

# Economic Evaluation of Care in Diabetes Patients – A Community Based Study in Rural Areas of Bangalore District

Farah N Fathima <sup>1</sup>, Shilpa Ravi <sup>2</sup>, Ashwini GS <sup>3</sup>, Twinkle Agrawal <sup>1</sup>

<sup>1</sup> Department of Community Health, St. John's Medical College, Bangalore, India

<sup>2</sup> Department of Community Medicine, Dnyandeo Yashwantrao Patil Medical College, Navi Mumbai, India

<sup>3</sup> Department of Community Medicine, BGS Global Institute of Medical Sciences, Bangalore, India

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## ABSTRACT

**Background:** Diabetes mellitus is a chronic disease which lead to great economic burden on the individual, the family and the community. Studies of low-income Indian family estimate that 25% of family income is required for the care of one adult member with diabetes. This study was carried out to estimate the prevalence of type 2 diabetes mellitus in persons aged more than 30 years in the villages of Bangalore district. We also assessed the direct, indirect and intangible costs involved in the care of a person with diabetes mellitus in a rural setting of India.

**Methods:** Partial economic evaluation from a patient perspective was done in four villages under the Hesaraghatta Primary Health Centre, Bangalore Urban District.

**Results:** The prevalence of reported diabetes among individuals aged 30 years and above is 8.2%. Mean duration of diabetes mellitus was 6.7± 5.0 years. The annual median total cost per patient was Indian Rupees (INR) 6228 out of which the annual median direct cost was INR. 4800 (77%). Cost of medicines constituted a large proportion of 59% of the direct costs, followed by laboratory tests (19.4%), consultation charges (12.5%), hospitalization (7.7%), transport (2.9%) and food (1.9%). The indirect costs consisted of the mean amount spent while caring for a person with diabetes was INR. 54.2 and the mean cost for the patient losing his income as a result of hospitalization was INR. 814.

**Conclusions:** Care of diabetes imposes considerable economical burden on the low and middle income families in India. Cost of medicines is responsible for the major share of this expenditure. Price control of diabetic drugs will benefit patients.

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**Key words:** Diabetes mellitus, rural area, cost of health care, health economics, community settings

**Abbreviations:** HCE - health care expenditure; INR - Indian rupees

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## Introduction

Diabetes Mellitus has been recognized by both the United Nations and the World Health Organization as an ever-increasing public health problem. [1] Globally, diabetes prevalence is increasing and is responsible for 5% of all deaths annually (World Health Organisation 2011).

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### Address for correspondence

Farah Naaz Fathima, Assistant Professor, Department of Community Health, St. John's Medical College, Sarjapur Road, Bangalore 560034, India

Phone: 080 - 22065000

Email: doc.farah@gmail.com

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Prevalence of diabetes according to 2010 statistics was 285 million people and it is expected to increase to 438 million by 2030 (Diabetes Help 2010). Given the current projections, mortality due to diabetes is expected to increase by 50% in the next 10 years. [2]

Because of its chronic nature, the severity of its complications and the means required to control them, diabetes is a costly disease, not only for the affected individuals and their families, but also for the health authorities. [2] Unlike in the West, where mostly the older population is affected, the burden of diabetes in Asian countries is disproportionately high in young to middle-aged adults. [3] This could have long-lasting adverse effects on a nation's health and economy, especially for developing countries.

In 2010, HCE on diabetes was 11.6% of the total HCE in the world. Global HCE of treating or preventing diabetes and its complications is estimated in 2010 to be at least 376 billion US. dollars. By 2030, this cost is projected to exceed 490 billion US. dollars.[4] The financial burden due to diabetes stems not only from the medicine cost, but also from charges due to consultation, investigation, hospital stay and surgery done for the complications of diabetes. Apart from this, indirect cost which arises from the time lost and loss of productivity also accounts significantly.[3] The cost of treating diabetes is enormous, as most of the patients with diabetes not only require anti-diabetic medications, but also need anti-hypertensives, aspirin, statins and other medications related to its complications. This becomes more expensive when the cost of insulin therapy is added that also requires rigorous monitoring.[4]

In recent times, changing economic trends have meant that evaluation of treatment costs is no longer a subject of mere academic interest, even in the developing world.[6] Community based studies in Rural India to assess costs of care in diabetes is lacking. Therefore this study was conducted to assess the prevalence and costs of care in type-2 diabetes mellitus in terms of direct, indirect and intangible costs from a patient perspective.

## Methods

A cross sectional study was done in 4 villages falling under the administrative jurisdiction of Hesaraghatta Primary Health Centre located in Bangalore Urban District. A house-to-house survey was conducted to list all the permanent residents aged 30 years and above. From this, all individuals diagnosed with type-2 diabetes mellitus were identified. All households that were locked despite two visits by the study team were excluded from the study. A partial economic evaluation was done from a patient perspective to assess the different types of costs in diabetic care. A pretested semi-structured interview schedule was administered to the identified individuals suffering from diabetes for at least 1 year prior to the study. The interview schedule included questions related to socio demographic profile, care of diabetes control, healthcare expenditure for diabetes, diabetes care and household economy. The following costs were included in the study: (1). Direct medical costs which included money spent on consultation fees, laboratory investigations, hospitalization, drugs and insulin; (2) Direct non medical costs which included food and transport of patient and caregiver; (3) Indirect costs which included the income loss of patients because of hospitalization, income loss of caregivers while accompanying the patient for check-up or hospitalization

or while caring for the patient; (4) Intangible costs which included reduced productivity, premature retirement.

The direct medical costs were estimated by documenting the expenditure on medicines, laboratory investigations and hospitalization. If the patient was taking the same medicines for the past one year average drug costs were estimated by calculating the drug costs including insulin cost, cost of syringes etc per month multiplied by 12 to get the annual cost. If patients were prescribed with any new medicines in the preceding 1 year or if any medicines were stopped, suitable modifications were made in the calculation. Information was collected on consultation fee per visit separately to private and public health centres and it was multiplied by the stated frequency of consultations in the past one year. Similarly expenses on investigations were multiplied by the frequency of tests to get an estimate of average annual costs for sugar level monitoring and laboratory investigations. The estimated cost of hospitalizations was based on the average hospital charge per event multiplied by number of hospitalisations per year.

Non-medical direct costs were difficult to estimate compared to medical costs as it was not possible to check for the validity of information given by the participants. However patients were asked regarding the average travel costs per visit in the recent past and it was multiplied by the number of total visits in the year. Similarly the cost of food taken outside during the visit for diabetic care in the recent past visit was multiplied by the number of visits. Patient was specifically asked whether food was taken outside for all the visits and accordingly the cost was estimated. Details of special food items prepared only for the diabetic patient at home was obtained and the cost of preparing them was calculated per month; later it was multiplied by 12 to get the average annual indirect cost of special food. All these estimated costs were added up to get the average annual direct non-medical costs incurred by a diabetic patient.

Data on indirect costs covered in this study include man-days lost due to diabetes and the loss of personal as well as family income. We have also calculated the number of days lost for the caregiver while accompanying the patient for diabetes care. Number of man-days lost has been estimated for workers only. Monetary value of man-days lost has been calculated by multiplying number of man-days lost with reported personal daily income (monthly income divided by 30). Loss in personal and family income is calculated by reported percentage loss in income with the monthly income multiplied by 12. An attempt was made to estimate the intangible costs by asking the diabetic patients if their diabetic status resulted in reduced productivity at work expressed in

terms of percentage and the number of years of premature retirement due to their diabetic status.

The sources of information were mainly the patient, family members or caregiver of the patient. The given information was crosschecked by inspecting the medicine and their price list. To check the validity of the costs reported, patients were asked to produce the bills for the investigations, consultations and hospital admissions.

The data collected were entered in Microsoft Excel and analyzed using standard statistical package (SPSS). Total expenditure was computed by adding the individual components of the direct, indirect and intangible costs. Costs were measured as continuous variables and checked for normality using Kolmogorov Smirnov test. All costs were described using percentages, mean and standard deviation, median and inter quartile range. Mann Whitney U test was used to compare the median between 2 groups. Spearman correlation coefficient was used to find out the correlation between total costs and other selected variables. Linear regression model analysis was done to find out association between total costs as dependent variable and the different variables influencing cost as the independent variables. P value < 0.05 was considered statically significant.

## Results

Out of 571 households in the 4 villages, the study team was able to contact only 541 households. These 541 households contained 1065 individuals above the age of 30 years out of which 87 were diagnosed with diabetics. Thus the prevalence of diabetes in the 4 villages among individuals aged 30 years and above is 8.2%. Mean duration after diagnosis of diabetes mellitus was  $6.7 \pm 5$  years. In 4 of the 87 diabetics, the duration of illness was less than one year and hence they were excluded from the study. The interview schedule was administered to the remaining 83 individuals.

The mean age of the study population was  $57.1 \pm 12.0$  years and males constituted 61.4% of the study population. [Table 1] A total of 46 individuals (56.6%) were financially independent where as 32 individuals (38.6%) were completely dependent on their family members for their financial needs, the rest (4.8%) being partially dependent.

Around two thirds (67.5%) of the study population had their blood sugars under control (last blood sugar reading  $< 200\text{mg/dl}$ ) and 30.1% of the diabetic individuals had an associated co-morbid condition (the most common being hypertension). A large majority (83%) of the study population had a health check-up at least once in three months and about 60% of them accessed health care from

private sector. Majority (98.8%) of the diabetics reported consuming medications regularly and they procured medicine mostly from private pharmacy (56.1%). About 83.1% of the diabetics had regular laboratory tests done and most of them availed the services of private laboratory (42.2%). Among the study cohort, 71 individuals (85.5%) had at least one complication of diabetes and the common complications encountered were neuropathy, peripheral vascular disease, eye complications and cardiovascular diseases.

The median total annual cost of diabetes was INR 6228 and the total median annual direct cost was INR 4800. The direct costs were contributed by medicines which constituted a large proportion of 59.06%, followed by laboratory tests 19.38%, consultation charges 12.46%, hospitalization 7.7%, transport 2.94 and food 1.96%. (Fig.1) The mean annual indirect cost was INR 1546. The mean amount spent while caring diabetic patient was INR 54.17 and the mean cost for the patient losing his income as a result of hospitalization which was INR. 813.98. The mean cost for the caregiver while accompanying the patient for hospitalization was INR. 27.71 and the mean cost of the caregiver losing his income while accompanying the patient for checkups was INR. 650.60. The total costs did not show a statistically significant difference among the two sexes ( $p=0.246$ ), regularity of check ups ( $p=0.195$ ), presence of complications of diabetes ( $p=0.858$ ) and presence of co-morbidities ( $p = 0.249$ ).

Our study showed that 58.5% of the study population had experienced less productivity at work due to their diabetic status and 2 persons had premature retirement (<60 years) due to their diabetic status. Three patients (7.3%) had given-up some form of diabetic care due to financial difficulty and all 3 of them had discontinued taking medications and laboratory tests in the last one year.

## Discussion

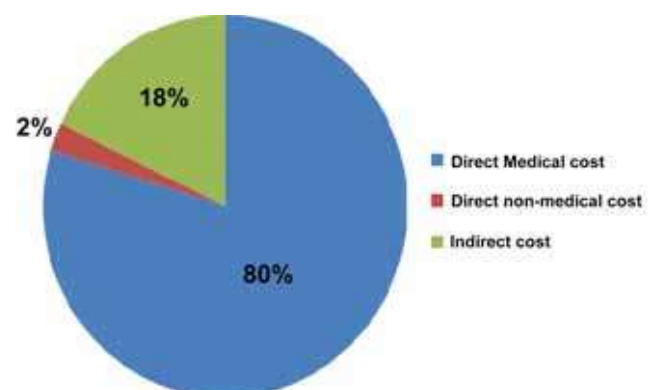


Fig. 1: Pie chart displaying the components of the annual cost of diabetic care

**Table 1: Age and gender distribution of the study population**

Age group (in years)	Males (%)	Females (%)	Total
31-40	3 (60)	2 (40)	5
41-50	16 (64)	9 (36)	25
51-60	21 (75)	7 (25)	28
>60	11 (44)	14 (56)	25
<b>Total</b>	<b>51 (61.4)</b>	<b>32 (38.6)</b>	<b>83</b>

**Table 2: Estimation of the annual cost of diabetic care\***

Costs	Total Expenditure	Inter quartile range	Mean cost †
<b>Direct Costs</b>	589,441	2314 - 8980	7101
<b>Direct Medical Costs (total)</b>	572,509	2064 - 8896	6897
• Medicines	319,724	936 - 5760	3852
• Lab tests	82,605	300 - 1200	995
• Consultation	46,680	200 - 800	562
• Hospitalisation	123,500	0 - 700	2872
<b>Direct Non Medical Costs (total)</b>	16,932	40 - 250	204
• Food	4,895	0 - 100	59
• Transportation	12,037	22 - 150	145
<b>Indirect Cost (total)</b>	128,355	0 - 2141	1546
• Cost incurred by caregiver	4,495	0 - 0	54
• Income loss to patient during hospitalization	67,560	0 - 0	814
• Income loss to caregiver during hospitalization of patient	2,300	0 - 0	28
• Income loss to caregiver while accompanying patient for check up visits	54,000	0 - 0	650

\* All costs are expressed in Indian National Rupees (INR)

† Mean cost is calculated per patient per year

Indian studies estimate that, in low-income families as much as 25% of family income is allocated to the care of one adult diabetic.[5] The costs of diabetic care is not only a financial problem but also a social burden. Intangible costs (pain, anxiety, inconvenience and generally lower quality of life etc.) also have great impact on the quality of lives of the patients and their families; however they are the most difficult component of health care to quantify.[5]

There are three different types of costs involved in care of a diabetes patient. Direct costs to individuals and their families include medical care, drugs, insulin, hospital charges and other consumables. Costs range from relatively low-cost items, such as primary-care consultations and hospital outpatient episodes, to costly items, such as long hospital inpatient stays for the treatment of complications. Indirect costs include loss of job or loss of work efficiency. Sickness, absence, disability,

premature retirement or premature mortality can cause loss of productivity. Intangible costs include pain, anxiety, inconvenience and other factors which decrease the quality of life. Some activities may have to be foregone in favour of treatment, discrimination may be experienced in the workplace, obtaining jobs may be more difficult, and professional life may be shortened because of complications leading to early disability and even death. Personal relationships, leisure and mobility can also be negatively influenced.[5] For most countries, the largest single item of diabetes expenditure is hospital admissions for the treatment of long-term complications, such as heart disease, stroke, kidney failure and foot problems. Many of those are potentially preventable given prompt diagnosis of diabetes, effective patient and professional education and comprehensive long term care.[5]

Research of economic evaluation is still in its infancy in India. Literature shows that most of the studies are conducted in hospital settings. This may lead to non inclusion of data from patients who do not seek regular care which is very often the case in diabetes. The strength of our study is that it is a community based study which included not only patients seeking care at both government and private institutions but also those who did not seek any form of care at all. Unlike many previous studies, in the present study costs of diabetic care were assessed under three different subheadings namely the direct, indirect and intangible. The costs were assessed only from the patient's perspective. Finally, costs were assessed as comprehensively as possible and every effort was made to ensure that important components of cost were estimated with some degree of accuracy.

In our study, the direct costs were contributed by medicines which constituted a large proportion (59.0%) followed by laboratory tests and consultation charges. In a study done in coastal Karnataka, the total cost of care of diabetes was estimated at INR.14517.42 per person annually and the greatest bulk of it (42.4%) was attributed to the cost of drugs. [6] The average costs cited in the above study was much higher than that of our study. As the study of Sachidananda et al [6] was done among patients attending a diabetic clinic in a tertiary care hospital, it could have resulted in higher costs. Further, patients attending hospitals are more likely to have complications which increase the cost of care. The present study was done in the community with persons who visited both government and private clinics for diabetic care. Therefore the average cost of our study is lower than that of the study done in a hospital setting.

In a study done by the London School of Economics in 2010 in 5 European Union countries to assess prevalence of diabetes and the cost of its care, cost of inpatient care

was consistently higher than that of outpatient care in all the countries.[7] This was attributed to increased medical care required in diabetes-related complications. Outpatient costs on the other hand, as well as diabetes medications, can be less than half of inpatient costs due to the relatively low costs of maintaining good glycemic control (medication and regular monitoring).[7] This study identified costs due to absenteeism, early retirement and expenditure on social benefits which amounts to a total of •98.4 billion across the study countries in 2010.[7] In a study done in Thailand, the total cost of diabetic care was estimated to be US \$ 418,696 in 2008. [8] Of this, 23% was direct medical cost, 40% was direct non-medical cost and 38% was indirect cost.[8] This study was done in a hospital setting and hence show higher cost as compared to our study.

Kumapatla et al showed a huge increase in the cost of treating diabetic complications.[9] They showed that diabetic foot complications costed an average of INR. 19,020 per patient, those who had two complications spent four times more, and those with renal disease, cardiovascular and retinal complications spent three times more than patients without any complications. [9] But in our study there was no significant difference in the total costs incurred among persons who had complications of diabetes and those who did not ( $p = 0.858$ ). This difference could be due to community based assessment which tends to dilute the concentration effect of hospital based studies.

Several studies done to assess the cost of diabetic care have been done in hospital settings. [10] In contrast the present study is one of the few studies done in the community. Thus it provides a realistic estimate of cost as experienced by diabetics. Further community-based studies are required to get a better picture of the economic implications of diabetic care and a larger sample size is also needed to generalise the results.

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