

DIRECT COST OF TREATMENT IN THE MANAGEMENT OF TYPE 2 DIABETES MELLITUS  
IN A TERTIARY HOSPITAL IN NIGERIA**Lomak Albert Paul\***, Mohammed Suwaiba Garba, Dauda Audi Dangiwa, Meshak DayolDepartment of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, University of Jos,  
Jos, Plateau State, Nigeria.**\*Corresponding Author's Email:** [albertlomak@gmail.com](mailto:albertlomak@gmail.com)DOI: <https://njcpt.com.ng/101.1.2.26>**Abstract****Background:** Diabetes mellitus (DM) is a growing epidemic with a parallel economic impact on health and society. If not diagnosed early, there is a high chance of the development of complications which are expensive to manage. It has become necessary, therefore, to assess the burden this disease poses.**Objectives:** This study assessed the direct medical costs (antidiabetic drugs, antihypertensive/antilipidemic drugs and costs of diabetes-related tests) and direct non-medical costs (cost of transportation to and from the health facility) of type 2 diabetes outpatient care in a tertiary health institution in North Central Nigeria.**Methods:** The study was a cross-sectional retrospective study conducted at the Outpatient Department of Plateau State Specialist Hospital in Jos from January 2018 to October 2018. A total of 400 conveniently selected patients with Type 2 Diabetes attending the Diabetic Clinic were interviewed, and their medical records were reviewed. A pretested data collection form was developed and used. Patient demographics, complications/current illness, diagnostic/monitoring tests, fasting blood sugar, glycosylated haemoglobin and blood pressure were recorded in addition to prescribed drugs and dosage forms.**Results:** The annual mean direct medical cost for outpatient care for a person with type 2 diabetes mellitus was N69,709.131 (US \$199.17), out of which oral hypoglycemic medications accounted for the largest proportion of the direct medical cost 370(55.37%), followed by the cost of antihypertensive/antilipidemic medications 383(21.47%), and then followed by the cost of diabetes-related tests 402(12.54%). Hypertension and dyslipidemia as co-morbidities added an additional N19,092.96 (US \$54.55). The mean direct non-medical cost was N4,404.369 (US \$12.58), attributable to the cost of transportation to and from the clinic. The probable annual national direct cost of illness for type 2 diabetes mellitus patients was N570 billion naira (US \$1.6 billion).**Conclusion:** Outpatient diabetes management leads to increased/additional costs to the patient. Costs increased along with the presence of co-morbidities. There is, therefore, a need to focus on primary prevention of diabetes, its co-morbidities and complications.**Keywords:** Cost, Type 2 Diabetes Mellitus, direct cost, medical cost, non-medical cost**Introduction**

Cost-of-illness (COI) studies include the impact of a disease on individuals, communities and the country from various aspects <sup>[1]</sup>. A COI study aims to identify and quantify all costs of a particular disease, including direct, indirect and intangible costs. Diabetes is a chronic disease that has spread widely in high-income countries (HICs) and many low- and middle-income countries (LMICs) over recent decades. In 2014, 8.5% of adults aged 18 years and older had diabetes. In 2019, diabetes was the direct cause of 1.5 million deaths, and 48% of all deaths due to diabetes occurred before the age of 70 years. Another 460 000 kidney disease deaths were caused by diabetes, and raised blood glucose causes around 20% of cardiovascular deaths <sup>[2]</sup>

The most recent data from the International Diabetes Federation (IDF) indicate that approximately 537 million adults (20-79 years) live with diabetes. The total number is projected to rise to 634 million by 2030 and 783 million by 2045 <sup>[3]</sup>. Diabetes affected 382 million people worldwide in

2013, expected to grow to 592 million by 2035<sup>[4]</sup>. The estimated global prevalence in 2013 amounts to 8.3 % among people aged 20–79 years, with the world's most populous countries, India and China, reaching prevalence rates between 9 and 10 %, corresponding to 65 and 100 million in absolute numbers, respectively. Particularly high prevalence rates are found in Mexico (12.6 %) and Egypt (16.8 %), surpassing the rates of most HICs, including the USA (9.2 %) and Germany (8.2 %) [2]. In 2013, about two-thirds of all individuals with diabetes lived in LMICs<sup>[2]</sup>. The rising prevalence of diabetes in LMICs appears to be fuelled by rapid urbanization, nutrition transition and increasingly sedentary lifestyles<sup>[3,4,12]</sup>.

The most prevalent form of diabetes is type 2 diabetes, affecting about 90 % of people with diabetes. In comparison, the remaining 10 % mainly have type 1 diabetes or gestational diabetes<sup>[2]</sup>. Diabetes affects individuals' functional capacities and quality of life, leading to significant morbidity and premature mortality<sup>[5]</sup>. Recently, concerns have been raised that more than one-third of diabetes-related deaths occur in people under 60<sup>[5]</sup>. The cost of diabetes care is at least 3.2 times greater than the average per capita healthcare expenditure, rising to 9.4 times in the presence of complications<sup>[7]</sup>. Despite the chronic nature of diabetes Mellitus and its devastating consequences, its economic impact in Nigeria is unknown. No cost-of-illness studies have been published in north-central Nigeria.

Therefore, this study was undertaken to fill that gap in our knowledge. The study assessed the direct medical costs (antidiabetic drugs, antihypertensive/antilipidemic drugs and costs of diabetes-related tests) and direct non-medical costs (cost of transportation to and from the health facility) of type 2 diabetes outpatient care in a tertiary health institution in North Central Nigeria.

## **Methods**

### *Study Setting*

The study was carried out in the medical outpatient department of Plateau State Specialist Hospital, a tertiary health institution in Plateau State, north-central Nigeria.

### *Study location*

Medical outpatient department of Plateau State Specialist Hospital, Plateau State, North-central Nigeria

### *Sampling method*

A cross-sectional drug utilization evaluation was conducted among type 2 diabetes mellitus patients in the 160-bed tertiary institution. Adult Type 2 Diabetes Mellitus patients attending the hospital's outpatient department were included. Inpatient Type 2 DM and children were excluded from the study. Four hundred and twenty-three randomly selected patient case notes were reviewed between January 2017 and January 2018. A pretested data collection form was developed and used. Patient demographics, complications/concurrent illnesses, diagnostic/monitoring tests, fasting blood sugar, and glycosylated haemoglobin were recorded in addition to prescribed drugs and dosage regimens. Other information collected were the costs of drugs and diagnostic/monitoring tests. COI analysis with a societal perspective(excluding the indirect and intangible costs) was carried out among the participants, and average costs were determined. In the computation of drug cost, the cost per defined daily dose(DDD) of each drug and therapy duration was considered.

### *Study design*

The study was a cross-sectional retrospective study using the bottom-up approach to estimate the different cost components.

### *Inclusion criteria*

Adult Type 2 Diabetes Mellitus patients who were diagnosed for not less than two years attending the Medical Outpatient Department of the hospital were included.

#### *Exclusion criteria*

Inpatient Type 2 Diabetes Mellitus adults and children were excluded from the study.

#### *Sample size estimation and sampling technique*

Participants were sampled conveniently during the review day at the clinic, and a face-to-face interview was conducted using a structured questionnaire and medical information from the patient's folder. The questionnaires had two sections: Section one was on participants' demographics (age, sex, age since diagnosed with DM, occupation, monthly income), cost of transportation to and from the clinic, and Section two included data on co-morbidities and prescriptions. Data on direct medical costs were divided into three categories: antidiabetic medications, antihypertensive/antilipidemic medications, and diabetes-related tests/investigations.

The sample size was determined using Fischer's formula for a prevalence study. Consequently, 400 participants were enrolled for the study. All participants received educational information from the researcher.

#### *Data collection*

A pretested data collection form was developed and used. Four hundred participants (confirmed diabetic patients) were administered questionnaires containing relevant questions. Patient case notes were also reviewed to obtain relevant information. Patient demographics (sex, age), complications/concurrent illnesses, diagnostic/monitoring tests, fasting blood sugar, and glycosylated haemoglobin were recorded in addition to the prescribed drugs and dosage regimen. Other information collected were the costs of drugs (from the Pharmacy Department) and diagnostic/monitoring tests (from the Central Laboratory). The costs of oral antidiabetic drugs, antihypertensive medications, antilipidemic medications and glucose-related tests were calculated for each participant.

#### *Ethical consideration*

The protocol for the study was approved by the ethical committee of the institution. Informed consent was taken from individual study participants.

#### *Statistical analysis*

The participants' completed questionnaires were coded into the statistical package for social sciences IBBM SPSS statistics (version 23 for Windows software [Armonk, New York, USA]) for data management and analysis. A total of 20 randomly selected questionnaires were checked by a different researcher to authenticate data entry. Cost of Illness (COI) analysis with a societal perspective (excluding the indirect and intangible costs) was carried out among the participants, and average costs were determined. In the computation of drug cost, the cost per defined daily dose (DDD) of each drug and therapy duration was considered. Data analysis used appropriate statistical techniques to meet specific research aims and objectives. Descriptive statistics were used in the result presentation.

## **Results**

Below is a breakdown of the socio-demographic characteristics of the study participants of this research

**Table 1:** Socio-demographic Characteristics of Study Participants (N=400)

Variables	Description	Frequency (%)
<b>Gender</b>	Male	115 (28.8)
	Female	285 (71.2)
<b>Age</b>	Less than 31	8 (2.8)
	31-40	29 (7.3)
	41-50	58 (14.5)
	51-60	132 (33)
	61-70	128 (32)
	71-80	39 (9.8)
<b>Occupation</b>	81-90	6 (1.5)
	Civil servants	110 (27.5)
	Retirees	65 (16.25)
	Business	76 (19)
<b>Monthly earning</b>	House Wives	149 (37.25)
	<18000	305 (76.25)
	19000-50000	36 (9)
	51000-70000	1 (0.25)
	71000 and above	58 (14.5)

A total of 400 patients were interviewed, and the majority were between the ages of 51-60(33.0%) followed by ages 61-70(32.0%) respectively. The majority of the participants were female. The majority of the participants were full-time housewives (37.25%), followed by civil servants (27.50%), followed by businessmen/women (19.00%) and then retirees (16.25%). Of the participants, the majority (76.25%) had a mean monthly income of N18,000 and below, followed by participants with a monthly income of N71,000 and above. A breakdown of the direct medical costs by various age groups is shown in Table 2.

**Table 2:** Mean Annual Direct Medical Cost of Diabetes Management in relation to demographic characteristics among studied participants

Variable	Description	Mean Annual Direct Medical Cost (₦)
<b>AGE</b>	Less than 31	8 (49710)
	31-40	29 (78952.72)
	41-50	58 (83594.48)
	51-60	132 (90688.18)
	61-70	128 (86153.44)
	71-80	39 (84972.31)
	81-90	6 (51780)

Participants from ages 51-60 had the highest mean monthly spending (N90688.18), followed by participants ranging from ages 61-70(N86153.44), followed by participants ranging from ages 71-80(N84972.31), followed by ages 41-50(N8359.48) and ages 31-40(N78951.72). (See Table 3)

**Table 3:** Clinical Characteristics of Study Participants (N=400)

Variables	Description	Frequency (%)
<b>Duration of Diabetes (yrs)</b>	<1	0 (0)
	2-5	153 (38.25)
	>5	247 (61.75)
<b>Type of Diabetes Treatment</b>	Oral Antidiabetic Agents	370 (92.5)
	Insulin	55 (13.75)
	Insulin+oral Antidiabetic Agents	40 (10)
<b>Co-morbidity</b>	Hypertension + dyslipidemia	345(86.25)
<b>Owns a glucometer</b>	Yes	45(11.25)
	No	355 (88.75)

<b>Health Insurance</b>	Yes	15(3.75)
	No	385 (96.25)

The majority (61.75%) of the study participants have had diabetes for more than 5 years, while a minority (38.25) have had diabetes for between 2-5 years. A more significant proportion of the participants, 370(92.5%), were on oral antidiabetics, while 55(13.75%) and 40(10.00%) were treating their diabetes with insulin and insulin plus oral antidiabetics, respectively. The majority (86.25%) of the participants had hypertension and dyslipidemia. A more significant proportion (88.75%) did not own a glucometer. Most participants (96.25%) were not on the national health insurance scheme. See Table 4

**Table 4:** Mean Annual Direct Cost (N=400)

<b>Variable</b>	<b>Mean Annual Direct Medical Cost (₦)</b>
Oral Antidiabetic Agents	370 (49232.95)
Glucose Related test	373 (11151)
Insulin + Oral Antidiabetic Agents	40 (1320.82)
Transport	400 (4404.36)

The mean total annual direct cost of treating type 2 diabetes (excluding costs attributable to antihypertensive drugs, anti-dyslipidaemic drugs and other medications) is N69,709.131. Table 5.

**Table 5:** Components of Annual Direct Medical Costs (Oral Medications + Diabetes-related Investigations) N=400

<b>Variable</b>	<b>Mean Annual Cost (₦)</b>
Oral Antidiabetic Agents	370 (49232.95±26643.82)
Antihypertensives + Hypolipidemics	331(19092.96±15906.54)
Diabetes-related Lab. Investigations	373 (11151±21053.29)
Other medications	146 (9442.2±18187.81)

The majority of the participants (370) had a mean expenditure of N49232.95 for oral antidiabetic drugs, followed by 331 participants who were on antihypertensive drugs with a mean expenditure of N19092.96 and 373 had either fasting blood sugar test or glycosylated haemoglobin or both with a mean expenditure of N11151. The details are in Table 6.

**Table 6:** Components of annual direct medical and non-medical costs (Oral Medications + diabetes-related tests + transportation) N=400

<b>Variable</b>	<b>Mean Annual Cost (₦)</b>
Oral Antidiabetic Agents	370 (49232.95±26643.82)
Antihypertensives+Hypolipidemics	331(19092.96±15906.54)
Diabetes-related Lab. Investigations	373 (11151±21053.29)
Other medications	146 (9442.2±18187.81)
Transportation to and from the clinic	400 (4404.36±7591.062)

In addition to the cost components, the participants had a mean annual spending of N4404.36+-7591.062 for transportation to and from the clinic. (Table 7)

**Table 7:** Co-morbid conditions among study participants (Oral Medical + Glucose related test) N=400

Variables	Description	Frequency (%)
<b>Co-Morbid Condition</b>	Cerebrovascular accident (CVA)	2 (0.58)
	Hypertension	280 (81.16)
	Hypertension+CVA	2 (0.58)
	Retinopathy	2 (0.58)
	Neuropathy	5 (1.45)
	Hypertension + Retinopathy	36(10.43)
	Hypertension + Neuropathy	17 (4.93)
	Hypertension+Neuropathy+Retinopathy	1 (0.29)

In terms of co-morbidities, the majority of the participants (81.16%) had hypertension, 10.43% had a combination of hypertension and retinopathy, 4.93% had a combination of hypertension and neuropathy, 1.45% had neuropathy, 0.58% had a combination of hypertension and stroke, 0.58% had retinopathy, 0.58% had stroke, and 0.29% had a combination of hypertension, neuropathy and retinopathy. Table 8

**Table 8:** Prescription Pattern of Antidiabetic agents N=400

Variables	Description	Frequency (%)
<b>Drug</b>	Galvus met	4 (0.6)
	Daonil	6 (1.0)
	Glucovance	8 (01.3)
	Glimepiride	209 (33.4)
	Metformin	82 (13.1)
	Glucophage	276 (44.2)
	Insulin	40 (6.4)

The most commonly used antidiabetic drug was Glucophage (33.4%), followed by glimepiride (33.4%), followed by metformin (13.1%), followed by insulin (6.4%), followed Glucovance (1.3%), followed by Daonil (1.0%) and lastly Galvus met (0.6%).

## Discussion

The cost of treatment is a beneficial tool for decision and policy-makers as it helps allocate resources. This research focused on direct medical and non-medical costs of diabetes management. In this study, most patients were on oral anti-hyperglycaemic agents (92.5%). Direct costs increased dramatically as the co-morbidities increased. This finding is comparable to a cocoa study that observed a 91.8% cost increase for patients with one or more co-morbidities <sup>[15]</sup>. This study also revealed that the share of medicine was highly accounted for in the direct cost. The study reported from Kenya showed similar findings where treatment accounted for 52.4% of the total direct cost of diabetes care <sup>[16]</sup>

The mean annual direct medical cost of diabetes management in relation to demographic characteristics showed that between ages fifty and sixty accounted for the highest cost. This could be because of delayed diagnosis, which accounts for varying degrees of microvascular and macrovascular complications. This is comparable to studies conducted in South Trinidad by Aloitabi A. et al. <sup>[8]</sup> and in the United Arab Emirates by Al-Maskari F. et al. <sup>[9]</sup>.

Concerning cost components, the direct medical costs attributable to oral antidiabetic drugs constitute the highest (N49, 232), followed by antihypertensive and hyperlipidemic agents (N19, 092). This is comparable to a study carried out in France by Bernard C. et al. because, in most cases, the patients present primarily with diabetes before hypertension or other complications and or co-morbid conditions develop. Transportation is a vital component of the patient's direct non-medical costs on every visit to and from the clinic (N4404.36+-7591.06). This aspect of the direct cost is also factored in most cost of illness studies, as seen in a similar study conducted in Cape Coast Ghana by Zinash A. et al. <sup>[11]</sup>.

Regarding complications and co-morbid conditions, hypertension alone accounts for the most common condition or complication (81.16%). This is distantly followed by hypertension and retinopathy (10.43%) and then hypertension and neuropathy (4.93%). This is like the previous studies, as seen in a study in the Niger Delta <sup>[13]</sup>. It is clear from this study that prescription by brand has a significant increase or impact on the total medical costs. Glucophage (prescribed as branded) accounts for 44.2%, closely followed by glimepiride 33.4% (prescribed as generic, which increases the cost of treatment).

This study showed that the mean annual direct medical cost for type 2 diabetes mellitus care was N88,919.11, the most significant component of which was attributed to oral antidiabetic medications (55.37%), followed by antihypertensive/dyslipidemia medications (21.47%), diabetes-related laboratory investigations (12.54%) and other medications (10.62%) respectively. This result is comparable to a study conducted in Ghana by Immanuel A. et al. <sup>[14]</sup>. For a patient who earns N18,000 per month, it implies an annual income of N216,000. Considering that, on average, a diabetic patient spends N7,416.67(41.2% of the minimum wage) monthly, the patient is left with around N10,583.33(58.85 of the minimum wage), out of which they pay house rent, utility bills, school fees and food, among other bills. It is, therefore, visible that the burden of diabetes is enormous.

## Conclusion

The annual mean direct medical cost for outpatient care for a person with type 2 diabetes mellitus was N69, 709.131 (US \$199.17), out of which oral hypoglycemic medications accounted for the largest proportion of the direct medical cost 370(55.37%), followed by the cost of antihypertensive/antilipidemic medications 383(21.47%), and then followed by the cost of diabetes-related tests 402(12.54%). Hypertension and dyslipidemia as co-morbidities added an additional N19,092.96 (US \$54.55). The mean direct non-medical cost was N4,404.369 (US \$12.58), attributable to the cost of transportation to and from the clinic. The probable annual national direct cost of illness for type 2 diabetes mellitus patients was N570 billion naira (US \$1.6 billion). The findings of our study suggest that there is an imperative need to develop and improve interventions toward the prevention of diabetes, co-morbidities and its complications. There is a need to promote more research at a national level on diabetes-based economic studies to know the social, financial and economic burden of diabetes to inform policy. Future research to evaluate the clinical and humanistic outcomes of therapy alongside the economic outcomes and determine the comparative cost-effectiveness of the various drug combinations for diabetes and concurrent illness is necessary.

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