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ORIGINAL ARTICLE

ECONOMIC BURDEN OF DIABETES MELLITUS TO DIABETIC PATIENTS AND THEIR FAMILIES ATTENDING HEALTH FACILITIES IN ADDIS ABABA

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ABSTRACT

Introduction: *Diabetes imposes large economic burden on individuals and their families, and on the national health care system and the economy at large. In developing countries, the problem is increasing rapidly because of limited attention toward non-communicable diseases prevention, including diabetes mellitus. International Diabetes Federation estimated average cost 1,437 United States dollars per person with diabetes was spent globally in treating and managing the disease in 2013.*

Objective: *The aim of this study was to assess the economic burden of diabetic mellitus on patients and their families.*

Method: *Institution based cross-sectional study design was conducted in patients with patient with diabetes mellitus selected from health facilities in Addis Ababa during April 1 - May 4, 2015. A structured questionnaire was used to collect the data, and the data was entered and analyzed using SPSS version 20. A Correlation between the dependent and independent variables was determined using the Spearman's rho correlation coefficient.*

Result: *This study involved 404 patients with diabetic mellitus. The median direct cost of caring for a diabetic patient was 21.8 United States dollars per month. The median of total indirect cost was 6 days (mean 17.3) for the patient and their caregiver in the last six months. Direct cost was significantly higher in those who had higher education level, higher monthly income, monthly family income, patients who had frequently laboratory test, patients source of medication cost from exempted to family/relative cost covered in correlation degree of (0.1 to 0.6 or -0.1 to -0.6) at p- value < 0.05.*

Conclusion: *Medical costs were the major contributor to the direct cost of patients with diabetes mellitus and caregivers. It is suggested that efforts need to increase to improve access to medical services at low cost to diabetic patients.*

Key words: *diabetes mellitus, economic burden, patients, families, Ethiopia*

INTRODUCTION

Diabetes mellitus (DM) is a disease that occurs when the body cannot produce enough insulin or cannot use the produced insulin effectively. In 2013, about 382 million people or 8.3% of adults were estimated to have diabetes and one-half of all adults with DM were between the ages of 40 and 59 years. About 80% of the cases live in low- and middle-income countries. If these trends continue, by 2035, 592 million people will have DM.

The highest increases will take place in developing countries due to poor community awareness and week national health care system. In Ethiopia, an estimated prevalence of DM was 4.4% and DM-related deaths were in the order of 34 thousand (1, 2).

In 2010, over 12 million people in sub-Saharan Africa (SSA) had DM and some 330 thousand people died from DM-related conditions (2). DM is among the main non-communicable diseases (NCD) in developed and developing countries. The millennium development goals (MD has not considered NCDs as one of the public health problems. However, in 2005, the World Health Organization (WHO) report drew attention to the neglect of chronic diseases and in 2011 non-communicable diseases started to get focus by United Nations (3).

The global economic burden of NCD is increasing, estimated United States (US) $6.3 trillion in 2010 and increased to $13 trillion in 2030. Increase in 10% of NCDs leads to 0.5% decrease in the gross domestic product of a country (4).

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Also, DM is as one of the NCDs, which imposes large economic burden to the individual, their families and the nation at large. The main costs it incurs are direct, indirect and intangible costs (5,6). In developing countries, like Ethiopia, the health-care costs have been covered by the patient. The cost for DM management and care imposes significant strain/load to households' expenditures particularly among the lower-income families (7-10).

Global economic development had been hindered due to DM and NCD burden (9-12). In sub-Saharan Africa the problem of diabetes was once considered a rare condition. Due to rapid urbanization, increasingly sedentary life, and poor prevention, early detection and treatment, and aging of the population, the prevalence of DM is increasing rapidly (2,13-15). Estimating the economic burden of DM in Ethiopia has been extremely difficult because of lack of data (2,14-16). Studies on the economic burden of DM, particularly studies examining direct and indirect costs of DM at the individual and at household level, are scarce in Ethiopia (15). The purpose of this study is to identify costs and factors influencing the costs of DMs at individual and household levels to help policy and program mangers make informed decision on resource allocation.

PATIENTS AND METHODS

Study Design

Institution-based cross-sectional analytical study was conducted in Addis Ababa during April 1 - May 4, 2015. Diabetes-induced medical and non-medical (direct) costs and lose of days (indirect costs) to the patient and their families were identified. Costs in cash expensed and in production day's loss were calculated. A micro-costing or bottom-up approach was used to calculate direct coasted and a loosely human capital approach used to calculate indirect costs. Indirect costs included earnings, present and future, and loss to individuals as a result of the illness. Each person's expenses were considered as equal to his market earnings at that time. Direct and indirect costs of DM patient/clients and their families were the dependent variables and socio-demographic variables (age, sex, marital status, occupation, monthly income, educational status, family number, number of visits, distances from the health facility) constituted the independent variables.

Study Area and population

Addis Ababa is the capital city of Ethiopia located at the central part of the country. It's total population 3,061,404 by the Central Statistics Agency (CSA) in 2012.

The city has five public hospitals and 86 public health centres, and a few private facilities providing DM management services. Only one diabetic centre, located at Tikur Anbessa hospital, provides specialized DM services. Patients seen at Tikur Anbessa and Zewditu hospitals and Kazanchis and Nifas Silik LaftoWorda 3 health center, Senaye private higher clinic were included in the study.

Operational definitions

Direct costs: The cost or expenditures in USD spent by patients and their families in the diagnosis and treatment of DM per prescription of physicians
Indirect costs: the lost productive days by patients and their families that is associated with DM care and treatment.

Inclusion and Exclusion criteria

Type 1 and type 2 diabetic patients/clients who lived in Addis Ababa and had follow-up at the health facilities for the preceding 12 months and patients greater than 14 and visited the facility with caregivers and comfortable to take part of the study. Mothers with gestational diabetes, patients severely ill, and children less than 14 years were excluded from the study.

Sample Size

Study sample size was determined by using a single population proportion formula. Due to the lack of similar studies in the country the proportion 50%, marginal error (d) of 5% and a confidence interval of 95% were used. The sample size (n) was calculated using the formulas:
$n = (Z\ 1-\alpha/2)^2 p\ (1-p)/\ d^2 = 1.96^2 * 0.5 * 0.5/0.05^2 \approx 384$. Making adjustment for a 10%non-response rate, the sample size for the study was estimated at 422.

Sampling Procedures

The health facilities in the city were identified based on availability of study participants and capacity in provision of DM services. The health facilities were stratified into three categories- public hospitals, public health centres and private health facilities. The facilities were selected purposively based on long service years and number DM patient in care. Study participants were selected proportionate to number of patient in each category and by employing simple random sampling using patient registers as the sampling frame.

Data Collection Procedures

A structured questionnaire designed after reviewing relevant literature was used to collect data. Face-to-face interviews were conducted with DM patients and with selected family members.

For children under 18 years of age and for very old patients data was collected from caregivers or those accompanying the patients. The interviews were administered by trained data collectors after consent was obtained from each patient.

Data Analysis Procedures

The data analysis was done by using SPSS version 20 statistical software. Frequency distributions and proportions were to summarize discrete variables - socioeconomic, demographic variables, and clinical variables, and direct and indirect medical costs. Mean with standard deviation (SD) or median were calculated as appropriate to summarize data on continuous variables. Medical costs of people with waiver privileged were considered as the cost for analysis by taking the estimated cost of expenditure from the pharmacy and laboratory. Pearson correlation coefficient and Manny Whitney U test were used to assess associations between quantitative and normally distributed variables. Association between rank orders for the variables with values non-normal distribution or had categories of independent variables with continuous dependent variables was tested the Kendall's tau-b or Spearman and Manny Whitney U test.

Data Quality Management

The data collection tool was translated to local language Amharic and translated back to English to check consistency. The questionnaires were pre-tested in 10% of participants and the necessary adjustments made. Data was collected by nurses with Bachelor of Science (BSc) degree and drawn from non-study facilities. They received three-day training on data collection tool and procedures. The principal investigator and supervisor checked the data for completeness and accuracy on daily basis.

Ethical Consideration

This study was approved by the School of Public Health Research and Ethics Committee of Addis Ababa University, the Internal Medicine Department and Addis Ababa City Health Bureau ethical committees. Administrative clearance was obtained from study health facilities. Written and oral informed consent were obtained from the study participates.

RESULTS

Demographic and Socioeconomic Characteristics

The study included 404 (95.7%) participants of the estimated sample, 148 (36.6%) of them were in the age group of 46 – 60 years, about one-quarter,99 (24.5%) and 97 (24%), attended primary and secondary education, respectively. Some127 (31.4%) were unemployed and 186 (46%) had a role as mothers in the family and 294 (72.7%) had their own income with a median of USD 27 (Table 1).

Table 1: Socio demographic characteristics of patients with diabetic mellitus followed up in health facilities, Addis Ababa, April 2015.

Variable	Number	Percent
Sex(n=404)		
male	175	43.3
Female	229	56.7
Age (n=404))		
14 – 30	69	17.1
31 – 45	103	25.5
46 – 60	148	36.6
61 and above	84	20.8
Education (n=404)		
Illiterate	39	9.7
Read and write	38	9.4
Primary	99	24.5
Secondary	97	24.0
Diploma	63	15.6
Degree and above	68	16.9
Occupations (n=404)		
Unemployed	127	31.4
Employed	198	49
Retired	62	15.3
Student	17	4.2
Employee type (n=198)		
Government	58	29.3
Private	100	50.5
NGO	40	20.2
Patients role in household (n=404)		
Father	148	36.6
Mother	186	46.0
Child	56	13.9
Other family member	14	3.5
Average household size	4.5	
Average employed family members	2.1	
Median income of the respondents (n=294)	1,600	
Median income of family (n=404)	3,500	

Clinical characteristics and burden of illness

Only 55 (13.6%) of the patients knew their diabetic status and 94 (23.4%) had Type 1 DM. The mean duration (SD) of follow up of participants was 8.4 (±6.75) years.

The range of follow-up period for Type 1 DM patients was one to six months with a mean (SD) duration 3.2 months and one to nine months with a mean of 2.9 for type 2 DM patients (Table 2).

Table 2: Clinical characteristics and burden on patient with diabetic Mellitus at Health Facilities, Addis Ababa, April 2015.

Variables	Number	Percent
Ways of diabetes identified at first		
Having exam for diabetes mellitus (n=404)	55	13.6
Other diseases examination (n=404)	349	86.3
Type of diabetes mellitus (n=404)		
Type 1	94	23.4
Type 2	308	76.6
Average duration year (n=404)	8.4	Range (1-35)
Average T1 frequency of visit (n=92)	3.2	Range (1-6)
Average T2 frequency of visit (n=312)	2.9	Range (1 -9)
Average wait at reception in hours (n=404)	3.2	Range (0.3 to 9)

Some 286 (70.8%) of the participants had worries related to diabetes and 88.5% were had concerns due to the illness **(**Table 3).

Table 3: Intangible burdens of disease to patients with diabetes mellitus and their family members, Addis Ababa, April 2015.

Variables	Number	Percent
Degree of worries related to DMs (N=286)		
very strong	68	23.8
Strong	73	25.5
Medium	112	39.2
Fair	23	8.0
Rarely	10	3.5
Mainly household caregiver (N=404)		
Female Sex, mother, wife, sister, daughter	200	49.5
Male sex, father, husband, brother, son	80	19.8
All family member and others	124	30.7

Of the direct cost, the medical cost in USD was 58.9% with a median of 11.5 and mean of 17.7. The median non-medical cost was 8.6 and mean 12.3. The median (IQR) of the overall monthly direct cost was 38.3 and the mean (SD) was 30 USD per patient per months. In 96 (32.6%) of the participants, direct cost expenditure for treatment of DM each month was more than 40% of their income (Table 4).

Indirect cost was a time devoted to diabetic patients and their caregiver in seeking treatment during the six months recall period. It was expressed by loss of days, directly by patients during follow up visits, days in inpatient treatment, days in emergency visits and emergency managements, a totally 4,460 days with a median of 6 days were used. Indirectly 2,507 days by 212 caregivers with a median (IQR) of 8 days were used in six months for the care of patients.

Total days used by patients and their caregiver were 6,987 days with a median of 6 days in 6 months. About 74 (18.3%) individuals used more than 30 days in six months for the care of diabetes by patients and their families. About one-fourth.108 (26.7%), of the study participants used more than 20 days (Table 5).

Table 5: Loss of days by patients and their caregiver who had follow-up in health facilities, Addis Ababa, April 2015.

Variables	n	Mean	Median	Std. Deviation
Total Days Used By patient in 6 Month	404	11.1	6.0	14.84
Number Day used Visit in 6 months	404	3.9	3.0	2.35
Stopped School days	17	7.9	6.0	5.73
Stopped Work days	72	12.4	10.0	10.01
Days in Care in Household for unemployed	140	9.9	7.0	8.17
Days used in inpatient services	53	6.5	5.0	5.65
Days Used During Emergency	69	4.2	3.0	3.62
Total Days Used by Caregiver in 6 Month	212	11.7	8.0	12.52
Days with Caregiver in follow up	144	3.4	3.0	2.62
Days with Caregiver in patient case	52	6.6	5.0	5.67
Days Used by Caregiver in Emergency	65	3.8	3.0	3.23
Days giving Care in Household	140	9.9	7.0	8.17
Total Days used by patients and their caregiver in six Months	404	17.3	6.0	25.05
Patients and their families used ≥ 20 days in 6 months	108 (26.7%)			
Patients and their families used ≥ 30 days in 6 months	74 (18.3)			

Correlates of costs for independent Variables

The variables such as educational status, individual income, family income, laboratory test frequency and financial sources were moderately correlated with direct costs, Spearman Correlation Coefficient 0.3 to 0.6 or -0.3 to -0.6, whereas family size, employed family number, year of follow up, and distance from health facilities were weakly correlated, Spearman Correlation Coefficient0.1 to 0.29 or -0.1 to -0.29.

The association between sex of participants and DM type tested using Mann-Whitney U test showed a significant difference at Z= -2.05 and P=0.04, but sex of participants had no significant difference in direct costs. The number of visits had moderate correlation with indirect costs but weak correlated with family income and duration of follow up (Table 6).

Table 6: Correlation of direct and indirect costs with independent variables in patients with diabetes mellitus and their families, Addis Ababa, April 2015.

	Spearman's rho correlation coefficient			
Variables	Monthly Medical cost	Monthly Non-medical cost	Direct cost	Indirect cost
Visit number in six months	-.056/.260	.163/.001**	.050/.321	.470/.00**
Education	.287/.00**	.338/.00**	.354/.00**	-.022/.66
Occupation	.042/.405	.121/.015*	.076/.128	-.061/.219
Family size	.101/.042*	.046/.353	.101/.042*	.060/.226
Employed family number	.209/.00**	.275/.00**	.282/.00**	.061/.239
Income	.393/.00**	.498/.00**	.492/.00**	.014/.812
Family income	.435/.00**	.560/.00**	.545/.00**	.102/.041*
Follow up year	.177/.00**	.086/.086	.148/.003**	-.123/013*
Laboratory frequency	-.398/.00**	-.330/.00**	-.415/.00**	-.068/.174
Distance from home	.227/.00**	.161/.001**	.240/.00**	-.085/.089
Medication finance source	.295/.00**	.268/.00**	.319/.00**	.020/.689
Mann–Whitney test of independent variable sex and DMs type with direct and indirect cost				
Sex Mann-Whitney U=19731.0, Z= -264, P=0.79				
DM type Mann-Whitney U=12451.5, Z= -2.05, P=0.04				
Sex Mann-Whitney U=17902731.5, Z= -1.85, P=0.064				
DM typeMann-Whitney U=13451.5, Z= -1.048, P=0.295				

DISCUSSION

The median direct cost of study participants was USD 21.9 (25.2) per patient per month of which medical cost covered 58.9%. This finding was consistent with reports from Brazil, Indian, and Nigeria (27, 28, 31, and 32). The find of a study conducted in Thailand was contrary with our study finding this might be (health care service difference and health insurance type) the hospitals in Thailand provide medications and drugs in cheap cost options. Another reason might be non-medical expenditure were expensive and take the higher percentage than medical costs as it was a percentile comparison, medical costs may be subsidized. Moreover, there might be aware of patient and advice of the medical professional to use cheap cost drugs from options (32).

The median per person per month medical cost in our study (USD 11.4) was similar to the finding in studies in Indian and Thailand, but lower than that in Brazil (23, 27, 28, 29, and 32). This could be due to the direct cost calculations, which varied in the studies and differences in health care system. In Thailand USD 5.9 or 45% of the direct cost was used for pharmacy services, in Nigeria USD 37.3 or 51.1% for insulin per person per month (29,31). The difference might be due to differences in health care system and some assumption in the study methods.

The total direct cost of diabetes in our study (USD 21.86 per month) was higher than that of reports from Pakistan, India, the Sudan and Thailand, while it was less than that of Nigeria and Brazil (22,25-29,31,33,34). Type of diabetes had a significant correlation while occupation had a weak correlation with direct non-medical costs. A study in Pakistan showed significant cost difference with duration of follow up and participant's sex. But had no significant marginal difference with age and higher socioeconomic status like education and income (22).

The finding from our study was similar with a study conducted in India, showing that none of the socio-demographic measures except education had significant correlations with direct costs and indirect costs (27). This might because educated people are more aware of their health status and earn more money than the non-educated. This was consistent with reports from India but contrasts that from Pakistan and this might be due to socio-economic and cultural differences (22,27). Overall, cost differences might be explained by variations in costs of commodities, the health care policy, and the quality of services provided across these countries.

In our study, indirect cost was correlated with number of visits, household role, family income and year of the follow-up, whereas, a study in Pakistan showed cost correlations with sex, family income, but no correlation with follow up duration (22). The finding from both studies were similar in terms of socio-economic status, loss of indirect costs among female participants, and need for frequent visits and services. In our study, though not statistically significant, 50% of female versus 20% male participate provided care for patients with DM. This is a similar trend with reports by other which showed that children and elderly patients were accompanied with a female caregivers (31), suggesting that the burden of diabetes mellitus was more on the females.

The indirect costs or lost days by patients over 180 days (six months) in our series were, on the average, 11.1 days, and the median outpatient visit used over the six months was three days. A report from Sweden showed inconsistent finding with this study (25). The Swede patients had medical follow up, on the average, of 10 days in the outpatient department and 4.8 at the inpatient nursing care over 12 months. The total number of days used as a result of diabetes mellitus in our study more than that is reported by the Swede series and this could largely be due to differences in socioeconomic status and the health care system.

Limitation of the Study

Study participants with age less than 14 years were excluded in our study and participants were no analyzed by type and level of complications. Aspects of economic burdens such as social burden and intangible costs were not evaluated. Indirect cost calculation was not expressed in terms of price.

Conclusion

Diabetes mellitus was a complex illness to treat and manage in individuals who had low income. Medical costs were the major contributors to direct cost of care for patients with diabetes mellitus. Need to be exerted to provide medical services at lower cost and cost reduction activities should be advocated for and supported.

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Competing interest:

The authors have declared that no competing interests exist.

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