

Economic Burden of Diabetic Mellitus and its Associated Factors among Patients on Follow up at Public Regional Hospitals in Addis Ababa, Ethiopia

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Abstract

Objective: The global economic burden of diabetes mellitus (DM) is remarkable and hindered global economic development. Ethiopia is among the nations that faced a double burden of DM. Hence, this study aimed to assess economic burden of DM and its associated factors among patients on follow up at public regional hospitals in Addis Ababa, Ethiopia, using an institution based cross-sectional study.

Result: Among the 385 respondents (94.4% response rate) enrolled in the study, 197 (51.12%) of them were females. More than three-quarter (77.1%) of the study participants were diagnosed with Type 2 DM. Majority of the participants (291; 75.6%) self-financed their expenses for the management of DM. Average total monthly cost of DM was found to be 1035.82 Birr per patient per month. Moreover, the mean cost of study participant for laboratory test and single purchasing of insulin, insulin syringe as well as oral antidiabetic agents were 56.34 (±90.68), 325.26 (±229.06), 86.90(±81.24) and 437.69 (±278.69) Birr per patient per month, respectively. Regression analysis study indicated that there is a significant ($p < 0.05$) association between cost of DM and variables such as education, income, admission, distance from the health facility, emergency visit as well as number of drugs prescribed.

Conclusion: This study showed that DM imposes a high out of pocket cost expenditure on patients and their families.

Keywords: Diabetes mellitus • Insulin • Oral hypoglycemic agents • Direct cost • Indirect cost

Introduction

Diabetes mellitus (DM) is a chronic disease that occurs when the body is incapable to produce sufficient insulin, cannot use insulin effectively, or both [1]. It is one of the most common and costly chronic disease, the burden of which has become an important public health issue all over the world [2]. Nearly 425 million people are affected by DM in 2017 [3]. Of which, 80% of them reside in low- and middle-income countries (LMIC). If these trends continue, by 2035, close to 592 million people will have diabetes [4]. Ethiopia is highly affected by DM. According to the 2017 estimate, Ethiopia had 2.57 million (5.2%) adult people, aged 20–79 years, with diabetes, making it the largest diabetes population in sub-Saharan Africa [5].

DM can impose havoc when health care systems are not consistently functioning against it [6]. Moreover, the economic burden of DM imposed on patients and society is enormous [7]. The global economic burden of Non-communicable diseases (NCDs) such as DM is large, estimated at

US\$ 6.3 trillion in 2010, rising to \$13 trillion in 2030 [8]. The economic burdens of diabetes comprises of direct costs, indirect costs and intangible costs patient/caregivers pay [8, 9]. Studies indicated that the relative cost for DM is between 2% and 3% of every country's healthcare expenditure. This in turn made global economic development to be hindered to an appreciable extent [10].

In sub-Saharan African countries, the problem of DM was once considered a rare condition. However, because of rapid urbanization, the aging population and other factors, its prevalence is raising rapidly. Recent reports indicated that prevalence-estimates of DM in these countries range between 2.1 and 6.0%, and the number of people suffering from the disease is likely to double within 25 years [11]. Generally, the 7.02 million cases of diabetes recorded by African countries in 2000 resulted in a total economic loss of \$25.51 billion [12]. In developing countries like Ethiopia, most health-care costs must be paid by patients out-of-pocket. The cost of health care for DM creates a significant strain/load on household budgets, particularly for lower-income families [13].

Although there is a well-established health infrastructure for diabetes care in Addis Ababa, the diabetic care is below the acceptable standard. Moreover, adequate studies on costs (medical and non-medical costs) of DM are not available for most of the developing countries, including Ethiopia. In spite of data limitations, DM keep on inflicting a substantial economic burden on developing countries of the African Region [14]. Thus, this study aimed to estimate the economic burden of DM and its associated factor among patients attending at public regional hospitals of Addis Ababa.

Methods

Study setting and period

In this study, an institution based cross-sectional study was employed from May 1 to June 20, 2020 in four Public regional hospitals (Menelik II Referral Hospital, Zewditu Memorial Hospital, Yekatit 12 Hospital, and Ras Desta memorial Hospital) of Addis Ababa, Ethiopia. These hospitals provide a diabetic care service.

Sample size and sampling technique

DM patients, who were on follow up at public regional hospitals of Addis Ababa during the study period, were employed as a study population. Diabetic patients (385), who attended in these hospitals and had a follow up, at least for the last 1 year, were included in the present study. The respective study participants were selected through a systematic random sampling technique using the assumption of equal and proportional allocation. The sample size of participants to be included in this study was determined using a single mean formula: $[N = (Za/2)^2 \times \sigma^2/d^2]$, considering the $d^2 = \text{Range}/4$ and $\text{Range} = \text{Maximum cost} - \text{minimum cost}$. The margin of error was set to be 0.05 with 95 % confidence interval (CI). With an added contingency of 10 % for non-response, the final sample was calculated to be 408 participants. But, only 385 participants have completed the interview.

Data collection

Data were collected by interviewing patients using a structured questionnaire. The questionnaire was checked for internal consistency and completeness. Skilled nurses, who were trained on the objective of the study, collected the data. Pretest was conducted on 20 interview encounters to check its suitability and validity, prior to the main data collection. Data quality was further assured by checking its completeness subsequent to each data collection. Moreover, data management were considered throughout the study design, data collection and analysis.

From the collected data, direct and indirect cost was determined. An out-of-pocket expense (in Birr: the unit of currency in Ethiopia) paid by patients and their families for medical and non-medical purposes were considered as a direct cost. Indirect costs, on the other hand, consist of opportunity cost of time due to losses of time invested by patients/family. Total tangible cost of diabetes comprises both direct costs as well as indirect costs. The 2018 exchange rate (during the study period) of Birr was \$1= 27.68.

Table 1. Socio-demographic and economic characteristics of diabetic patients attending chronic care clinics of public regional hospital in Addis Ababa, Addis Ababa, 2020 (n=385).

Variable	Frequency	Percent
Sex		
Male	188	48.8
Female	197	51.2
Age		
18-25	39	10.1
26-35	55	14.3
36-45	70	18.2
46-55	115	29.9
56-65	74	19.2
>66	32	8.3
Marital status		
Single	88	22.9
Married	219	56.9
Separated	18	4.7
Widowed	43	11.2
Divorced	17	4.4
Educational level		

Illiterate	39	10.1
Read and write	31	8.1
Grade 1-4	12	3.1
Grade 5-8	53	13.8
Grade 9-12	101	26.2
Diploma	75	19.5
Degree and above	74	19.2
Employee Type		
Government employee	99	66.9
Private employee	39	26.4
NGOs employee	10	6.8
Average monthly income (USD)		
35.90–80.85	76	19.7
80.86–119.5	94	24.4
≥118.59	215	55.9
Role in household		
Father	139	36.1
Mother	150	39
Child	70	18.2
Other family member	26	6.7
Type of DM (n=385)		
Type 1	55	14.3
Type 2	297	77.1
Don't know	33	8.6
Financial sources from self (n=385)		
No	94	24.4
Yes	291	75.6

Table 2. Tangible costs DM management in public regional hospitals of Addis Ababa, July 2020.

Cost components	N	Mean(Std. Deviation)	Median(IQR)
Control of food habit	55	543.71 (325.63)	500.00(200.00)
Regular exercise	75	814.01 (445.72)	800.00(800.00)
Laboratory test	370	56.34 (90.68)	25.00(30.00)
Purchasing of insulin	123	325.26 (229.06)	250.00(220.00)
Purchasing of insulin syringe	112	86.90(81.24)	72.50(63.00)
Purchasing of oral anti-diabetic agent	316	437.69 (278.69)	400.00(200.00)
DM patients' and caregivers' cafeteria use	109	74.82 (75.35)	50.00(70.00)
Hospitalization	43	895.49 (1077.41)	500.00(600.00)
Transportation (caregiver)	34	26.12(29.44)	20.00(20.00)
Transportation (DM patients)	331	20.49 (52.23)	10.00(11.00)
Emergency medication/treatment	37	723.24 (796.71)	400.00(475.00)
Overall average monthly cost (Birr)	385 (14 USD)	1035.82 (998.87)	680.00(904.00)
95% CI (935.73, 1135.92)			

Table 3. Simple linear regression analysis for tangible costs to independent variables of diabetic patients attending public regional hospitals of Addis Ababa, July 2020 (n=385).

Variable	B	p-Value	95% CI for B		R Square
			Lower Bound	Upper Bound	
Age	1.780	.608	-4.90	9.08	.001
Educational status	59.37	.027**	6.67	112.06	.013
Income	0.16	.000**	0.10	0.23	.153
Type of DM	210.41	.050	.33	420.50	.010
Inpatient Admission	1094.66	.000**	805.90	1383.43	.127
Distance from the health facility	1.57	.005**	0.48	2.67	.021
Emergency Visit	818.63	.000**	509.61	1127.65	.067
Co morbidity	145.92	.158	-56.74	348.57	.005
Medication Adherence	80.39	.845	-729.17	889.96	.000
No of drug prescription	84.22	.022**	11.99	156.45	.014

Data analysis

The collected data were cleaned and organized using Epi-info and then exported and analyzed using SPSS version 22. The analyzed data were described in frequency counts and percentages. Mean, median, standard deviations and inter quartile range was calculated for continuous variables. Linear regression was done for associated factors related with cost of DM and p-value < 0.05 was considered to be statistically significant.

Ethical consideration

Prior to data collection, all of the study participants were provided with a clear explanation about the purpose of the study and asked for their consent to participate in the study with a written informed consent. Participant's information obtained from the questionnaire was kept confidential via data coding.

Results

Socio-demographic and economic characteristics

As depicted in Table 1, this study interviewed 385 respondents that made a response rate of 94.4%. Of these, more than half (51.12%) of the study participants were females and about a third (29.9%) of the DM patients were within the age group of 46 to 55. Among the respondents, participants with a secondary school (9-12), level of education constituted the highest proportion (26.2%; 101). As it is indicated in Table 1, more than three-quarter (77.1%) of the respondents were diagnosed with Type 2 DM. Majority (75.6%) of the study participants cover their expenses for the management of DM out of their pocket.

Economic burden of DM

Table 2 shows the direct cost invested for the management of DM among study participants. The average total monthly cost of the participants was 1035.82 (\pm 998.87) Birr or 37.4 USD per patient per months with 95% CI (935.73, 1135.92). Of which, the highest (895.49) expense was paid for the management of patients' admission due to DM. Cost of DM for a single purchasing of insulin and insulin syringe were 325.26 (\pm 229.06) and 86.90 (\pm 81.24), respectively.

Logistic regression of independent variables with economic burden of diabetes mellitus

Simple linear regression analysis, in this study, showed that tangible cost had an association with educational status ($p \leq 0.05$), income ($p \leq 0.001$), distance for the facility (p -value ≤ 0.05), admission to inpatient ($p \leq 0.001$), emergency visit ($p \leq 0.001$), and number of drugs prescribed ($p \leq 0.005$). In this study, the average value of tangible cost was increased by 0.16 Birr as a result of one unit change of income. Moreover, as number of prescription increased by one unit the average value of cost was increased by 84.22 Birr (Table 3).

Discussion

DM exerts a heavy economic burden on society and the nation. This burden is related to health system direct cost incurred by society in managing the disease and indirect costs resulting from productivity losses due to disability and premature mortality. Moreover, time spent by family members when patients seek care and other intangible costs, which include psychological pain to the family and beloved ones are among the burden of the disease [15]. Diabetes and associated complications in Ethiopia are major causes of morbidity and mortality with consequential economic impact. The present study is aimed at assessing the direct and indirect cost of diabetes care on Ethiopian diabetic patients with or without complications.

In the current study, the overall monthly average total tangible cost of DM was 1035.82 (\approx 37USD) Birr per patient per months. However, a previous study done in Addis Ababa, Ethiopia, reported a lower overall monthly direct cost of DM that was 630.33 Birr (\approx 30 USD) per patient per month [16]. Regular median monthly medication cost in our study was 468.50 Birr (\approx 17USD) Birr. This is much more superior to a similar unpublished study done in Addis Ababa (174 Birr \approx 8.3USD) [16]. In considering the direct cost calculations, this cost differences may be due to the inflation occurred in pharmaceutical and other sectors in Ethiopia. Moreover, recall bias as a result of collecting information during a six month period might be the other factor.

In a study conducted by Grover et al. in North India reported that the total cost of diabetes was estimated to be 17 USD per person, monthly [17]. However, patients enrolled in our study expend more than North Indian patient per month. On the contrary, the mean monthly average total cost of DM of a study done in China was superior to the current study. This could be due to health system difference between these countries. In China, direct medical and direct nonmedical costs per case averaged 1320.90 USD and 180.80 USD, respectively [18].

Financial sources for cost of DM in this study were from self (75.6%), family/ relatives (51.7%) and insurance (6.2%). Study in Jimma identified that most (69.1%) of hospital diabetic patients', source of costs for their treatment was for free payment [19]. The report from Jimma was somewhat different from this; the possible reason might be due to the exclusion of waiver privileged DM patients in our study.

Education and income level of participants were found to have significant association with cost of DM, in the present study. This could be because of more awareness level of patient with higher educational status and they can earn more; hence they can afford more for their health. People with a higher income may have better access to health services. Another hypothesis for this result is ; people with a higher income could be more affected by the illness [20]. In line with our results, income was a predictor of DM cost, in Mali [21]. Another study done in Pakistan reported that income has significant association with cost of DM [22]. However, opposite to our finding, a similar study in Mali reported that higher level of education was a predictor of low cost in DM [21].

The highest (895.49) expense in the current study was paid for the management of patients' admission as a result of DM. In the US, the largest component of medical expenditure was hospital inpatient care, accounting for 43% of the total medical costs [23]. Similarly, in Argentina, admission cost is the most important direct cost of DM [24]. Both studies are in line with our study. In Brazil and Mali [21], nevertheless, the greatest portion of direct costs was attributed to medication followed by laboratory tests [25].

Conclusion

This study showed that DM imposes a high economic burden on patients and their families. Medical costs, laboratory investigation, insulin, oral antidiabetic agents and insulin syringe costs being a major contributor to the tangible cost of diabetes care. Moreover, economic burden of DM had an association with educational status, income, Type of DM, admission, emergency visit and number of drug prescription encountered by patients. It also clearly made evident that the largest share of costs was being paid by patients and their families.

Limitations

As the respondents were interviewed in the compound of the hospital, study bias could have occurred. Moreover, the study was conducted in a governmental hospital that provides care to the certain group of the population in the city as a result findings may not be a reflective of the situation in the general population. Moreover, the cross-sectional design gives only a snap shot of events. Consequently, the finding of this study was interpreted in light of such limitations.

Data Availability

The data generated or analyzed during this study will be available from the corresponding author on reasonable request

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Ethical Approval

Ethical clearance was obtained from the Research and Ethical Review Committees of the Menelik II health Science College and Addis Ababa city health bureau and written consent was obtained from the study participants.

Consent for Publication

Not applicable

Conflict of Interest

The authors declare that they have no conflicts of interest.

Author's Contribution

MT and SA contributed to the conception of research idea. MT, performed data collection. MT, AY and SA conducted the analysis, interpretation and drafted the manuscript. All authors read and approved the final manuscript.

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