

ORIGINAL RESEARCH

Cost Burden of Treatment in Type 2 Diabetes Mellitus Patients With and Without Complications: A Population Based Socioeconomic Study in North India

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ABSTRACT

Introduction: Diabetes Mellitus is heterogeneous diseases in which patients have higher blood sugar due to defect in insulin action, insulin secretion or both. Present study was done to find out the annual Diabetic health care expenditure for Diabetic patients with and without diabetic complications.

Material and Methods: Present study is based on overall expenditure on diabetes treatment collected from Out Patient Department (OPD) and wards of Hospital in between February 2013 to February 2014 from patients of Eastern India. The Direct cost (Medical and Non Medical) recorded from patients data sheet available in hospital and Indirect cost collected through human approach and dearness of our city.

Results: Total 450 Diabetes patients were screened in which most had diabetic complications. The median annual direct cost and indirect cost associated with diabetes care are higher in diabetic patients with complications as compared with diabetic patients without complications. From this study we find out that direct and indirect cost of Indian population increase continuously as patients is progressing towards severe complications.

Conclusions: From this study we can assume that the future diabetes treatment cost will increase in developing countries; this is a huge burden on poor diabetic patients belonging to lower economic condition. We highlight urgent need for the decision to resource planning and control of care of diabetes prevention and management of Diabetes and its complication in future, which is beneficial for diabetic patients in developing country.

Keywords: Economic value, Medical Expenditure, Diabetic complication, Diabetes Direct health cost.

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INTRODUCTION

Diabetes lead to many complications where acute complications are hypoglycemia, hyperglycemic hyperosmolar state, diabetic ketoacidosis, diabetic retinopathy, diabetic nephropathy and chronic complications are cerebrovascular disease, coronary artery disease, stroke, peripheral artery disease and foot ulcer. The world is facing “epidemic of diabetes” during last two decades and its costs both in terms of economic burden and human sufferings are increasing at an alarming rate. The number of people with diabetes is expected to rise per year continuously to 592million near the end of 2030. Whole worldwide it is estimated that 382 million people suffer from diabetes with a prevalence of 8.3%. North America and the Caribbean countries are the region with the higher prevalence, (36,755 people with diabetes 11%) followed by the Middle East and North America with (34,571 people with diabetes 9.2%) and Western Pacific regions, (138,195 people with diabetes 8.6%), is the region with higher number of people with diabetes, however its prevalence is approximately close to the prevalence of the World.¹ The Economic cost of diabetes treatment seems to be increasing continuously and will reach \$580billion dollar till 2025.¹ According

to World Health Organization; in 2014, 9% of adults 18 years and 91% older age had diabetes. One review study by WHO in 2012 showed diabetes was the direct cause of 1.5 million deaths. More than 80% of diabetes deaths occur in low- and middle-income countries.^{2,3} The higher incidence of diabetes patients in Asian and African populations is probably due to change in environmental condition, urbanization and life style change. Some studies in Southeast Asian (SEA) and the African (AFR) regions have shown that Diabetes Mellitus and hypertension coexist in type 2 Diabetes ranging from 20.6% in India to 78.4% in Thailand in the South East Asian region and prevalence from 9.7% in Nigeria to 70.4% in Morocco in the North African region.⁴ With the increase of Diabetes patients, the global prevalence of all the leading chronic diseases is also increasing. The majority of occurring is in developing countries and projected to increase substantially over the next 2 decades.⁵ India, the second most populous country, also stand second position after China amongst all diabetic patients in the world and annual coronary deaths are expected to reach 2 million by 2010.⁶

Expenditure on the management of diabetes mellitus and its complications is increasing rapidly but there are very few studies compiling the cost burden among diabetic complications in North Indian populations. From India there are only a few studies⁷⁻¹¹ showed the comparison between medical treatment expenses of rural and urban diabetic population among which Ramchandran et.al. is superior study.¹² Our study is a small initiative to provide an outlook on the cost burden of patients suffering from diabetic complications which may be helpful for government and non government organisations who can help these patients to overcome heavy expenses on the treatment.

MATERIALS AND METHODS

This cost burden cross sectional study was done at Institute of Medical Sciences, Banaras Hindu University; Varanasi from February 2013 to February 2014. There is a specialized wound clinic in SS Hospital, BHU which exclusively treats diabetic patients with wound complications. A total of 450 diabetic patients were enrolled in which 264 male and 186 female patients were included. This present study was randomly selected Type 2 Diabetes patients with several different complications. There were some patients who had many complications associated with Type 2 Diabetes. Some diabetic patients had long term chronic complication like non healing diabetic foot ulcer; some patients at

early stage of complications presented with two or more complications. All subject were grouped on the basis of their complication and compared with diabetic patients having no complication. Group1 consisted of 29 Type 2 Diabetes patients without complications, group2 consisted of 145 Type 2 Diabetes patients with Cardiovascular complications, group3 consisted of 197 Type 2 Diabetes patients with Neuropathy, group4 consisted of 52 Type 2 Diabetes patients with Nephropathy and group5 consisted of 27 Type 2 Diabetes patients with retinopathy. We also divided each group in three parts according to the onset of the disease in years (0-5, 6-10, 11-30).

This study was approved by ethical committee of Institute of Medical Sciences, BHU and patients were enrolled with written consent form. The data collection was carried out by using diabetic management questioner. The study questioners comprised details of patient such as family history of diabetes, family pedigree, education, occupation, hospitalization details, treatment details, family income and direct cost of treatment. Demographic data of patients were also collected such as height, weight and BMI calculated by using standard formula. Biochemical parameter were also analyzed as per requirement on standard protocol provided by hospital including random blood sugar, glycosylated hemoglobin, serum total glyceride, high density lipid, low density lipid, very low density lipid etc.

The Medical treatment cost per patient was calculated from their expenditure bill, hospital admission charge, surgery expenses, investigations such as ECG, Radiology examination, CT scan, color Doppler, biochemistry. In Non Medical cost such as transportation and accommodation charges were included. Patient's duration of hospitalization, reason for hospitalization, and surgery details were also recorded. The questions were administered by single research scholar who was well trained and data collection time taken was about 30-40 minute per patient and then signed consent form with their own interest in participants.

STATISTICAL ANALYSIS

The statistical analysis of this data was done by Statistical Package for the Social Sciences (SPSS) software. For multiple group comparisons analysis odd Variance (ANOVA) testing with honestly significant different and χ^2 test test with Yate's correction was used for comparison of proportions and for comparison of mean values. $P < 0.05$ was considered as significant for each groups.

RESULTS

In this study total 450 patients (Male 264 and Female 186) were screened with different complication groups of diabetes. In our study table 1 shows the demographic and anthropometric details of the all groups involved. Most patients were > 41 year age group (372) and very less patients were < 40 year age (78). Occupational and Educational status of different complication shows differences between this study groups. Majority of the study subjects belongs to the urban location (63.3%) than rural location (36.7%). In this study more than 53.3% of subjects were vegetarians and 46.7 % were non-vegetarians. Table 2 is composed of overall income and treatment expenses of Diabetic subjects involved in group1, group2, group3, group4 and group5. Expenditures on medications, laboratory tests, hospitalization and transport are varied and in most complications the expenditures are higher than the group1 patients. Patients on retinopathy spent more on initial and monthly maintenance medicine cost than other complication. The Total Medicine cost in treating both Diabetic and Neuropathy was significantly higher than

for patients' also. The laboratory charge for patients of one or more complications was also higher compare to without complication. Patients without complication were not hospitalized.

Figure 1 showing Duration of Diabetes in Different complication Group of Diabetes mellitus in which Diabetic Neuropathy Group 3 patients had suffer higher duration for their treatment in all respect . Figure 2 showing Average Monthly expenditure on Medicine in Different complication of Diabetes mellitus. The Expenditure pattern was significantly higher in group 5 with statistical significance ($p < 0.001$). The detail description of mode of payment of whole patients is described in Figure 3. In which approximately 66% patients paid from their own personal savings, 16% patients having reimbursement, 8% people soled their properties like as land and house and 7% patients shows borrowed loan for their treatment and very less percentage of patient's had medical insurance for their treatment.

DISCUSSION

Diabetes mellitus is increasing rapidly at an alarming

Variables		Group1 Without Complication (N=29)	Group2 Cardiovascular (N=145)	Group3 Neuropathy (N= 197)	Group4 Nephropathy (N=52)	Group5 Retinopa- thy (N= 27)
Gender	Male	24 (82.8%)	81 (55.9%)	113 (57.4%)	28 (53.8%)	18(66.7%)
	Female	5(17.2%)	64(44.1%)	84(42.6%)	24(46.2%)	9(33.3%)
Age in year	<40	6(20.7%)	28(19.3%)	29(14.7%)	13(25.0%)	2(7.4%)
	>41	23(79.3%)	117(80.7%)	168 (85.3%)	39(75.0%)	25(92.6%)
Education	Illiterate	5(17.2%)	27(18.6%)	36(18.3%)	4(7.7%)	7(25.9%)
	School	12(41.4%)	60(41.4%)	78(39.6%)	16(30.8%)	9(33.3%)
	Graduate	9(31.0%)	34(23.4%)	54(27.4%)	14(26.9%)	3(11.1%)
	Post Graduate	3(10.3%)	24(16.6%)	29(14.7%)	18(34.6%)	8(29.6%)
Occupation	House Wife	4(13.8%)	52(35.9%)	63(32.0%)	16(30.8%)	6(22.2%)
	Unskilled	7(24.1%)	10(6.9%)	19(9.6%)	3(5.8%)	5(18.5%)
	Skilled	3(10.3%)	8(5.5%)	24(12.2%)	11(21.2%)	0(0%)
	Office job	3(10.3%)	19(13.1%)	21(10.7%)	4(7.7%)	7(25.9%)
	Business	4(13.8%)	21(14.5%)	22(11.2%)	7(13.5%)	2(7.4%)
	Professionals	1(3.4%)	8(5.5%)	6(3.0%)	3(5.8%)	1(3.7%)
	Retired	6(20.7%)	17(11.7%)	14(7.1%)	4(7.7%)	3(11.1%)
	Farmer	1(3.4%)	10(6.9%)	28(14.2%)	4(7.7%)	3(11.1%)
Duration of DM (In Year)	0-5	18± 6.1	78± 5.8	113± 5.4	36± 6.9	8± 2.6
	6-10	7± 2.1	39± 2.9	41± 2.8	8± 1.4	11± 4.7
	11-30	4± 1.8	28± 1.3	43± 2.8	8± 1.4	8± 2.6

Table-1: Details of Demographic data between different complications group of diabetes mellitus

Variables	Group1(N=29)	Group2(N=145)	Group3(N=197)	Group4(N=52)	Group5(N=27)	P-Value
Monthly family Income	15000±9994.229	16700±11408.875	15600±10969.823	16700±11440.904	15200±9914.272	.853
Expenditure on Medication (Per Month)	4155.17±1150.337	5118.62±1224.631	12100±2003.829	15700±1563.512	23600±3377.064	.0001
Laboratory test (Per Month)	2108.97±621.274	2647.93±863.429	3711.62±1698.805	4062.31±1241.662	4455.93±879.944	.0001
Expenditure on Hospitalization (Per Month)	-	23200±9978.219	33000±11699.931	35200±11001.577	40700±10339.673	.0001
Expenditure on Transport (Per Month)	1606.90±507.22	1640.41±598.783	3793.86±749.337	1640.58±688.398	4104.07±412.014	.0001

Table2: Income and Treatment expenses of Diabetic subjects in Indian Rupees (INR).

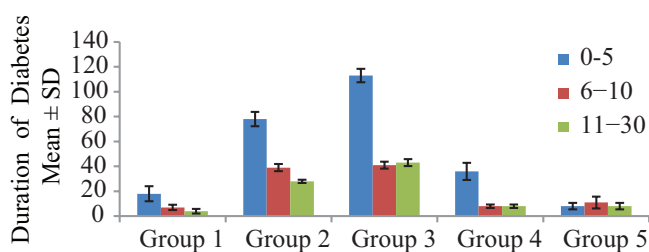


Figure-1: Figure showing Duration of Diabetes in Different complication Group of Diabetes mellitus

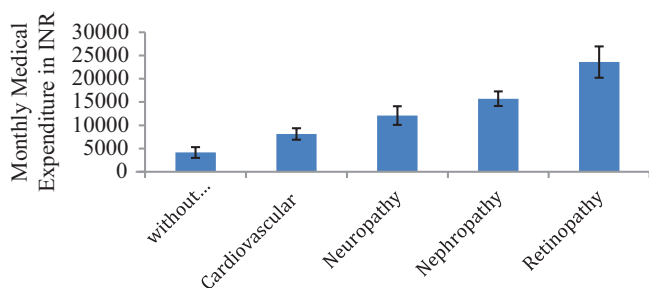


Figure-2: Figure showing Average Monthly expenditure on Medicine in Different complication of Diabetes mellitus. The Expenditure pattern was significantly higher in group 5 with statistical significance ($p < 0.001$)

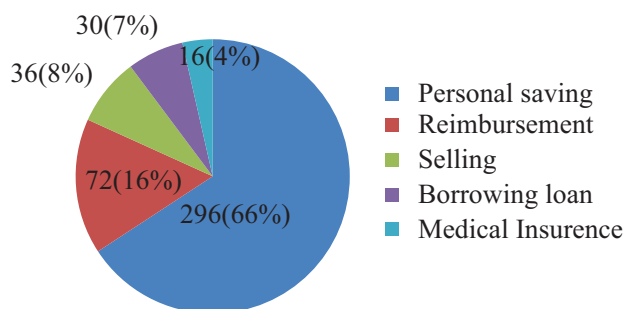


Figure-3: Figure showing the mode of payment of Diabetic patients in percentage (%) in this study.

rate and no any single country is spared from its reach. As the numbers of patients are increasing the cost on

the management of this disease is also increasing rapidly. In developing countries like India the cost of treatment is an extra burden on the pocket of poor and middle income families. Socioeconomic determinants have also been reported as a source of disparate outcomes. Socioeconomic status is a term that attempts to capture an individual’s capacity to function within society. This is often measured using their level of education, annual income, or community of residence.⁷ The wealth of a community also can contribute to limitations in access to care and resources that can be directed to remove obstacles. An individual from higher income group has an access to specialized wound center to provide treatment, than an individual living in a resource-poor community, where the treatment options may be more limited and less effective in reducing the likelihood of progression.⁸ In our study we also consider patients socioeconomic status within the community.

In the case of diabetic foot most physicians and patients agreed that prevention of lower extremity ulceration, infection, debridement and ultimately amputation is the most desirable clinical strategy, and several studies have shown that this approach is either highly cost-effective or cost saving. In the UK, a 2-year prospective cohort study of 2,000 patients comparing a diabetic foot protection and screening programmed with conventional diabetes care demonstrated that only 24 patients in the protection program developed ulcers vs. 35 patients receiving conventional care. Further most importantly only 7 of the patients with ulcers in the specialized program progressed to amputation, whereas 23 progressed in the conventional care group ($p < 0.01$). The total cost of the screening program was only £100 per patient per year while producing a savings of 11 amputations in 1,000 patients at a cost of £12,084/amputation.⁹ A retrospective cohort study from Austria

using a Markov model to estimate long-term costs and outcomes in a dedicated screening program compared with conventional care similarly concluded that the screening program would reduce costs by 29.8% for mild (grade A) ulcers and by 49.7% for severe (grade D) ulcers, primarily due to lower amputation rates.¹⁰ In a systematic review from the CDC on the cost-effectiveness of interventions to prevent diabetes and its complications, the use of comprehensive foot care to prevent ulcers was one of the few interventions found to be cost saving.¹¹ In Indian communities there is major difference in the cost of treatment between urban and rural communities. This may be due to lack of education and awareness in rural population. Urban families spent more on diabetes than rural families, both as absolute values and as proportions of family income. This was due to the upper expenditure on medical consultations, pathological investigations, and medications and may be partly attributed to the differences in the availability of these more expensive treatments in urban areas.¹² Health care costs associated with diabetic ulcers and amputations contribute significantly to the financial burden of diabetes. According to the US national inpatient sample, as of 2008, the total number of discharges attributed to diabetes related amputations was projected to be 45,000. The average length of stay was 10.1 days with an in-hospital mortality proportion of 1.29%. The most frequent discharge statuses were to a rehabilitation facility (37.9%), routine discharge (31.5%), or home health care (26.9%). The mean charges were \$56,216 while the aggregate charges for the year 2008 had a total of \$2,548,319,965.¹³ In India, the expenditure on health care is borne mainly from self earned resources. Only 6.4% of the urban low-income group received medical reimbursement, whereas this was 21.3% in the high-income group. In urban settings, the concepts of medical health insurance and med claim policies seem better understood and are utilized by the high-income family group. Even the urban low-income family group prefers treatment from private practitioners or health centres rather than government hospitals.¹⁴ The direct cost of diabetes care in India has been reported by others.¹⁵⁻¹⁷ There was one report on the indirect cost from this part of the world, being Rs 12,756 (\$290). Computational studies on the diabetic complications cost in developed countries have also been performed by Brandle et al groups.¹⁸ In our study we have not divided patients on the basis of their living location but on the basis of diabetes complications and we observed that as the complications are progressing the cost of treatment is increasing.

In this study we mostly focused on the direct cost of treatment whereas for indirect cost only one parameter was included. With the increase in duration of uncontrolled diabetes mellitus; patients are more prone for various complications like cardiovascular, neurological, renal, retinopathy and various other related complications which are lethal if not managed properly on time. The present study indicated that as complications of diabetes is progressing the direct and indirect cost of the treatment is increasing rapidly. This was the time limited and short period study on the limited number of patients whereas further studies required to providing clearer picture on the cost burden. This study can create awareness in the region about the severeness of the diabetic complications and cost burden. The government and non government organisations will also know the cost burden on the patients living in this area and they can help them by providing financial assistance and awareness about diabetes mellitus.

CONCLUSION

The present cost burden cross sectional study strengthens the hypothesis of future diabetes treatment cost will increase in developing countries; this is a huge burden on poor diabetic patients belonging to lower economic condition.

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