n (%)			χ^2 (df)	p-value
	Ads N = 15	Ahs N =28	Overall N = 43		
Lenardy Pharmacy, Akwanga	9 (60.0)	22 (78.6)	31 (72.1)	1.7 (1)	0.196
Dilimi Central Pharmacy, Jos	7 (46.7)	22 (78.6)	29 (67.4)	4.5 (1)	0.033*
Bishop Murray	6 (40.0)	22 (78.6)	28 (65.1)	6.4 (1)	0.011*
Luis Chuks	7 (46.7)	21 (75.0)	28 (65.1)	3.5 (1)	0.063
Galaxy Abuja	7 (46.7)	20 (71.4)	27 (62.8)	2.6 (1)	0.109
Ghali, Jos	8 (53.3)	19 (67.9)	27 (62.8)	0.9 (1)	0.348
Kauthar, Juth	7 (46.7)	20 (71.4)	27 (62.8)	2.6 (1)	0.109
Westside Pharmacy, Lafia	5 (33.3)	22 (78.6)	27 (62.8)	8.6 (1)	0.003*
Benjonalson, Keffi 1	8 (53.3)	17 (60.7)	25 (58.1)	0.2 (1)	0.64
FMC, Keffi	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
Honey Deryl, Lafia	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
Hybrid Pharmacy, Jos	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
Lamed, Jos	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
Lamed, Lafia	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
Nanka	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
Top Ten, Lafia	7 (46.7)	17 (60.7)	24 (55.8)	0.8 (1)	0.377
M&B Abuja	6 (40.0)	17 (60.7)	23 (53.5)	1.7 (1)	0.194
Bakankizo	7 (46.7)	16 (57.1)	23 (53.5)	0.4 (1)	0.512
DASH Lafia	6 (40.0)	17 (60.7)	23 (53.5)	1.7 (1)	0.194
Gerald Pharmacy, Akwanga	4 (26.7)	19 (67.9)	23 (53.5)	6.7 (1)	0.010*
Horsepower	6 (40.0)	17 (60.7)	23 (53.5)	1.7 (1)	0.194
Minaco	6 (40.0)	17 (60.7)	23 (53.5)	1.7 (1)	0.194
Noble, Lafia	6 (40.0)	17 (60.7)	23 (53.5)	1.7 (1)	0.194
Obiano Pharmacy, Akwanga	5 (33.3)	18 (64.3)	23 (53.5)	3.8 (1)	0.052
Porters, Lafia	6 (40.0)	17 (60.7)	23 (53.5)	1.7 (1)	0.194
Cliff, Akwanga	6 (40.0)	16 (57.1)	22 (51.2)	1.1 (1)	0.284
Cubic, Jos	6 (40.0)	16 (57.1)	22 (51.2)	1.1 (1)	0.284
Emerald, Abuja	6 (40.0)	16 (57.1)	22 (51.2)	1.1 (1)	0.284
Faryah, Jos	5 (33.3)	17 (60.7)	22 (51.2)	2.9 (1)	0.087
Royal, Abuja	6 (40.0)	16 (57.1)	22 (51.2)	1.1 (1)	0.284
Celex Collins	6 (40.0)	15 (53.6)	21 (48.8)	0.7 (1)	0.396
ECWA Central, Jos	6 (40.0)	15 (53.6)	21 (48.8)	0.7 (1)	0.396
Hanka Pharmacy, Jos	6 (40.0)	15 (53.6)	21 (48.8)	0.7 (1)	0.396
Be Healed, Keffi	3 (20.0)	17 (60.7)	20 (46.5)	2.9 (1)	0.087
Ben G, Lafia	5 (33.3)	15 (53.6)	20 (46.5)	1.6 (1)	0.205
Bencare	4 (26.7)	16 (57.1)	20 (46.5)	3.6 (1)	0.056
First Millennium, Abuja	5 (33.3)	15 (53.6)	20 (46.5)	1.6 (1)	0.205
Liyah Pharmacy	5 (33.3)	15 (53.6)	20 (46.5)	1.6 (1)	0.205
Divine Health	3 (20.0)	16 (57.1)	19 (44.2)	5.5 (1)	0.019*
CMS, Jos	1 (6.7)	5 (17.9)	06 (14.0)	1.0 (1)	0.313
Total	240 (40.0)	684 (61.1)	924 (53.7)	69.8 (1)	0.000*

Notes: ADs = Antidiabetics; AHs = Antihypertensives; χ^2 = chi-square; df = degree of freedom; * significance difference between the availability of ADs and AHs in the premises.

Table 4 – Unit prices of the medicines available in the pharmacy premises

Medicine Name	Generic Unit Price*		Branded Unit Price*		Reference Price*
	n	Mean ± SD	n	Mean ± SD	
Antidiabetics					
Acarbose 25mg	1	318.7	1	318.7	318.7
Dapagliflozin 5mg	1	6,911.10	1	6,911.10	6,911.10
Glibenclamide 5mg	39	7.7±7.7	1	4.1	4.1
Gliclazide 30mg	1	23.4	1	23.4	23.36
Glimepiride 2mg	37	34.7±13.4	1	6.3	6.25
Glipizide 5mg	5	24.0±42.4	2	75.0±35.3	99.91
Glyburide 5mg	37	14.8±28.7	1	183.2	183.24
Insulin (soluble 40IU)	37	3,463.9±1,102.8	25	6,066.6±1,517.7	163.88
Linagliptin 5mg	1	592.4	1	592.4	592.38
Metformin 500mg	39	15.5±24.9	22	82.1±40.2	150.5
Nateglinide 60mg	24	39.2±123.4	1	609.8	609.76
Pioglitazone 15mg	28	50.3±28.0	16	104.7±21.0	150.5
Repaglinide 0.5mg	1	900.8	1	900.8	900.81
Repaglinide 1mg	5	240.1±497.7	1	1,130.30	1,130.26
Sitagliptin 25mg	2	3,829.3±5,408.3	1	7,653.50	7,653.55
Antihypertensives					
Amlodipine 5mg	37	8.3±5.4	26	35.4±14.8	11.36
Atenolol 100mg	38	9.8±6.8	31	24.4±2.9	12.79
Bisoprolol 5mg	5	12.4±4.3	0		65.55
Captopril 25mg	39	19.3±7.3	0		17.68
Carvedilol 25mg	7	5.7±1.9	0		31.55
Clonidine 0.1mg	6	45.8±2.0	0		108.6
Elanapril 10mg	31	21.1±3.2	0		3.18
Furosemide 40mg	40	1.1±0.3	35	9.0±0.0	4.38
Hydralazine 20mg Amp	39	29.2±10.5	0		2,772.81
Hydrochlorothiazide 25mg	40	4.8±0.7	1	30	3.09
Labetalol 5mg	32	2.3±1.1	0		16.17
Lisinopril 5mg	40	19.6±6.1	29	41.6±4.5	2.19
Losartan 25mg	39	16.8±6.4	0		82.73
Methyldopa 250mg	39	31.9±9.7	32	85.0±9.5	23.29
Metoprolol 25mg	2	2.0±0.0	0		31.91
Moduretic 50mg	39	16.8±3.9	36	64.0±10.5	16.13
Nifedipine 10mg	39	6.9±7.2	21	43.1±6.6	8.77
Olmesartan 5mg	2	50.0±0.0	0		1,532.29
Perindopril 2mg	0		0		589.62
Prazosin 2mg	37	23.5±7.4	37	1.0±0.0	53.75
Propranolol 10mg	39	4.0±2.1	34	20.0±0.0	26.23
Ramipril 5mg	6	17.3±8.7	0		442.31
Spironolactone 25mg	40	1.1±0.2	7	14.1±0.4	29.11
Telmisartan 40mg	0		0		279.5
Timolol 0.25%	0		0		173.65
Torasemide 5mg	1	50	0		315.54
Valsartan 80mg	8	38.3±4.8	0		365.5
Verapamil 100mg	38	39.0±44.1	0		29.68
Acarbose 25mg	1	318.7	1	318.7	318.7

Notes: *prices estimated in Nigerian Naira (NGN) (1 USD = 395 NGN as at 21/01/2021); Reference Price = price based on the International Medical Products Price Guide and the Nigerian National Health Insurance Scheme (NHIS) price list, adjusted for exchange rate and consumer price index (CPI); n = number of pharmacy premises having the medicine in stock, whose prices were used out of the 40 pharmacy premises evaluated; SD = standard deviation.

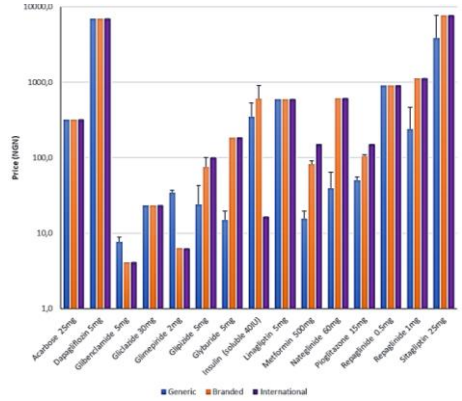

Figure 1 – Comparison of the prices of antidiabetic medicines with the international reference prices

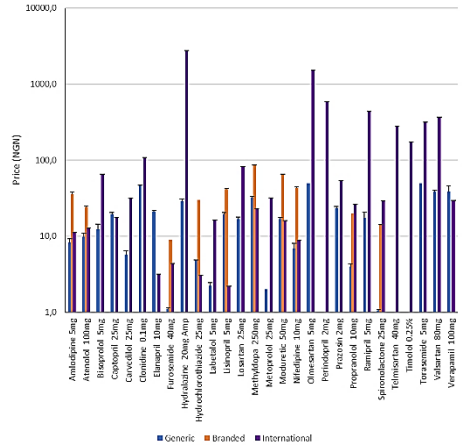

Figure 2 – Comparison of the prices of antihypertensive medicines with the international reference prices

This study demonstrates significant cost variation in antihypertensive and antidiabetic medicines in North-Central Nigeria, with important implications for access, adherence, and long-term disease control. The higher availability of antihypertensive medicines compared with antidiabetics may reflect prescribing patterns, higher diagnosis rates, and supply chain prioritisation of cardiovascular medicines. Studies across low- and middle-income countries (LMICs) report similar findings, showing that health facilities more consistently stock essential cardiovascular medicines than diabetes medicines [4, 17].

The observation that branded antihypertensive medicines were consistently more expensive than their generic counterparts aligns with extensive pharmacoeconomic evidence demonstrating that generic medicines offer comparable efficacy and safety at substantially lower cost [18, 19]. Despite this evidence, continued preference for branded medicines by both prescribers and patients—often driven by perceptions of superior quality—contributes to sustained price differentials and increased out-of-pocket expenditure.

The relatively narrow price differences observed among oral antidiabetic medicines may be attributed to increased market competition, wider availability of generics, and inclusion of some agents in essential medicines and insurance formularies [15, 16]. However, the markedly higher prices of branded insulin preparations are particularly concerning. Insulin is a life-saving medicine for many individuals with diabetes, and its high cost has been identified globally as a major barrier to access, especially in LMICs [20, 21]. In Nigeria, reliance on imported insulin, cold-chain logistics, and limited local manufacturing capacity likely exacerbate price inflation.

The finding that international reference prices exceeded local prices for several antihypertensive agents highlights the influence of macroeconomic instability and exchange rate fluctuations. Nigeria's pharmaceutical sector is heavily import-dependent, rendering medicine prices highly sensitive to currency devaluation and inflationary pressures [22, 23]. These economic dynamics contribute to price volatility and uncertainty for both suppliers and patients.

High medical costs consistently lead to poor adherence, treatment interruptions, and a higher risk of disease complications, ultimately increasing healthcare costs and societal burden [8, 14]. Strengthening medicine price regulation, promoting generic prescribing, expanding health insurance coverage, and supporting local pharmaceutical production are therefore critical strategies for improving affordability and achieving universal health coverage goals.

CONCLUSIONS

There is substantial cost variation among antihypertensive and antidiabetic medicines in North-Central Nigeria. Generic antihypertensive medicines are generally more affordable than branded products, while oral antidiabetic medicines show relatively limited price variation. In contrast, branded insulin preparations remain significantly more expensive, posing a major barrier to access and sustained diabetes management. Policy interventions focused on generic substitution, price transparency, and local manufacturing are urgently needed to enhance the affordability of medicines and improve health outcomes.

Recommendations

1) Promotion of generic prescribing and substitution through policy and professional education.

2) Strengthening of medicine price regulation and routine market surveillance.

3) Expansion of health insurance coverage to reduce out-of-pocket expenditure.

4) Support for local pharmaceutical manufacturing to reduce dependence on imports.

Ethical Considerations

The researchers obtained ethical approval for this study from the relevant institutional ethics committees at Plateau Specialist Hospital, Jos, Nigeria (NHREC/09/23/20106); Federal Medical Centre, Keffi, Nigeria (NHREC/21/12/2012) and Jos University Teaching Hospital, Nigeria (JUTH/DCS/ADM/127/XXV/016). The study was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent requirements were waived, as the study involved price and availability data collected on pharmacy premises, in line with approved protocols.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgements

The authors gratefully acknowledge the management and staff of the participating pharmacy premises, Plateau Specialist Hospital, Jos; Federal Medical Centre, Keffi; Jos University Teaching Hospital; and the Centre of Excellence in Phytomedicines Research and Development, University of Jos, for their cooperation and support during data collection.

REFERENCES

1. Kumar, V., Agarwal, S., Saboo, B., & Makkar, B. (2022). RSSDI Guidelines for the management of hypertension in patients with diabetes mellitus. *International Journal of Diabetes in Developing Countries, 42*(4), 576–605. doi: 10.1007/s13410-022-01143-7

2. Song, Z., Kennedy, P. G., Liew, F. J., & Schilling, J. S. (2016). Fungal endophytes as priority colonisers initiating wood decomposition. *Functional Ecology, 31*(2), 407–418. doi: 10.1111/1365-2435.12735

3. Venkateswaramurthy, N., Krishnaveni, K., Freeda, M., R., & Kumar, S. R. (2016). Assessment of Potential Drug–Drug Interaction in Stroke Patients. *International Journal of Pharmacy and Pharmaceutical Sciences, 8*(12), 221. doi: 10.22159/ijpps.2016v8i12.13878

4. Chow, C. K. (2013). Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in High-, Middle-, and Low-Income countries. *JAMA, 310*(9), 959. doi: 10.1001/jama.2013.184182

5. Ibrahim, M. M. (2018). Hypertension in developing countries: a major challenge for the future. *Current Hypertension Reports, 20*(5). doi: 10.1007/s11906-018-0839-1

6. Correa-Gallegos, D., Jiang, D., & Rinkevich, Y. (2021). Fibroblasts as confederates of the immune system. *Immunological Reviews, 302*(1), 147–162. doi: 10.1111/imr.12972

7. Naseri, K., Aliashrafzadeh, H., Otadi, M., Ebrahimzadeh, F., Badfar, H., & Alipourfard, I. (2022). Human Responses in Public Health emergencies for Infectious disease control: An Overview of controlled topologies for biomedical applications. *Contrast Media & Molecular Imaging*, (1), 6324462. doi: 10.1155/2022/6324462

8. Balu, S., & Thomasiii, J. (2006). Incremental expenditure of treating hypertension in the United States. *American Journal of Hypertension, 19*(8), 810–816. doi: 10.1016/j.amjhyper.2005.12.013

9. Trogdon, J. G., Finkelstein, E. A., Feagan, C. W., & Cohen, J. W. (2011). State- and Payer-Specific estimates of annual medical expenditures attributable to obesity. *Obesity, 20*(1), 214–220. doi: 10.1038/oby.2011.169

10. Wang, J., Shen, J., Wu, Y., Tu, C., Soininen, J., Stegen, J. C., He, J., Liu, X., Zhang, L., & Zhang, E. (2013). Phylogenetic beta diversity in bacterial assemblages across ecosystems: deterministic versus stochastic processes. *The ISME Journal, 7*(7), 1310–1321. doi: 10.1038/ismej.2013.30

11. Zhang, Q., Wu, X., Fan, Y., Jiang, P., Zhao, Y., Yang, Y., Han, S., Xu, B., Chen, B., Han, J., Sun, M., Zhao, G., Xiao, Z., Hu, Y., & Dai, J. (2021). Single-cell analysis reveals dynamic changes of neural cells in the developing human spinal cord. *EMBO Reports, 22*(11), e52728. doi: 10.15252/embr.202152728

12. Feingold, K. R. (2000). Dyslipidemia in Patients with Diabetes. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK305900/

13. Ogaji, J. I., & Alawode, A. O. (2014). Capacity utilisation in the pharmaceutical industry in Nigeria. *Pharmaceutical Regulatory Affairs Open Access, 3*(2). doi: 10.4172/2167-7689.1000121

14. Shahu, A., Herrin, J., Dhruva, S. S., Desai, N. R., Davis, B. R., Krumholz, H. M., & Spatz, E. S. (2019). Disparities in socioeconomic context and association with blood pressure control and cardiovascular outcomes in ALLHAT. *Journal of the American Heart Association, 8*(15), e012277. doi: 10.1161/jaha.119.012277

15. Mandal, M., Mandal, S., & Das, S. (2007). A critical study on availability and price variation between different brands: Impact on access to medicines. *Indian Journal of Pharmaceutical Sciences, 69*(1), 160. doi: 10.4103/0250-474x.32139

16. Lee, K. S., Kassab, Y. W., Taha, N. A., & Zainal, Z. A. (2020). Factors impacting pharmaceutical prices and affordability: Narrative review. *Pharmacy, 9*(1), 1. doi: 10.3390/pharmacy9010001

17. Lotfizadeh, A., Palafox, B., Takallou, A., Balabanova, D., McKee, M., & Murphy, A. (2022). Factors associated with the availability and affordability of essential cardiovascular disease medicines in low- and middle-income countries: A systematic review. *PLOS Global Public Health, 2*(3), e0000072. doi: 10.1371/journal.pgph.0000072

18. Cooper-DeHoff, R. M., & Elliott, W. J. (2013). Generic drugs for hypertension: Are they really equivalent? *Current Hypertension Reports, 15*(4), 340–345. doi: 10.1007/s11906-013-0353-4

19. Kotwani, A., Singal, G., & Nanda, A. (2011). A comparative evaluation of the price and quality of some branded versus generic medicines of the same manufacturer in India. *Indian Journal of Pharmacology, 43*(2), 131. doi: 10.4103/0253-7613.77344

20. Beran, D., Hirsch, I. B., & Yudkin, J. S. (2018). Why are we failing to address insulin access? a national and global perspective. *Diabetes Care, 41*(6), 1125–1131. doi: 10.2337/dc17-2123

21. World Health Organisation. (2021). The WHO Global Diabetes Compact. Retrieved from https://www.who.int/initiatives/the-who-global-diabetes-compact

22. Fatokun, O. (2020). Fostering local production of essential medicines in Nigeria. *Bulletin of the World Health Organisation, 98*(7), 507–508. doi: 10.2471/blt.19.249508

23. Woldie, G. A., & Siddig, K. (2019). Macroeconomic and distributional impacts of exchange rate devaluation in Ethiopia: A computable general equilibrium approach. *Heliyon, 5*(12), e02984. doi: 10.1016/j.heliyon.2019.e02984