

Original Research Article

Economic burden of diabetes mellitus and its socio-economic impact on household expenditure in an urban slum area

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ABSTRACT

Background: India is on the brink of an epidemic of diabetes mellitus (DM). In the near future, DM will pose a severe burden on the already fragile and under-resourced health care system in India.

Methods: A prospective community based cohort study was taken up for assessing the financial burden on households of patients with DM in an urban slum of Mumbai to reflect the economic implications of DM.

Results: The mean age of participants was 51 years. Forty (33.33%) out of 120 were suffering from diabetes for more than 5 years and it was proved statistically that the total cost of expenditure on treatment per month was significantly related to the duration of DM. On an average the monthly direct expenditure was INR 687.5 per patient and indirect expenditure was INR 348.75 per patient. Catastrophic expenditure was borne by 5.8% of the participants.

Conclusions: Direct cost forms the major component of the total cost of DM management. The expenditure on the management of Diabetes increases with the duration of the illness. As the out-of-pocket expenditure is the mainstay of financing the cost of diabetes mellitus in India, there is a possibility of these households of DM patients might be pushed into the poverty trap. It is recommended that the Government facilities for management of DM should be strengthened and quality of services should be improved in the interest of diabetic patients. Public awareness campaigns about the economic implications of DM and services provided by the government should be carried out.

Keywords: Catastrophic expenditure, DM, Healthcare expenditure

INTRODUCTION

Diabetes mellitus (DM) is a common chronic disease in nearly all countries. The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014. The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014. Diabetes prevalence has been rising more rapidly in middle- and low-income countries.¹

DM leads to both premature death and complications such as blindness, amputations, renal disease and cardiovascular diseases. DM is also costly to health care

systems. People with DM have more outpatient visits, use more medications, have a higher probability of being hospitalized, and are more likely to require emergency and long-term care than people without the disease.

Estimates of the current and future economic burden of the disease on the health system can assist decision-makers understand the magnitude of the problem, prioritize research efforts, and plan resource allocation to properly manage the condition. Disease cost estimates also help prioritize interventions, which must be done in the face of limited health care resources in our country. Expressed in International Dollars (ID), which correct for

differences in purchasing power, the global expenditures on diabetes will be at least ID 561 billion in 2030.²

More than 80% of expenditures for medical care for DM are made in the world's economically richest countries, not in the low- and middle-income countries where 80% of persons with DM will soon live. In 2012, an estimated 1.5 million deaths were directly caused by diabetes and another 2.2 million deaths were attributable to high blood glucose.¹

The impact of diabetes is not only due to the mortality attributed to the disease but also on account of the high morbidity and disability associated with it.

A measure of disability burden is the number of years lived with disability. This figure has gone up for diabetes, by 67.2%, from 12,412 (per 100 000) in 1990 to 20,758 in 2010. In South Asia, DM is the eleventh most important disease causing disability in individual (ranked 13 in men and 9 in women).³

Several studies have been carried out on the association of DM with cardiovascular diseases and stroke, complications in DM with respect to adherence to treatment and the decrease in complications and mortality rates with adequate management of DM. In most of these studies the issue of economic burden caused by the disease is quite left unattended. In the absence of adequate public health programs to effectively deal with this problem, estimates of costs will help conceptualize strategies to deal with the situation at local, regional and national level.

The objective of this study was to assess the socio-economic impact of diabetes mellitus on household expenditure in an urban slum area in Mumbai.

The objectives of the study were to estimate the direct, indirect and total healthcare expenditure incurred by patients (both outpatient and inpatient) suffering from diabetes mellitus, to estimate the impact of the cost of management of DM on household expenditure and to find the proportion of households bearing catastrophic expenditure on account of DM.

METHODS

The study was a community based prospective cohort study conducted from November 2013 to April 2014 with the study subjects followed-up every month, for a period of six months. It was undertaken in Malvani, an urban slum of Mumbai. The Department of Community Medicine of a tertiary care hospital and medical college runs an Urban Health centre (UHC) at the urban slum. The area taken up for the study was New Collectors Colony (NCC) of the slum. As per municipal corporation ward office records, the total population of the study area was approximately 2 lakhs. The study area is divided into

69 plots. The subjects for the study were the households of patients with diabetes mellitus in the study area.

Taking prevalence of DM as 9% in the population, the prevalence of households with DM is estimated to be approximately 45%, assuming uniform distribution of DM patients in the households (every household on an average comprises of 5 members as seen in the pilot study).⁴ Using the prevalence of DM and the total population of the study area, a sample size of 122 households was arrived at with a type II error of 0.2 and type I error of 0.05. Cluster sampling was used and house-to-house survey was conducted in the selected plots to identify household with patients with diabetes mellitus. Households with Diabetes mellitus from the plots consenting to the study were enrolled in the study to get the required sample size. Only families staying in the study area for at least 1 year were interviewed. Patients with type 1 DM were excluded from the study.

Operational definitions

Direct cost

Direct cost includes hospital services, physician services, laboratory tests and the daily management of DM - which includes availability of products such as insulin, syringes, oral hypoglycemic agents, blood-testing equipment and transportation cost. Costs range from relatively low-cost items, such as primary-care consultations and hospital outpatient episodes, to very high-cost items, such as long hospital inpatient stays for the treatment of complications.⁵

The direct cost for the month was calculated as follows

Monthly expenditure on medicines, Number of visits and consultation fees for the month, cost for investigations during the month, cost of hospitalization for the month was estimated using a structured interview. Medical bill records were checked.

Indirect cost

Indirect cost includes loss of productivity due to sickness, absenteeism, disability, premature retirement and premature mortality of the patients.⁵

The Indirect cost for the month was calculated as follows

Monthly income lost due to disease related absenteeism (calculated by daily wages multiplied by number of absent days), monthly income loss of the accompanying household member (calculated by daily wages multiplied by number of absent days). Cost of transportation of the patient and accompanying member to the physician and for investigations for the month were estimated. Ancillary costs like snacks, photocopy, etc. were also taken into account.

Catastrophic expenditure: Health spending is taken to be catastrophic when a household must reduce its basic expenditure by 40% over a period of time to cope with health costs.⁶

Out of pocket expenditure (OOPE)

Out of pocket expenditure is any direct outlay by households, including gratuities and in-kind payments to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services whose primary intent is to contribute to the restoration or enhancement of health status of individuals or population groups. It is a part of private health expenditure.⁷

A pre-tested structured interview schedule to elicit the direct and indirect cost, was administered to the study participants after making necessary modifications based on findings of the pilot study.⁸

The patients and their households were followed up every month, for 6 months by home visit to evaluate the direct and indirect expenditure borne by them on account of DM during this period. Patients who were not traceable for follow-up were contacted on the phone. Two households were lost to follow-up during the study period. For the purpose of building a rapport with the participants and the household members, the first home visit to every participant was conducted with a medical social worker who is currently working in the study area and the purpose, duration and protocol of the study was explained to them.

Information from patients who were not traceable to follow-up was collected telephonically.

Statistical analysis

Data was entered and analysed using Microsoft Excel 2007 and SPSS version 16.0. Frequency and percentages for the qualitative data were calculated. Chi square and Fischer exact test was used for analysis.

RESULTS

A total of 120 patients participated in the study. Mean age of the participants was 51 years. Maximum age of the participants was 71 years and minimum age was 43 years. Males made up 52.5 % of all the participants while female participants formed the remaining 47.5 %. Around half of the participants were unemployed (52.5 %). This included retired participants, housewives and unemployed participants.

A large proportion of patients, with duration of disease less than 3 years, availed treatment from private sector. This proportion significantly reduced with advancing duration (3-5 years) of treatment. However, a shift to private facility was seen in patient with prolonged duration of treatment (> 5 years) (p =0.0092) (Table 1).

Table 1: Distribution of participants on the basis of treatment facility and duration of DM.

Duration of DM (in years)	Treatment sought from		Total
	Government	Private	
>3	7 (18.92 %)	30 (81.08 %)	37 (100%)
3-5	19 (44.19 %)	24 (55.81 %)	43 (100%)
>5	7 (17.5 %)	33 (82.5 %)	40 (100%)
Total	33 (27.5 %)	87 (72.5 %)	120 (100%)

Chi-square test, $\chi^2 = 9.378$, $p = 0.0092$, significant at 0.05 level of significance.

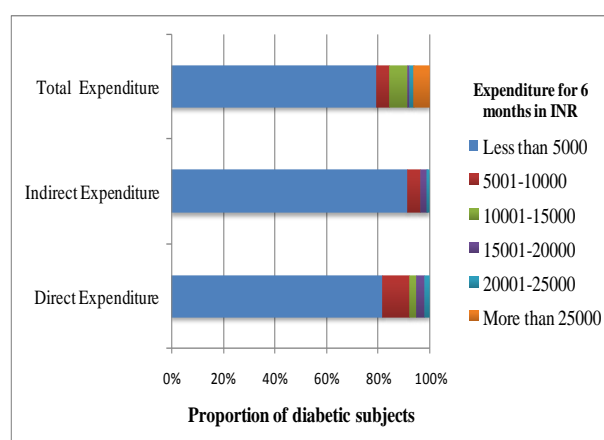


Figure 1: Distribution of participants based on the “direct and Indirect expenditure” towards DM for 6 months.

Direct cost

The mean cost of physicians’ consultation for DM and its complications was INR 77.9 per visit, mean cost of medicines was INR 287.5 per month, mean cost of investigations was INR 85 per visit and mean cost of hospitalisation during the follow-up period was INR 8636. The mean direct cost of DM management over 6 months was estimated to be INR 4125 (687.5 per month). 92.5 % of the participants had a direct cost for the management of DM less than INR 10000/-.

Indirect cost of DM management

The mean loss of wages on account of DM, during the follow-up period (6 months) was INR 1416.6. Only one participant changed job with decreased wages on account of DM. The mean cost of transportation was INR 30 per visit (86 participants had zero cost of transport). Mean ancillary cost was INR 9.58 per visit and mean loss of wages of the accompanying relative was INR 97.5 per visit. Majority of the participants (91.6 %) had an indirect cost less than INR 5000 towards the management of DM.

The mean indirect cost of management of DM for 6 months was INR 2092.5 (INR 348.75 per month).

Total cost of DM

The mean total expenditure in the management of DM for 6 months was INR. 5120.83 (INR. 853.47 per month). Total DM management expenditure was under INR.5000 in majority of the participants (79.2 %).

Catastrophic expenditure and out of pocket expenditure

In the current study, “Out of pocket expenditure” towards management of DM was borne by 72.5% of the participants studied.

Of the total participants, 65% had DM expenditure less than 5% of house hold expenditure. Most of the participants (61.7 %) did not have a cut down on the monthly household expenditure. The mean cut down in monthly household expenditure was INR 1978.26 Participants with higher percentage of DM expenditure of the total household expenditure, tend to cut down on household expenditure. Difference was statistically significant (Fisher exact, p=0.00007024).

Catastrophic expenditure (i.e. expenditure exceeding 40% of house hold expenditure) was borne by 5.8 % of the study participants. “Out of pocket expenditure” towards management of DM was borne by 72.5 % of the participants.

Table 2: Distribution of participants on the basis of percentage of DM expenditure of the total household expenditure.

% of DM expenditure of total household expenditure	Frequency n=120	Percent %
<5%	78	65.0
5%-10%	17	14.2
10.1%-20%	15	12.5
20.1%-30%	0	0
30.1%-40%	3	2.5
>40%	7	5.8
Total	120	100.0

It was seen that patients with a longer duration of DM and patients not living with their spouses, incur a greater cost of DM management, perhaps owing to a poor compliance to treatment.

DISCUSSION

The findings of the current study are consistent with the findings of other studies conducted to assess the financial burden of DM. In a study by Mohan V et al, to assess the trends in the prevalence of diabetes and glucose tolerance in urban South India, 50.1 % of the study subjects with DM were in the age group of 40-59 years.⁹ This

corroborates the finding of the current study where the mean age of the participants was 51 years, which suggests significant burden of DM in the middle-aged population. This is an economically productive age group and so the cost of management of the disease and loss of economic productivity inevitably affects the households.

In a study by Akari S et al, to assess the health-care cost of diabetes in South India, 42% of the participants were unemployed (which included pensioners, housewives and students). Also 65% of the study participants had been suffering from DM for less than 5 years, while the remaining were suffering for more than 5 years, which was similar to the findings in the study.¹⁰

In the current study, it was seen that patients with a longer duration of DM and patients not living with their spouses tend to incur a greater cost of DM management, perhaps owing to a poor compliance to treatment.

The economic implications of DM seen in the current study are similar to the expenditures in other studies. A study by S Grover et al reported a mean cost of consultation of INR 78.5, mean cost of investigations of INR 277 and a mean cost of medicines of INR 301.8 per month totaling to a mean direct cost of INR 4966.42 over 6 months.¹¹ The mean loss of income of the participant was INR 1263 whereas the mean loss of income of the accompanying relative was reported to be INR 823.46M totaling to indirect cost of INR 2086.74 over 6 months. These figures were similar to the expenditure found in the current study where the direct cost of treatment is almost twice the indirect cost of treatment.

In the study by Pablo Chandra et al to assess the economic burden of DM in urban Indians, the average monthly income of the sample was Rs. 20,000 out of which Rs.735 (3.6%) was spent on direct cost and Rs. 329 (1.4%) was spent on indirect cost, which is almost close to the findings of this study with mean direct and indirect cost of INR 687.5 and INR 348.75 per month.¹²

A study by Loganathan ACV et al, carried out in 6 outpatient diabetic clinics of Chennai reported a mean consultation fee per month of INR 63.58/- and mean cost of transportation of INR 143/- per month.¹³ A lower mean cost of transportation was found in the current study, the reason for which could probably be the absence of any requirement to spend on transportation. The study area being in a central hub with many medical facilities in the vicinity minimises the requirement for use of modes of transport, thereby minimising the expenditure on transportation.

In the current study the mean total expenditure in the management of DM is INR. 853.47 per month which was similar to the total median expenditure on diabetes care in the study by Ambady Ramachandran et al which was Rs 10,000 (\$227) in the urban subjects, which amounts to approximately INR 833.33 per month.¹⁴ Also in the study

it was seen that expenditure on management of DM increased with duration of diabetes which confirms the findings in the current study.

Similarly, the study by Pablo Chandra et al showed a positive correlation between the duration of diabetes and the cost of diabetes.¹²

In the current study, catastrophic expenditure was borne by 5.8 % of the study participants. An analysis of 108 surveys in 86 countries has revealed that catastrophic payments are incurred by less than 1% of households in some countries and up to 13% in others. Up to 5% of households are pushed into poverty.¹⁵ Every year, approximately 44 million households, or more than 150 million individuals, throughout the world face catastrophic expenditure, and about 25 million households or more than 100 million individuals are pushed into poverty by the need to pay for services.¹⁶ This is called poverty trap.

In the current study, “out of pocket expenditure” towards management of DM was borne by 72.5 % of the participants. World health statistics 2012 by WHO reported that in 2009, the private expenditure on health as a percentage of total expenditure on health in India was 69.7%, of which 86.4 % was made up of OOPE.¹⁷ As per the World Development Indicators given by World Bank the OOPE of India stood at 62.4 % of total Health Expenditure.¹⁸

CONCLUSION

The financial burden of type 2 DM can have catastrophic implications. The economic burden of DM is enormous as it perpetuates and exacerbates poverty. As India stands on the brink of a DM epidemic due to the rapid increase in population, increased longevity and high ethnic susceptibility to DM, coupled with rapid urbanization and changes from a traditional lifestyle, it is imperative that the Government takes major steps with regards to this disease.

Recommendations

Government health facilities providing services for the management of non-communicable diseases, including DM, need to be strengthened. The outreach of these services should be increased along with improvement in the quality of services provided. Awareness campaigns, IEC activities regarding not only physical and financial implications of DM but also of services and facilities provided by the Government, should be conducted.

This will help patients of DM in evaluating his/her expenditures, planning finances and taking benefit of government schemes and facilities. Improvement in quality and quantity of services coupled with increasing awareness will encourage people to avail of Government facilities thereby reducing the financial burden of the

disease on individual households. Compliance to treatment should be ensured by health institutions by promoting awareness regarding the consequences of complications of DM through public awareness campaigns.

Resources should be invested to deliver cost- effective or cost-saving, easy-to-use interventions which can reduce the economic burden of diabetes on households.

In the absence of an adequate health insurance system in India, Households use savings, borrow or sell assets to cope with health shocks and pay catastrophic proportions of their available income. This pushes many households into poverty. Insurance schemes to cover direct medical costs in patients with chronic diseases need to be developed by the government. The scope and outreach of national schemes like the Rajiv Gandhi Jeevandayee Yojna should be increased.

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REFERENCES

1. Global report on Diabetes. France: World Health Organisation, 2016. Available at http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf. Accessed on 16 March 2017.
2. Ping Z, Xinzhi Z, Jonathan B, Dorte V, Richard AS, Shaw J, et al. Economic impact of diabetes. IDF Diabetes Atlas fourth edition. 2009:1-28.
3. Bhutani J, Bhutani S. Worldwide burden of diabetes. *Indian J Endocrinol Metab.* 2014;18(6):868-70.
4. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. *Indian J Med Res.* 2007;125(3):217-30.
5. Diabetes: the cost of diabetes, fact sheet no. 236. World Health Organization,2002. Available at <http://www.who.int/mediacentre/factsheets/fs236/en/>. Accessed on 17 January 2017.
6. Ke X, David BE, Kei K, Riadh Z, Jan K. Christopher M. Household catastrophic health expenditure: a multicountry analysis. *Lancet.* 2003;362:111-7.
7. Out of pocket expenses, World Bank Data. Available at <http://data.worldbank.org/indicator/SH.XPD.OOPC.ZS>. Accessed on 16 March 2017.
8. Kapur A. Cost of diabetes in India. The CODI study paper presented at the Novo Nordisk. In: Kapur A, Joshi JK, eds. Diabetes Update Proceedings. Bangalore: Communication Workshop (P); 2000:71-7.
9. Mohan V, Deepa M, Deepa R, Shanthirani CS, Farooq S, Ganesan A, et al. Secular trends in the prevalence of diabetes and impaired glucose tolerance in urban South India: the Chennai urban

- rural epidemiology study (CURES-17); *Diabetol.* 2006;49(6):1175-8.
10. Akari S, Mateti UV, Kunduru BR. Health-care cost of diabetes in South India: a cost of illness study. *J Res Pharm Pract.* 2013;2(3):114-7.
 11. Grover S, Avasthi A, Bhansali A, Chakrabarti S, Kulhara P. Cost of ambulatory care of diabetes mellitus: a study from north India. *Postgrad Med J.* 2005;81:391-5.
 12. Pablo C, Bageshri G, Parikshit G, Nilesh T, Abhay M, Amit W. Economic burden of diabetes in urban Indians. *Open Ophthalmol J.* 2014;8:91-4.
 13. Loganathan ACV, John KR. Economic burden of diabetes in people living with the disease: A field study. *J Diabetol.* 2013;3(4):1-8.
 14. Ramachandran A, Shobhana R, Chamukuttan S, Christina A, Nara, Rhys W. Increasing expenditure on health care incurred by diabetic subjects in a developing country-a study from India. *Diabet Care.* 2007;30(2):252-6.
 15. Health financing for universal coverage. 2017. Available at www.who.int - Health financing for universal coverage. Accessed on 15 March 2017.
 16. Ke X, David BE, Guy C, Ana MAR. Designing health financing systems to reduce catastrophic health expenditure- technical brief for policy makers, number 2, Department of Health systems financing, Health financing policy, WHO, 2005. Available at <http://www.who.int/iris/handle/10665/70005>.
 17. World Health statistics by WHO, 2012. Available at www.who.int/iris/bitstream/10665/44844/1/9789241564441_eng.pdf. Accessed on 15 March 2017.
 18. Health systems - World Development Indicators | The World Bank. 2017. Available at <http://wdi.worldbank.org/table/2.15>. Accessed on 15 March 2017.

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