The Direct Cost and Pattern of Anti-Diabetic Therapy among Patients in a Teaching Hospital in a Resource-Poor Setting

Adesoye OO[1]*, Oyibo PG[1-3], Adesoye FT[4], Ntaji MI[1,2] and Adesoye O[5]

[1]Delta State University Teaching Hospital, Nigeria
[2]Delta State University Abraka, Nigeria
[3]City University of London, United Kingdom
[4]University of Benin Teaching Hospital, Nigeria
[5]Babcock University Teaching Hospital, Nigeria

*Corresponding authors: Oluwaseun Opeyemi Adesoye, Department of Community Medicine, Delta State University Teaching Hospital, Oghara-Otefe road, off Benin-Warri road, p.o box 07, Nigeria, Tel: 08051022457; Email: adesoyeopeyemi7@gmail.com

Abstract

Background: Diabetes Mellitus is a prevalent disease in Sub-Saharan Africa with debilitating effects on health and socio-economic activities. Payment for health services, such as medications to manage the ailment, remains challenging and worsens a household's access to care. The study's objectives were to determine the direct medical cost of anti-diabetic medications and drug utilization patterns amongst out-patients seeking diabetic care in a tertiary health facility.

Methods: A cross-sectional study was conducted among 104 respondents at the endocrinology unit of Delta State University Teaching Hospital, Oghara, from Jul 14 to Nov 30, 2022. The monthly expenditures (total and mean) for drug payments were assessed. The drug prescription pattern was similarly evaluated.

Results: The total and mean costs for anti-diabetic medications were N1, 576, 458/ $3,608.69 and N7, 436.07/ $17.02 per month, respectively. All respondents paid out-of-pocket for the drugs provided. The majority of respondents were prescribed metformin.

Conclusion: The mean cost of drug treatment of diabetes mellitus amongst respondents at the facility was high and unsustainable, given the economic conditions. Health subsidies in alignment with community-based contributory health insurance will protect the vulnerable financially and improve access to anti-diabetic care.

Keywords: Direct Medical Cost; Type 2 Diabetes Mellitus; Antidiabetic Drugs; Prescribing Pattern; Drug Utilization; Resource-Poor Setting

Abbreviations: DM: Diabetes Mellitus; ADA: American Diabetes Association; ESC: European Society of Cardiology.

Introduction

Diabetes mellitus (DM), a prevalent and chronic metabolic disease, is one of the most significant challenges healthcare systems face globally, especially in Nigeria, where the standard of living and quality of life are low [1]. All age groups are impacted, with a male preponderance, and the majority over 65. Type 2 DM, due to insulin resistance or insufficient production, is commoner [2]. Globally, an estimated 537 million persons aged 20-79 years, accounting for approximately one in ten individuals, are affected by DM,

with this figure expected to rise to about 783 million by 2045 [3]. The disease was said to have contributed to 6.7 million deaths in 2021 alone [3].

Diabetes Mellitus causes a significant burden on society vis-à-vis increased frequent hospital visitations, medical care costs, premature death, productivity losses, and reduced quality of life [2,4]. The illness imposes significant financial burdens on the patient, their families, and the public healthcare system because it is a lifelong condition with severe, disabling effects [1,5]. The patients' direct medical cost is linked with money expended on consultation, investigations and treatment within the health system [6].

The management of DM depends on its severity and duration to lower the risks of complications, which, according to the American Diabetes Association (ADA) and the European Society of Cardiology (ESC) guidelines widely used for the management of DM [7]. Physical exercise and dietary modifications are the first line of treatment, before considering drugs when there are poorly regulated glucose levels in the blood [7-9]. These drugs, including insulin, also have different mechanisms of action to maintain and optimize glycemic control [7,10]. Individuals on anti-diabetic drugs are also placed on it for life, which, in a sense, could be either cumulatively or singly expensive. Due to the chronicity of the illness, a substantial financial liability is imposed on households on treatment costs managing this ailment [11].

There is a paucity of studies within the geographical region in which the study assessed treatment costs and the prescribing pattern of anti-diabetic agents due to the availability of newer drugs for treatment in the market. Based on this background, the study examined the abovementioned objectives among out-patients attending an endocrine clinic in a tertiary health facility in South-Southern Nigeria.

Materials and Methods

A cross-sectional design was adopted for the study. A prevalence-based, 'cost-of-illness' study (a descriptive economic evaluation method) using the micro-cost estimation method was used to calculate the direct cost of diabetic care medications.

Setting

The study was conducted in the Endocrinology Unit of the Delta State University Teaching Hospital Oghara, South-South Nigeria, a 180-bed tertiary hospital providing medical care in over 20 medical specialities and serving as a training and research institution. It is located in a semi-urban town.

Study Population

Adult DM patients with co-morbidities, such as hypertension and dyslipidaemia, attending the hospital's out-patient clinic within the last 12 months were included in the study, while pregnant women and critically ill patients were excluded.

Sample Strategy

The minimum sample size was calculated using the Cochrane formula for descriptive studies. A prevalence of 3.5% was used based on findings from a previous study in Nigeria among diabetic patients.1 Respondents were selected using a systematic sampling technique.

Data Collection

A structured pre-tested interviewer-administered questionnaire was used to elicit information about the socio-demographic characteristics, personal income, household income and welfare payments, illness history and co-morbidities, and healthcare-seeking episodes in which costs were incurred through illness visits, scheduled clinic follow-up visits, and laboratory/diagnostic visits. The unit cost per medication was obtained from the hospital pharmacy departments. The micro-cost estimation method was used to compute the cost component in managing the patients. The price of hypoglycemic agents was obtained by multiplying the unit cost of the drug by the dosage per day. The product was then multiplied by the frequency per month. After that, the total prescribed drugs were summed up to get the costs of the medications.

Costs were calculated in Naira (N) and converted to the US dollar equivalent for comparison with similar studies, with the exchange rate being one dollar to N436.85 when the study was conducted.

Data Analysis

Data was coded and analysed using the IBM SPSS version 23 (IBM Corporation, Armonk, NY, USA). The outcome variables of interest included the total direct cost and the average cost of medications for diabetic care per month. The variables were expressed as frequency and proportions, while tables were used to present the drug costs of diabetic care and the drug prescription pattern, respectively.

Results

Respondents who attended the DM clinic ranged from 18 to 93 years, with a mean age of 53.22 ± 13.07 years. Most

respondents (39.4%) were in the 50-59 age group, with males (54.8%) being the predominant gender. Most respondents were Christians (97.1%) and married (86.5%). More than half (56.7%) had completed tertiary education. About one-fifth (21.2%) of the respondents were civil servants, and all (100%) respondents paid out-of-pocket (Table 1).

Age Group (Years)	Frequency (%) (n=104)
Less than 30	2 (1.9)
30-39	19 (18.3)
40-49	20 (19.2)
50-59	41 (39.4)
60 and above	22 (21.2)
Mean age= 53.22 ± 13.07 years	
Gender	
Male	57 (54.8)
Female	47 (45.2)
Marital status	
Single	6 (5.8)
Married	90 (86.5)
Widowed	7 (6.7)
Cohabiting	1 (1.0)
Religion	
Christian	101 (97.1)
Islam	3 (2.9)
Educational status	
Tertiary	59 (56.7)
Secondary school	27 (26.0)
Primary school	17 (16.3)
None	1 (1.0)
Occupational category	
Unemployed	2 (1.9)
Trader/artisan	14 (13.5)
Employed in the private sector	14 (13.5)
Farmer	6 (5.8)
Civil servant	22 (21.2)
Big business	14 (13.5)
^Others	32 (31.0)

^Others (retirees, pensioners, housewives, self-employed)
Table 1: Socio-demographic characteristics of respondents.

About half (48.1%) of the respondents were diagnosed more than five years ago. Most (58.7%) were hypertensive; only one respondent had degenerative spine disease, while two-fifths (40.4%) did not have co-morbidities. All respondents (100.0%) visited the follow-up clinic once a month (Table 2).

Duration of Diagnosis (years)	Frequency (%) (n=104)
2-Jan	15 (14.4)
5-Mar	39 (37.5)
>5	50 (48.1)
Co-morbidities	
Hypertension	61 (58.7)
Degenerative spine disease	1 (1.0)
Nil	42 (40.4)
Clinic follow-up visits per month	
Once	104 (100.0)
Payment method	
Out-of-pocket	104 (100.0)
Health insurance	0 (0)

Table 2: Illness history of respondents.

The monthly costs of mixtard and glargine insulin were ₦374, 967/ $858.34 and ₦323, 451/ $740.41, respectively, among respondents, while the average costs of the former and latter were ₦74, 993.40/ $171.66 and ₦14, 063.08/ $32.19 monthly, respectively. Metformin, vildagliptine, and glibenclamide average costs were ₦2, 779.43/ $6.36, ₦13, 921.87/ $31. 86 and ₦613.63/ $1.40 monthly, respectively. The majority 23 (82.1%) of respondents on injectable were on glargine insulin, while a higher proportion, 71 (68.3%) of those on oral hypoglycemic agents, were on metformin, closely followed by glimepiride 34 (32.7%). The least of the respondents were on glibenclamide 11 (10.6%). The overall cost of hypoglycemic agents was ₦1, 576, 458.00/ $3, 608.69 (Table 3).

Most respondents used metformin 71 (68.3%) compared with other drugs, while the least prescribed medication was pregabalin and gabapentin 19 (18.3%). Slightly less than one-third, 32 (30.8%) of respondents were prescribed galvusmet, a combination of metformin and vildagliptin, and the average cost of this drug was (N13, 921.87/ $31.86). Of the prescribed medications, the average cost of daonil was N613.63/ $1.40, the least commonly prescribed (Table 3).

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Variable	Frequency (%)	Total costs (₦)	Average costs (₦)
*Insulin (n= 28)			
Mixtard	5 (17.9)	374, 967.00	74, 993.40
Lantus/Glargine	23 (82.1)	323, 451.00	14, 063.08
Total	28 (26.9)	698, 418.00	
*OHA (n= 104)			
Metformin/Glucophage	71 (68.2)	197, 340.00	2, 779.43
Galvusmet/Vildagliptine	32 (30.7)	445, 500.00	13, 921.87
Diamicron/Gliclazide	17 (16.3)	44, 100.00	2, 594.11
Daonil/Glibenclamide	11 (10.6)	6, 750.00	613.63
Glimepiride	34 (32.6)	121, 500.00	3, 573.52
#Others	19 (18.2)	62, 850.00	3, 307.89
Total		878, 040.00	
Overall costs		1, 576, 458.00	^7,436.07

*OHA: Oral Hypoglycaemic Agents | #Others include Gabapentin and Pregabalin | *Most patients were on polytherapy (insulin and OHA) | ^combined mean of medications.

Table 3: Drug costs for disease management incurred by DM patients monthly in DELSUTH, Oghara.

Discussion

Diabetes Mellitus is regarded as a debilitating non-communicable disease that exposes households to financial hardship and worsens their economic fortunes due to rising care costs. This study's preponderance of respondents was above 50 years, which is expected given that the epidemiology of type 2 DM commonly develops in the latter part of life and usually affects individuals in their fifth and sixth decades of life, as studies have shown [12-14]. Studies conducted in tertiary health facilities in Umuahia, Yenogoa, and Ghana reported similar findings regarding the predominant age group accessing care [1,15,16]. Nevertheless, in contrast to the results of this study, a higher disease burden was reported among individuals within the 36-44-year age group in referral facilities in Ethiopia and Thailand [17,18].

This variance amongst the study populations in our study and the latter could be attributed to these respondents having better self-awareness, health-seeking behaviours and presenting earlier at the health facilities than respondents in the current study. The onset of DM and its associated complications can be considerably delayed with early identification of at-risk persons and the immediate adoption of appropriate interventions, such as intentional weight loss, increasing physical activity, and improving medication adherence.

Fifty-seven males (54.8%) had a higher proportion of diabetes, as reported in our study. This is in support of other reports which have been documented elsewhere [1,14]. Men tend to store more of their fat in the abdomen as visceral fat than women, and this fat storage over time is typically linked to insulin resistance, leading to glucose intolerance and type 2 DM, which may explain this observation. On the other hand, women have more subcutaneous and peripheral fat storage, which correlates with insulin sensitivity and protection against type 2 DM. Women, nonetheless, have been reported in other studies to be a majority suffering from DM, which is inconsistent with the report of this study and may have been due to clinico-demographic and study design variants [13,19,20].

Respondents in this study with hypertension (58.7%) were predominant among those with other intercurrent disorders, although less than reported in a study in Ghana (63.7%) and in Ogbomosho (60.5%) [13,21]. This is plausible as hypertension is a well-known co-morbidity with the development of DM and vice-versa. This result implies that apart from monies spent on anti-diabetic medications, more household earnings will be expended on drugs, reducing spending on other basic needs at home.

Our study found drug costs in managing DM to be high and consistent with other study findings among their study population [13]. The reason for this is unclear but may be related to the high cost of brands of drugs being prescribed by the clinician due to effectiveness and the need to optimize the glycemic levels of their respective patients. Another reason may be that the cheaper ones like Daonil, which had a total cost of ₦6, 750/ $15.45 and an average cost of ₦613.63/ $1.40 among the eleven patients being treated for DM, may

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not be well tolerated by the entire population of interest. It is also well-established that Daonil results in rapid hypoglycemia, hence the caution with use in most patients.

The prescription pattern revealed metformin (biguanides) as monotherapy or combination therapy frequently prescribed in almost 7 in 10 respondents. This was followed by glimepiride (sulfonylurea) (32.6%). Reasons may not be unrelated to the fact that the drug is considered the drug of choice for initial treatment of type 2 DM, to being preferable or better tolerated by patients, the patient's clinical characteristics, or the duration of treatment. This study's finding is consistent with prior studies which reported a similar result of metformin being the most frequently prescribed drug at the endocrine clinics [7,22-25]. Only more than one-fourth (26.9%) of respondents were placed on insulin as stand-alone or supportive therapy in this study, slightly lower than that recorded in another study (27.7%) [26]. This is possible, considering the patients were treated for type 2 DM, not type 1 DM, which depends entirely on insulin. However, Uwakwe, et al. [14] reported an even lower prevalence (13.3%) among a similar population of interest in a tertiary facility in Jos, Nigeria [14].

All one hundred and four respondents (100.0%) paid out-of-pocket to purchase their medication, which is alarming, bearing in mind the high total and average costs of hypoglycemic agents documented for this study. This finding demonstrates that there were no forms of health insurance to cushion this unfair access to diabetic care. An explanation may be that respondents failed to avail themselves of the opportunity to register for the state's health insurance program, which is well-advocated and advertised in the entire state. Developing countries are also known for not implementing health insurance for the citizenry compared to developed countries [27-29]. To corroborate our study findings, all patients on diabetic treatment in other studies in Nigeria similarly paid out-of-pocket to access care [15,20,30]. This form of payment, in the long run, predisposes such an individual and, by extension, the household to catastrophic expenditure where crucial needs of the family such as food, shelter and clothing will not be met.

Conclusion

The overarching goal of DM management is to prevent target organ damage and other attendant problems by achieving optimal glycemic control with the rational prescription of hypoglycemic medications. This study has demonstrated the high cost of treatment of diabetes and has shown that metformin was the frequently prescribed drug. This study provides evidence for policy guidelines towards implementing community-based health insurance programmes, which cannot be overemphasized to enable the underserved to access diabetic care.

Conflict of Interest: None declared

Contribution of Authors

OOA, PGO – were involved in the conceptualization of the study
OOA- wrote the proposal, participated in the data collection process, data analysis and drafted the manuscript
MIN, FTA, OA- drafted the manuscript
All authors read and approved the manuscript

References

1. Suleiman IA, Festus JA (2015) Cost of illness among diabetes mellitus patients in Niger Delta, Nigeria. J Pharm Heal Serv Res 6(1): 53-60.

2. World Health Organization (2022) Diabetes.

3. International Diabetes Federation (2021) IDF Diabetes Atlas. 10th (Edn.).

4. Yang W, Dall TM, Beronjia K, Lin J, Semilla AP, et al. (2018) Economic costs of diabetes in the U.S. in 2017. Diabetes Care 41(5): 917-928.

5. Ijoma U, Onyeka T, Onyeka TI, Nwatu C, Onyekonwu CL, et al. (2019) Health-related quality of life in people with chronic disease managed in a low-resource setting- A study from South East Nigeria. Niger J Clin Pract 22(9): 1180-1188.

6. Zawudie AB, Daka DW, Teshome D, Ergiba MS (2022) Economic Burden of Diabetic Mellitus Among Patients on Follow-up Care in Hospitals of Southwest Shewa Zone, Central Ethiopia. BMC Health Serv Res 22(1398): 1-15.

7. Lorenzati B, Zucco C, Miglietta S, Lamberti F, Bruno G (2010) Oral Hypoglycemic Drugs: Pathophysiological Basis of Their Mechanism of Action. Pharm 3(9): 3005-3020.

8. Worth J, Soran H (2007) Is there a role for low carbohydrate diet management of Type 2 Diabetes. QJM An Int J Med 100(10): 659-663.

9. Colberg SR, Sigal RJ, Fernhall B, Regensteiner JG, Blissmer BJ, et al. (2010) Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association: joint position statement. Diabetes Care 33(12): 147-167.

10. Agarwal AA, Jadhav PR, Deshmukh YA (2014) Prescribing pattern and efficacy of anti-diabetic drugs in maintaining optimal glycemic levels in diabetic patients. J Basic Clin Pharm 5(3): 79-83.

11. Ochei O, Oyibo P, Adesoye O, Agbajor S, Agboro O, et al. (2020) Direct Medical Cost of Diabetes Mellitus in a Teaching Hospital in South-South Nigeria. Niger Res J Clin Sci 10(2): 80-87.

12. Ifejika U, Onwuchuluba E, Ogbonna B (2020) Cost of Burden of Type 2 Diabetes in a Tertiary Hospital in South West Nigeria: A Cost of Illness Analysis. Value Heal 23(1): 110-111.

13. Fadare J, Olamoyegun M, Gbadegesin B (2015) Medication Adherence and Direct Treatment Cost among Diabetes Patients Attending a Tertiary Healthcare Facility in Ogbomosho, Nigeria. Malawi Med J 27(2): 66-70.

14. Uwakwe JN, Agboghoroma OF, Akanbi FO, Odoh OF, Puepet FH (2015) Pattern of Anti diabetic Drug Prescription at a Health Facility in Jos North Central Nigeria. Jos J Med 9(1): 59-62.

15. Okoronkwo IL, Ekpemiro JN, Onwujekwe OE, Nwaneri AC, Iheanacho PN (2016) Socio-economic inequities and payment coping mechanisms used in the treatment of type 2 diabetes mellitus in Nigeria. Niger J Clin Pract 19(1): 104-109.

16. Quaye EA, Amporful EO, Akweongo P, Aikins MK (2015) Analysis of the Financial Cost of Diabetes Mellitus in Four Cocoa Clinics of Ghana. Value Heal Reg Issues 7: 49-53.

17. Abrha S, Dinda SC, Demeke B, Assen A, Yilma Z, et al. (2014) Pharmacoeconomic Evaluation of Anti Diabetic Treatment at Ayder Referral Hospital, Mekelle, Ethiopia. Int J Pharm Sci 25(1): 47-52.

18. Alemu Z, Workneh BD, Mohammed SA, Workneh M (2020) Economic Assessment of Direct Cost of Illness of Diabetes Mellitus at Dessie Referral Hospital, North East Ethiopia. Int J Diabetes Clin Res 7(2): 1-8.

19. Chukwu BN, Ezebuiro VO, Samue ES, Nwachukwu K (2013) Gender Differential in the Incidence of Diabetes Mellitus among the Patients in Udi Local Government Area of Enugu State, Nigeria. Mediterr J Soc Sci 4(8): 131-138.

20. Ogbera AO, Kuku SF (2012) Insulin use, prescription patterns, regimens and costs-a narrative from a developing country. Diabetol Metab Syndr 4(1): 1-50.

21. Sefah IA, Okotah A, Afriyie DK, Amponsah SK (2020) Adherence to Oral Hypoglycemic Drugs among Type 2 Diabetic Patients in a Resource-Poor Setting. Int J Appl Basic Med Res 10(2): 102-109.

22. Kakade A, Mohanty IR, Rai S (2017) Assessment of Prescription Pattern of Antidiabetic Drugs in the Out-patient Department of a Tertiary Care Hospital. Int J Clin Endocrinol Metab 3(1): 1-7.

23. Moayad A, Ahmad K, Akrm A, Sultan F, Majid Ali, et al. (2022) Prescribing patterns of antidiabetics in type 2 diabetes and factors affecting them. Saudi Pharm J 30(2): 112-119.

24. Ethiraj D, Amit D, Rajbharm Y, Anil B, Pramil T (2013) Prescribing pattern of antidiabetic drugs and achievement of glycemic control in T2DM patients tertiary care hospital in North India. Int J Diabetes Dev Ctries 33: 140-146.

25. Hassan Y, Mathialagan A, Awaisu A, Aziz NA, Yahaya R, et al. (2009) Trend in the use of oral hypoglycemic agents in an out-patient pharmacy department of tertiary care hospital in Malaysia (2003-2006). Asian J Pharm Clin Res 2(2): 40-46.

26. Kalpana T, Manisha B, Ravi K, Shailendra S (2022) Prescribing pattern of anti-diabetic drugs and adherence to the American Diabetes Association's (ADA) 2021 treatment guidelines among patients of type 2 diabetes mellitus: A cross-sectional study. J Fam Med Prim Care 11(10): 6159-6164.

27. Lee S, Brown S, Bennet A (2021) The relationship between insurance and health outcomes of diabetes mellitus patients in Maryland: a retrospective archival record study. BMC Health Serv Res 21(495): 1-10.

28. Chapman D, Foxtrot R, Dale-Harris L, Ronte H, Bidgoli F, et al. (2019) Insights for Care: The Healthcare Utilisation and Cost Impact of Managing Type 2 Diabetes-Associated Microvascular Complications. Diabetes Ther 10(2): 575-585.

29. Casagrande S, Cowie C (2012) Health Insurance Coverage Among People With and Without Diabetes in the U.S. Adult Population. Diabetes Care 35(11): 2243-2249.

30. Ipingbemi AE, Erhun WO (2019) Cost of associated hospitalization of non-adherent type 2 diabetes patients in a tertiary healthcare facility in Ibadan, Nigeria. Trop J Pharm Res 18(4): 869-875.

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