Cost- of- Illness Analysis of Type 2 Diabetic Patients in a Multispeciality Hospital at Coimbatore

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A B S T R A C T

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The prevalence and the number of people living with diabetes in India is increasing every year, which imparts a burden on the economic growth. The studies related to the healthcare cost of diabetes are limited in India. A prospective observational study was carried out for a period of seven months with the aim to determine average annual per patient direct cost for management of type 2 diabetes mellitus, to determine the average annual per patient direct cost for diabetic patients having micro and macro vascular complications, and the factors affecting the healthcare cost. The average annual per patient direct cost for management of type 2 diabetes is 38,589 rupees. Diabetes patients who did not have any complications spent 15,512 rupees as average annual per patient direct cost for their care. Patients with one complication spent 25,228 rupees as average annual per patient direct cost for their care. Patients with three complications spend 52,607 rupees as average annual per patient direct cost for their care. The factors affecting healthcare cost and hospitalization were the medicine cost, lab investigation cost, hospital admission cost, presence and severity of diabetes associated complications. Cost of illness studies can provide a framework for estimation of cost estimation for Cost Effectiveness and Cost Benefit Analysis, the methods which are commonly employed for decision making while updating the formulary. Pharmacist can perform his role when making formulary decisions as a member of Pharmacy and Therapeutic Committee (PTC), using the information gathered from pharmacoeconomic evaluation.

Keywords: Diabetes Mellitus, Pharmacoeconomics, Healthcare Cost, Cost of Illness, Direct Cost, Annual Medicine Cost, Annual Lab Cost, Annual Consultation Cost.

INTRODUCTION

According to IDF atlas 5th edition update India is having a total diabetes population of 61.3 million, which is just behind China having a total diabetes population of 92.3 million.[1] The prevalence of type 2 diabetes mellitus is rising in alarmic scale in India, which poses a major threat to clinical management, economic growth and social wellbeing of patients.[2] Financial burden is more on the individuals who have diabetes and associated co-morbid condition than those who have only diabetes.

DIABETES MELLITUS

Diabetes (DM) is a group of metabolic disorders characterized by hyperglycaemia: associated with abnormalities in carbohydrates, fat and protein metabolism; and resulting in chronic complications including microvascular, macrovascular and neuropathic.[4]

CLASSIFICATION

1) Type 1

Type 1 diabetes mellitus is characterized by destruction of pancreatic beta cells.

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Type 1 is subdivided in to two types

- Type 1A - Immune mediated
- Type 1B - Idiopathic

2) Type 2

May range from predominantly insulin resistant to predominantly insulin deficient.

3) Gestational diabetes mellitus

Defined as any degree of glucose intolerance that has its onset or is first detected during pregnancy. Occurs in 2-4 % of pregnant woman, generally during the second or third trimester.

4) Other specific types (secondary diabetes) - Broad term used to classify patients who have unusual causes of diabetes owing to certain diseases of the pancreas, genetic defects, endocrinopathies, or drugs.

Type 1A Immune-Mediated Diabetes

This type is characterized by an absolute deficiency of insulin.

Idiopathic Type 1B Diabetes

Idiopathic type 1B diabetes is used to describe those cases of beta cell destruction in which no evidence of autoimmunity is present.

Type 2 Diabetes Mellitus

Type 2 diabetes mellitus is a heterogeneous condition that

describes the presence of hyperglycemia in association with relative insulin deficiency.

LONG-TERM COMPLICATIONS

A. **Macrovascular complications (coronary artery, cerebrovascular and peripheral vascular disease)**

1. Atherosclerosis (coronary, cerebrovascular and peripheral vessels) occurs at an earlier age than nondiabetic individuals.

2. Peripheral vascular disease may lead to pain, chronic cold feet, or insufficient circulation to enable healing of distal lesions (ultimately leading to gangrene and amputation).

3. Hypertension (HTN) Co- existence of HTN and DM strikingly increases the risk of cardiovascular disease, doubles the risk of cardiovascular death, and increases incidence of stroke and transient ischemic events in DM individuals.

B. **Eye Diseases**

1. Diabetic retinopathy

a. A consequence of microvascular changes. Most prevalent eye complication and is often detectable within 5 years after the diagnosis of DM.

b. There are mainly three types of retinopathy

- Non proliferative retinopathy
- Preproliferative retinopathy
- Proliferative retinopathy

C. **Diabetic nephropathy:** Renal failure occurs in 30-40% of patients with type1 DM within 30 years after diagnosis and 20-30% of patients with type 2 DM.

D. **Diabetic neuropathies**

1. Peripheral neuropathy: The sensorimotor nervous system is most often affected, but sympathetic or parasympathetic abnormalities may be present also.

2. Autonomic neuropathy: It involves multiple systems throughout the body.

E. **Foot, skin, and mucous membrane complications:** These problems stem from vascular change and peripheral neuropathy that cause alterations in the nerves that control blood flow and skin hydration.[5,6]

PHARMACOECONOMICS

"Pharmacoeconomics is the field of study that evaluates the behaviour of individuals, firms, and markets relevant to the use of pharmaceutical products, services and programs, and which frequently focuses on the costs (inputs) and consequences (outcomes) of that use".

NEED FOR PHARMACOECONOMICS

Pharmacoeconomics offers assistance under resource constraints, tight budgets and competing programmes. It can aid in decision making in evaluating the affordability of and access to the right medication to the right patient at the right time, comparing two drugs in the same therapeutic class or drugs with similar mechanism of action and in establishing accountability that the claims by a manufacturer regarding a drug are justified[7].

Cost of Illness Analysis (CIA):

It may be defined as the evaluation and assessment of the resources used in treating an illness.[8]

Types of costs and perspectives used in analysis

Direct Cost

Direct economic costs of disease are those generated by the resources used in treating or coping with a disease, including expenditures for medical care and the treatment of the illness (hospital care, physician services, nursing home care, drugs and other medical needs).

Indirect Cost

Indirect costs consider the potential resources that are lost as a result of a disease. They include the societal costs of morbidity, disability and premature moratality.eg: lost productivity, care giver costs, and quality of life.

Intangible Cost

Non-financial outcomes of disease and medical care.

Perspectives

A cost-of-illness study may be conducted from several different perspectives, each of which includes slightly different costs.

Uses of Cost of Illness study

The data from Cost-of-Illness studies are used in determining budgetary allocations, prioritizing research funding and justifying funding for disease projects. Knowledge of the costs of an illness can help policy makers to decide which diseases need to be addressed first by health care and prevention policy.[9]

NEED OF THE STUDY

There are very few studies quoting direct cost of diabetes care.[3] Major studies which estimated the cost of care for diabetes are the following. A study by Rayappa et al[10] estimated that the annual direct cost of routine care in 1998 was about US$191 (about 8595 rupees) and the mean direct cost and hospitalization for a diabetes related episode was about US$208(9360 rupees). A study by Kapur et al[11] in year 2000 found that the annual direct cost of ambulatory care for

diabetes was 4724 Rupees. Shobhana et al[12] conducted a study to estimate the health care expenditure for type 1 and type 2 diabetes in the year 2000 and the study found that the expenditures as 8578 and 3310 rupees respectively. Study conducted by Viswanathan V et al[3] in 2009 found out that the total direct per annum for the management of diabetes was 25391 rupees. Diabetes patients who did not have any complications spent 6520 rupees ($134.9) for their diabetes care, while presence of three and above complications escalated the direct cost to 32,500 rupees ($672.6) per annum. The latest study by Viswanathan V[13] et al found that on an average, patients with foot complications (19020 rupees) and those who had two complications (17633 rupees) spent four times more and patients with renal disease (12690 rupees),cardiovascular (13135 rupees) and retinal complications (13922 rupees) spent three times more than patients without any complications (4493 rupees). This indicates the purpose for conducting this study.

The main objectives of the study were to determine the average annual per patient direct cost for management of type 2 diabetes, to determine the average annual per patient direct cost for management of diabetic complications (foot ulcer, retinopathy, nephropathy, peripheral vascular disease), to analyze the factors affecting healthcare cost of diabetes and to determine the difference in Annual Medicine Cost (AMC), Annual Lab Cost (ALC), and Annual Consultation Cost (ACC) among non-complicated and complicated group.

MATERIALS AND METHODS

The study was conducted at department of diabetology, Kovai Medical Center and Hospital, an 800 bed multispeciality hospital in Coimbatore.

Study Design

It is a prospective observational study at Department of Diabetology and Endocrinology, Kovai Medical Center and Hospital, a multispeciality hospital in Coimbatore.

Study period

A period of 7 months from January 2013 to July 2013 in Kovai Medical Center and Hospital.

Inclusion criteria

1) Type 2 diabetes

2) Age ⩾ 18 years

3) Hospitalized for complications like diabetic foot ulcer, nephropathy, nephropathy, peripheral vascular disease.

Exclusion criteria

1) Age below 18 years

2) Dialysis patients

Data collecting method

The study was conducted on the basis of patient perspective and is a type of prevalence based study. The medical history consisting of inpatient medical records were reviewed for the prescribed time period to record the patient's demographic characteristics, clinical status, duration of disease, length of stay, types of complications, cost details. The parameters such as the Annual Medicine Cost (AMC), Annual Laboratory Cost (ALC), and Annual Consultation Cost (ACC) were calculated for each patient. The total per patient direct cost per annum was calculated by the cost-of illness method. The direct cost was divided in to three sub categories that include direct medical cost, direct non-medical cost and the management & monitoring cost. The average value of three sub categories was summed to calculate the total per patient direct cost per annum. The cost spend for patients having no complications, one complication, two complications, and three complications were also calculated by taking the average cost for total study population. The data was analyzed by Graphpad prism statistical software using unpaired t-test to find out whether there is any statistical difference in annual medicine cost, lab cost and consultation cost between the non-complicated and complicated group.

RESULTS AND DISCUSSION

A total of 120 type 2 diabetic patients were included in this study. The demographic details among the subjects reveal that 81(67.5%) were males while 39 (32.5%) were female (Table:1).

- The average per patient annual direct cost for management of type 2 diabetes is 38,589 rupees (Table: 2).

- Diabetes patients who did not have any complications spent 15512 rupees as average annual per patient direct cost for their care (4263-22087).

- Patients with one complication spent 25228 rupees as average annual per patient direct cost for their care (7422-1,64381).

- Patients with two complications spent 30497 rupees as average annual per patient direct cost for their care (9027-1,64437).

- Patients with three complications spent 52607 rupees as average annual per patient direct cost for their care (18750-1,81655).
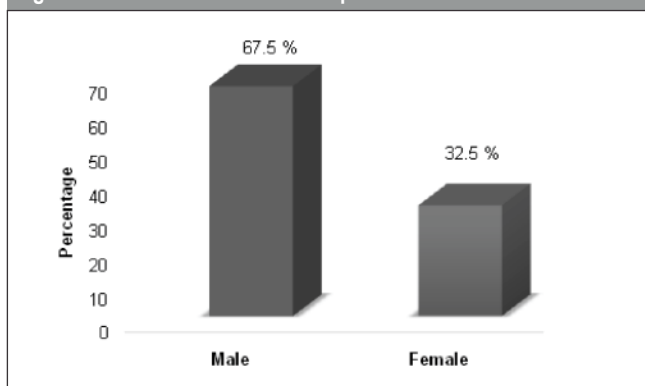
Table 1: Gender-wise distribution of patients		
Gender	Number of patients	Percentage
Male	81	67.5
Female	39	32.5
Total	120	100

- The factors affecting healthcare cost and hospitalization were the medicine cost, lab investigation cost, hospital admission cost, presence and severity of diabetes associated complications.

- The statistical analysis unpaired t-test was performed to find out the difference in AMC, ALC, and ACC among the non-complicated group and complicated group.

- P-value was found to be < 0.05 for AMC and ALC between non-complicated and complicated group which is significant. P value was found to be < 0.001 for ACC between non- complicated and complicated which is significant.

- Annual Medicine Cost (AMC), Annual Lab Cost (ALC), Annual Consultation Cost (ACC) details of non-complicated group are as follows (Table 3).

1) Annual Medicine Cost (AMC) - 6485±987.7

2) Annual Lab Cost (ALC) - 4496±334.9

3) Annual Consultation Cost (ACC) - 635.2±23.54

- Annual Medicine Cost (AMC), Annual Lab Cost (ALC), Annual Consultation Cost (ACC) details of complicated group are as follows.

1) Annual Medicine Cost (AMC) - 12980±803.4

2) Annual Lab Cost (ALC) - 6060±263.7

3) Annual Consultation Cost (ACC) - 1060±50.10

The study was conducted to determine the average per patient annual direct cost spent for the management of type 2 diabetes. In this study the socio-demographic factors such as the education, income, length of stay and the type of complications were found to be influencing the outcome of the diabetes and so the costs for treatment.

In the current study(N=120), among the gender wise prevalence there was a male predominance with 81 out of the total 120 patients and only 39 patients were female. These results reciprocates the result of the study conducted by Riewpaiboon A et al in which out of the total 475 study population 354 were females and only 121 patients were males.[16]

The total average direct cost per annum for the management of type 2 diabetes was found to be 38589 rupees in this study. The patients who did not have any complications spent 15512 rupees as average direct cost per annum for their diabetes care, patients having one complication spent 25228 rupees as average direct cost per annum for their diabetes care, patients having two complications spent 30497 rupees as average direct cost per annum for their diabetes care, patients having three complications spent 52607 rupees as average direct cost per annum for diabetes care. These results reciprocates the results of the study conducted by Viswanathan V et al in which the total average direct cost per annum for the management of type 2 diabetes was found to be 25391 rupees, patients having no complications spent 6520 rupees as average direct cost per annum for their diabetes care, patients

Table 2: Details of total direct cost per annum for the management of type 2 diabetes

Cost Details (Rupees)	Hospital Admission & Ambulatory care
Direct Medical cost	
Doctor fees	962.5 (450-2800)
Lab investigations & other investigations	2453.81 (130-9974)
Admission charge	10382 (1130-42330)
Medicine charge	4087.07 (300-24830)
Direct Non-medical cost	
Transportation	1455.25(150-4000)
Food	2074.58(700-5250)
Management & Monitoring	
Hypoglycemic medications & other medications	11504.78(676.8-30660)
Lab investigations	5669.43(2340-11700)
Average cost per patient per annum for management of type 2 diabetes (Rupees)	38589

Fig. 1: Gender-wise distribution of patients

Table 3: Shows Comparison of Annual Medicine Cost (AMC), Annual Lab Cost Annual Consultation Cost (ACC) of non-complicated and complicated group

Number of patients	Annual Medicine Cost (AMC)	Annual Lab Cost (ALC)	Annual Consultation Cost (ACC)
Non-complicated(27)	6485±987.7	4496±334.9	635.2±23.54
Complicated(93)	12980±803.4	6060±263.7	1060±50.10

having one complication spend 9760 rupees as average direct cost per annum for their diabetes care, patients having two complications spent 15000 rupees as average direct cost per annum for their diabetes care, patients having three complications spent 32500 rupees as average direct cost for their diabetes care. The deviation in the respective costs may be due to the variation in the determinants of cost like the medicine cost, admission cost, lab cost and other investigation costs, consultation fee   in the current study year(2013) with that of the study year (2009) of the reference study.[3]

The limitation of the study is that the indirect cost is not included in the study as it is difficult to determine the indirect cost for the study population where majority of them were unemployed and of the age group 51-60. The data obtained from the cost of illness analysis can be further used in the field of Cost Effectiveness and Cost Benefit analysis, methods more advanced and commonly employed while updating the drug formulary.

CONCLUSION

Diabetes is one of the major lifestyle diseases that can be a risk factor for several complications. The prevalence and the number of people living with diabetes in India is increasing every year, which imparts a burden on the economic growth.

Cost of illness studies can provide a framework for estimation of cost estimation for Cost Effectiveness and Cost Benefit Analysis, the methods which are commonly employed for decision making while updating the formulary. Pharmacist can perform his role when making formulary decisions as a member of Pharmacy and Therapeutic Committee (PTC), using the information gathered from pharmacoeconomic evaluation. Pharmacist can also give patient counselling on diabetes to patients as lack of proper knowledge about the disease is also a contributing factor towards the cost of care. A proper knowledge about the disease can contribute to proper monitoring of diabetes and thereby the extent of complications can be reduced.

Pharmacoeconomics is a less explored discipline in India. More education to healthcare professionals should be given to facilitate the use of pharmacoeconomic evaluation methods. Evidence based standard treatment guidelines and the proper implementation of Rational Drug Use would ensure better choice of therapeutic options. Factors affecting health-care costs and hospitalizations may help health-care providers intervene to improve patient management and possibly reduce health-care costs in the future.Most importantly a concerted effort is needed to reduce the incidence of diabetes mellitus in the society.

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