Original Research Article

Socio- Economic and Demographic Variables Impacting the Costing of Diabetes Mellitus in an Urban Slum in Mumbai

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ABSTRACT

Although Diabetes mellitus (DM) is a common chronic disease in nearly all countries, India is on the brink of an epidemic of Diabetes Mellitus. It is an escalating problem in India and has major socioeconomic dimensions. A prospective community based cohort study with cluster sampling was taken up in an urban slum of Mumbai for assessing the effect of socio-demographic and economic variables on the expenditure incurred on management of diabetes mellitus.

Results: In the current study, the mean age of the participants was 51 years, suggesting a significant burden of DM in the middle aged population. Males made up 52.5 % of all the participants. Most of the participants were from lower middle socio-economic class according to modified Kuppuswamy's classification (65.8 %). The mean monthly household expenditure was INR 13,032 and the mean monthly expenditure on Diabetes was INR 874.17.

There was a statistically significant difference in direct expenditure among groups by age, educational qualification and staying with partner. The indirect expenditure was affected by sex and staying with partner, while total expenditure differed by age, sex, educational qualification and staying with partner.

Conclusion: Socio- economic and demographic variables affect the costing of Type 2 Diabetes Mellitus DM. Public awareness regarding the impact of diabetes not only on the mortality and morbidity but also on the financial health of the household, needs to be increased by Heath education and awareness campaigns through the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke.

Keywords: Diabetes Mellitus, Socio-demographic variables, direct cost, indirect cost.

INTRODUCTION

Diabetes mellitus is a common chronic disease in nearly all countries. In India, diabetes is an escalating problem with major socioeconomic implications. Diabetes is growing alarmingly in India, home to more than 65,1 million people with the disease, compared to 50.8 million in 2010. [1] The rapid increase in population, increased longevity and high ethnic susceptibility to DM, coupled with rapid urbanization and changes from a traditional lifestyle will trigger a DM epidemic.

Although there is an increase in the prevalence of type 1 diabetes also, the major driver of the epidemic is the more common form of diabetes, namely type 2 diabetes,

which accounts for more than 90 per cent of all diabetes cases.

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. [2]

Nowhere is the diabetes epidemic more pronounced than in India. Different statistics put the prevalence diabetes in India between 7.8% (World Health Organization – Diabetes country profiles - 2016) [3] to 9.1% (IDF Diabetes Atlas, 5th edition annual update, 2012). The International Diabetes Federation (IDF) estimates the total number of adult diabetic subjects (20-79 years) to be around 69.1 million in India in 2015. The cost per person with DM is 94.9 USD. The IDF also estimates that approximately 36 million cases of DM in adults are undiagnosed, [4] which is a cause of serious concern.

In the absence of adequate public health programs to effectively deal with this problem, an understanding of the factors affecting the cost of diabetes will help in formulating strategies to control the epidemic.

This study is an attempt to find the socio-demographic and economic variables impacting the expenditure incurred on the management of diabetes mellitus in an urban slum of Mumbai.

The objectives of the study were to assess the socio-demographic and economic profile of patients diagnosed and treated for Diabetes mellitus and to study the impact of these variables on the direct, indirect and total healthcare expenditure incurred by them towards the management of the disease.

MATERIALS AND 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.

Taking prevalence of DM as 9% [5] 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). 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 consenting to the study were enrolled 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. [6]
Indirect cost: Indirect costs include loss of productivity due to sickness, absenteeism, disability, premature retirement and premature mortality of the patients. [6]

A structured interview schedule was designed to collect the socio-economic and demographic profile and elicit the direct and indirect cost, [7] and administered to the study participants after necessary modifications were made based on findings of the pilot study.

Socio-economic and demographic data was collected in the first interview. 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. The patients and their households were then 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.

Statistical Analysis: Data was entered and analysed using Microsoft Excel 2007 and SPSS version 16.0. Frequency and percentages for the qualitative data was calculated. Bivariate continuous data was analysed using Independent sample t test. Multivariate data was analysed using One-way ANOVA test and the Bonferroni test was used as a post-hoc test. (level of significance was 0.05)

RESULTS

A total of 120 patients participated in the study. The mean age of the participants in the study 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. Among the study participants, 89(74.2%) were married and living with their partners. The rest were widowed, divorced or separated. Muslims comprised 66.7% of the study participants, while the rest belonged to the Hindu religion. Around half of the participants were unemployed (52.5 %) this included retired participants, housewives and unemployed participants. Among the employed, the participants were unskilled laborers, vegetable vendors, hawkers, factory workers, shop owners, auto-rickshaw drivers.

More than half of the participants were illiterate (52%) while 38% of the participants had received primary education and 10% of participants had received

secondary education. Nuclear families made up for 43.3 %

Most of the participants belonged to a monthly income group of INR 10000 to INR 20000/-. Per capita income of the households was INR 2794.00 (± 1187.06). The mean monthly household expenditure was INR 13,032 (± 5371.72) and the mean monthly expenditure on Diabetes was INR 874.17 (± 1218.22). According to modified Kuppuswamy's classification, (65.8 %) of the participants were from lower middle socio-economic class.

Mean direct cost of DM management was estimated to be INR 687.5/-(± 765.1) per month. The mean indirect cost of management of DM was INR 348.75/- (± 642.87) per month. Mean total expenditure in the management of DM was INR 874.17/- (±1218.22) was month.

There was a statistically significant difference in the direct and total expenditure between the age groups as determined by one-way ANOVA [$F(2,117) = 5.955$, $p = 0.003$ and $F(2,117) = 3.119$, $p = 0.048$ respectively]. The Bonferroni post-hoc test showed a statistically significant difference between the age group of over 60 yrs and the 51 to 60 yrs age group for direct expenditure ($p = 0.005$) and total expenditure ($p = 0.044$), with the former age group having higher mean values (Table 1). Male participants had a statistically significant higher indirect ($p < 0.0005$) and total expenditure ($p = 0.007$) as compared their female counterparts. The expenses did not differ based on the occupation of the study participant. Educational qualification had a statistically significant effect on the expenditure. The participants with secondary education had higher direct and total expenditure as compared with those with primary education ($p < 0.0005$ and $p = 0.004$ respectively) or with those who were illiterate ($p < 0.0005$ and $p = 0.005$ respectively). There was a statistically significantly higher direct ($p < 0.0005$), indirect ($p = 0.007$) and total expenditure ($p < 0.0005$) when the subjects were not living with their partner (Table 2). The type of

family and the socio-economic status had no   effect on the expenditure.

Table 1: Effect of socio-demographic variables on the direct, indirect and total expenditure due to Diabetes Mellitus

Socio-demographic variable	Frequency (%)	Mean (SD) Values Direct Expenditure	Mean (SD) Values Indirect Expenditure	Mean (SD) Values Total Expenditure
Age (yrs)				
40-50	59 (49.2)	536.41 (521.82)	303.65 (851.71)	840.06 (1239.61)
51-60	46 (38.3)	876.63 (1022.17)	247.28 (374.58)	1124.09 (1318.05)
> 60	15 (12.5)	173.22 (171.56)	68.67 (96.5)	241.89 (160.67)
F statistic (ANOVA)		$F_{(2,117)} = 5.955$, $p = 0.003$*	$F_{(2,117)} = 0.799$, $p = 0.452$	$F_{(2,117)} = 3.119$, $p = 0.048$*
Post-hoc Test		1:2 p = 0.061 1:3 p = 0.271 2:3 p = 0.005*	-	1:2 p = 0.690 1:3 p = 0.260 2:3 p = 0.044*
Sex				
Male	63 (52.5)	601.38 (822.21)	396.43 (855.16)	997.81 (1498.83)
Female	57 (47.5)	643.6 (703.21)	93.77 (140.11)	737.52 (793.87)
Independent sample t-test		p = 0.658	p < 0.0005*	p = 0.007*
Occupation				
Unemployed	63 (52.5)	693.92 (710.37)	183.2 (676.13)	877.25 (1077.13)
Unskilled	23 (19.2)	441.88 (764.64)	383.9 (815.97)	825.78 (1563.56)
Semi skilled	8 (6.7)	360.42 (433.01)	312.5 (431.29)	672.92 (864.31)
Skilled	9 (7.5)	434.44 (117.34)	95.89 (77.34)	530.33 (188)
Shop owner/clerical	17 (14.2)	817.55 (1159.23)	387.41 (473.1)	1204.96 (1621.56)
F statistic (ANOVA)		$F_{(4,115)} = 1.108$, $p = 0.356$	$F_{(4,115)} = 0.755$, $p = 0.557$	$F_{(4,115)} = 0.548$, $p = 0.701$
Educational status				
Illiterate	71 (59.17)	569.69 (687.82)	197.85 (651.14)	767.67 (1054.97)
Primary	37 (30.83)	450.77 (589.64)	270.18 (658.02)	720.95 (1220.84)
Secondary	12 (10)	1453.75 (1145.97)	523 (505.67)	1976.75 (1617.43)
F statistic (ANOVA)		$F_{(2,117)} = 9.329$, $p < 0.0005$*	$F_{(2,117)} = 1.340$, $p = 0.266$	$F_{(2,117)} = 5.933$, $p = 0.004$*
Post-hoc Test		1:2 p = 1.000 1:3 p < 0.0005* 2:3 p < 0.0005	-	1:2 p = 1.000 1:3 p = 0.004* 2:3 p = 0.005
Total	120 (100)	621.43 (765.1)	252.67 (642.87)	874.17 (1218.22)

*Significant at 0.05 level of significance

Table 2: Effect of social and economic variables on the direct, indirect and total expenditure due to Diabetes Mellitus

| Socio-economic variable	Frequency (%)	Mean (SD) Values Direct Expenditure	Mean (SD) Values Indirect Expenditure	Mean (SD) Values Total Expenditure
Staying with Partner				
Living with partner	89 (74.2)	380.39 (397.38)	145.25 (568.25)	525.64 (770.03)
Not living with partner	31 (25.8)	1313.44 (1091.59)	561.08 (748.1)	1874.78 (1659.05)
Independent sample t-test		p < 0.0005*	p = 0.007*	p < 0.0005*
Type of family				
Nuclear	52 (43.3)	582.98 (761.3)	237.62 (789.34)	820.6 (1318.29)
Extended	22 (18.3)	586.97 (391.57)	137.09 (113.9)	724.44 (451.11)
Three Generation	46 (38.3)	681.38 (902)	324.96 (607.12)	1006.33 (1351.96)
F statistic (ANOVA)		$F_{(2,117)} = 0.226$, $p = 0.798$	$F_{(2,117)} = 0.657$, $p = 0.520$	$F_{(2,117)} = 0.483$, $p = 0.618$
Socio-economic Class				
Upper lower	21 (17.5)	622.51 (723.77)	279.08 (752.16)	901.7 (1249.4)
Lower middle	79 (65.8)	768.42 (1070.53)	355.8 (440.95)	1124.22 (1501.06)
Upper middle	20 (16.7)	477.38 (554.85)	55.08 (116.35)	532.46 (643.09)
F statistic (ANOVA)		$F_{(2,117)} = 0.738$, $p = 0.480$	$F_{(2,117)} = 1.323$, $p = 0.270$	$F_{(2,117)} = 1.273$, $p = 0.284$
Total	120 (100)	621.43 (765.1)	252.67 (642.87)	874.17 (1218.22)

*Significant at 0.05 level of significance
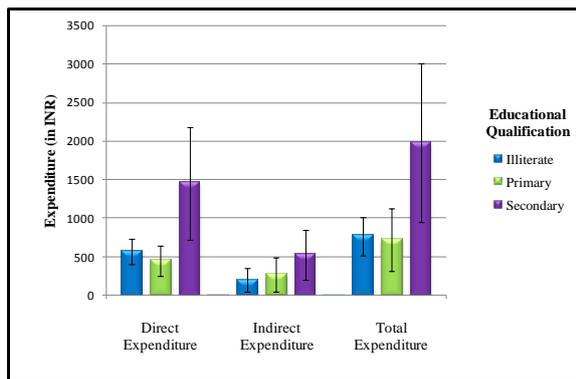
Fig. 1: Error Bar-diagram of expenditure on Diabetes Mellitus based on educational qualification

DISCUSSION

The participants of the present study had a higher mean age as compared to a study by Mayur Patel et al, [8] where the mean age of the studied population was 47.70 years. In another study by A.C.V. Loganathan et al, [9] the mean age of the participants was 57.23 years which is higher than the present study. Majority of the participants were in the age group of 45-55 years and 70-75 years. This suggests a significant burden of DM in the middle aged population. This, being an economically productive age group, increases the cost of management of the disease due to loss of economic productivity. An illness affecting the wage-earning member of a family often also has a significant effect on others. In the absence of protection during illness or bad times through an effective social-security system, many people in India rely on the physical and financial support of their family in order to overcome medical crises or other social problems. As a result, children and adolescents may be forced to start work prematurely and at low wages - significantly reducing their education and negatively impacting their long-term earning capability. [10]

The increased direct and total expenditure observed in the age group of over 60 years may be due to higher expenditure on complications as most of these may be longstanding cases.

In the current study, the proportion of males marginally exceeded that of females which was similar to the findings of

the study by A. C. V. Loganathan et al [9] which suggest equal distribution of diabetes among both the sexes. Diabetes affects all individuals irrespective of the gender. The indirect expenditure among males was significantly higher than among females. This was mainly due to the higher unemployment rate among females (91.8% were unemployed) than the males (17.5% were unemployed).

Distribution of the participants on the basis of marital status in the current study is consistent with the findings in the other studies by S Grover [11] and Baijayanti Baur et al. [12] and also in the current study, participants living with the spouse were seen to incur less cost of management of DM (Table 2). Married participants would tend to comply with the treatment schedule, on account of family pressure and thus avoid complications and in turn the cost of treatment.

As the study area comprised of a predominantly Muslim population, majority (66.7%) of the study participants were Muslims. In the study by Mayur Patel et al [8] 83.89 % of the participants were Hindus, 8.19 % of the participants were Muslims and 8.03 % were members belonging to other religions.

DM is seen in members of all religions. However religious and cultural factors may influence lifestyle and dietary habits and thus contribute to the development of DM. Muslims observe the practice of intermittent or prolonged fasting and this poses a great challenge in the management of diabetes. This may result in hypoglycemia, hyperglycemia with or without ketoacidosis, or even dehydration.

Around half of the participants were unemployed (52.5 %) this included retired participants, housewives and unemployed participants. In the study by A.C.V. Loganathan et al, [9] the percentage of unemployed participants was 41.41 %. Employment status plays an important role in assessing the indirect cost of management of DM. Participants who are employed would have the possibility of higher indirect

cost which would be proportionate to the wages earned.

Illiterate participants made a significant proportion (52%). The high level of illiteracy in the current study can be accounted to the fact that the participants were from an urban slum and belonging to an elderly age group. The direct expenditure was significantly higher among those who had completed secondary education as compared to the illiterate. This may be due to various factors like neglecting of disease condition by those without formal education and the resultant lack of medical help seeking behaviour. Also the uneducated may be opting for lower cost alternatives for treatment. Educational status plays an important role in the patients' understanding of the disease and its co-morbidities, awareness about services provided by the government in management of the disease and adherence to treatment.

The distribution of type of families in the study by Baijayanti Baur et al, [12] was similar to the current study. The type of family plays an important role in determining the monthly household expenditure as the per capita income varies with the size of family and the number of earning members. Smaller families with more earning members tend to have less difficulty in coping up with the household expenditure. In the current study however, no such significant association is seen. Also the type of family, occupation and the socio-economic status had no effect on the expenditure towards DM.

CONCLUSION

Socioeconomic and demographic variables like age, sex, education, marital status of the patient affect the costing of diabetes, which in turn may have long term impact on the economic condition of the household. 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. Government initiated medical insurance and social support schemes are imperative, taking into consideration the high cost of management of DM in socially and economically weak populations. Few people are aware of the complications of DM and fewer still are aware of the financial implications of the disease. It is essential that along with improving the services and facilities for diagnosis and management of diabetes, special emphasis need to be laid on increasing awareness about the disease, its medical and financial consequences and the services provided by the government. Revamping of National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke, use of Public Private Partnership and a strong IEC strategy for reaching out across various sections of the population are the need of the hour.

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