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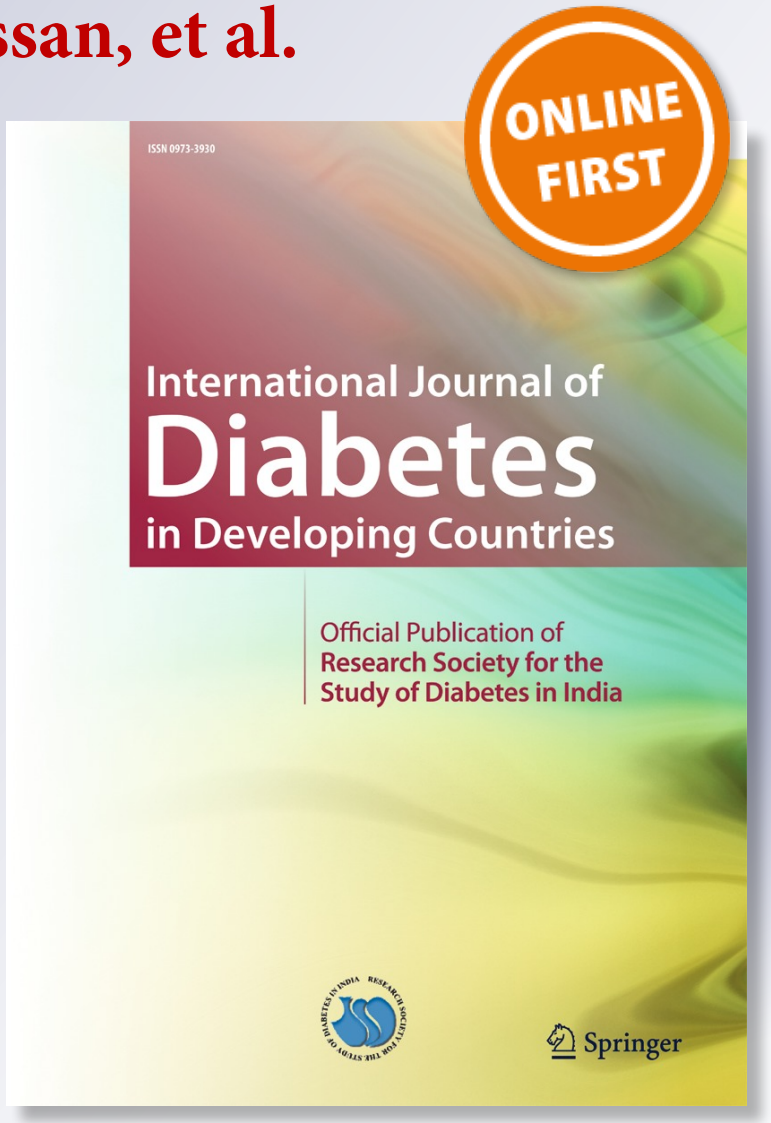

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ORIGINAL ARTICLE

Healthcare cost of type 2 diabetes mellitus in Bangladesh: a hospital-based study

Afsana Afroz[1] · Samira Humaira Habib[2] · Hasina Akhter Chowdhury[1] · Debashish Paul[2] · Md Shahjahan[3] · Md Abdul Hafez[1] · Md Nazmul Hassan[4] · Liaquat Ali[5]

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Abstract Healthcare-related expenditure for diabetes is increasing at an alarming rate all over the world, resulting in a huge burden on patients. The purpose of this cross-sectional study was to estimate the healthcare cost incurred by patients with type 2 diabetes mellitus (T2DM). The study included 531 registered patients with diabetes of more than 1 year. All the treatment-related records of the last 12 months were collected from the patients' guide books. Data were analyzed to determine the average cost (exchange rate: US$1=Bangladeshi Taka 80) incurred by the diabetic patients in treating the disease and were calculated based on the total amount spent by them to that of total number of patients. The mean±SD age of the patients (male 46.5 % and female 53.5 %) was 53.0± 10 years with duration of diabetes 9±6.7 years. The average annual cost of care was US$314 (direct cost US$283 and indirect cost US$31). Drugs accounted for the largest share (68 %) of the direct cost, followed by laboratory investigations (12.5 %) and consultation fees (11.7 %). Results of bivariate analysis showed that the annual direct cost of care significantly increased with age, monthly household income, duration of diabetes, and the number of co-morbidities/complications. However, results of multivariable analysis showed that, except age, all other remained significant ($p<0.001$) explanatory variable of direct cost. The annual cost of diabetes care per person in the outpatient department of a tertiary care facility was US$314. Based on this finding, it is estimated that the total annual burden of some 5.1 million diabetic patients will be US$1.5 billion, which is a large burden for a developing country like Bangladesh. Primary prevention should be in focus to combat the economic burden of diabetes.

Keywords Bangladesh · Burden of diseases · Cost of illness · Direct cost · Indirect cost · Type 2 diabetes mellitus

✉ Afsana Afroz
ar_tauras@yahoo.com

Samira Humaira Habib
samirahumaira@yahoo.com

Hasina Akhter Chowdhury
hachowdhury01@gmail.com

Debashish Paul
bapi_ads@yahoo.com

Md Shahjahan
mdshahjahan@agnionline.com

Md Abdul Hafez
mahafez47@gmail.com

Md Nazmul Hassan
nhassan@bangla.net

Liaquat Ali
liaquat@buhs.edu.bd

[1] Department of Biostatistics, Bangladesh University of Health Sciences (BUHS), 125/1, Darussalam, Mirpur, Dhaka 1216, Bangladesh

[2] Health Economics Unit, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorder (BIRDEM), 122 Kazi Nazrul Islam Avenue, Dhaka 1000, Bangladesh

[3] Department of Public Health, Daffodil International University, 102 Shukrabad, Dhanmondi, Dhaka 1207, Bangladesh

[4] Institute of Nutrition & Food Science, University of Dhaka, Dhaka, Bangladesh

[5] Department of Biochemistry & Cell Biology, Bangladesh University of Health Sciences (BUHS), 125/1, Darus Salam, Mirpur, Dhaka 1216, Bangladesh

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Introduction

Diabetes imposes a large socioeconomic burden on the individual, family, and nation. The costs associated with the treatment of diabetes include an increased use of health services, loss of productivity, and disability. The International Diabetes Federation (IDF) most recently estimated that 8.3 % of 382 million adult people have been suffering from diabetes, and the number of people with the disease will rise beyond 592 million in less than 25 years. The burden of diabetes and diabetes-related mortality and disability has been increasing in Southeast Asia. About one-fifth of all the adults with diabetes in the world live in the Southeast Asia Region. The number of people with diabetes in the region is likely to increase to 123 million by 2035 [1].

Mauritius has the highest (15.1 %) prevalence of diabetes among adults in the region, followed by Bangladesh at (10.6 %) [1]. Several small-scale population-based studies in Bangladesh at different time points revealed an increasing trend of diabetes prevalence in rural [2–8], semi-urban [8, 9], and urban [4, 6] communities.

Results of studies in different parts of the world showed an increasing trend of expenditure associated with diabetes, e.g., England and Wales US$1.92 million (or US$2042 per person) in 1995 [10], Spain US$650 million in 1997 [11], USA US$98 billion in 1998 [12], India US$50 million in 2000 [13], and Latin America and the Caribbean US$65.216 billion in 2003 [14].

The American Diabetes Association estimated that the global expenditure incurred to treat diabetes and prevent diabetes-related complications was at least US$548 billion in 2013. By 2030, the expenditure is likely to exceed US$595 billion. The people of the low- and middle-income countries pay a larger share of the expenditure on diabetes care compared to those of the high-income countries. They lack access to health insurance and publicly available medical services. In some poorest countries, people with diabetes and their families bear almost the total cost of medical care. Despite the huge number of people with diabetes in the Southeast Asia Region, healthcare spending on diabetes was estimated to be only US$6 billion, accounting for less than 1 % of the global total, with India estimated to have spent the largest proportion [1].

The American Diabetes Association reported that the US economy suffered the productivity loss of US$69 billion in 2012, as a result of loss of earnings due to loss of work days, restricted activity days, low productivity at work, mortality, and permanent disability caused by diabetes. Such losses are perhaps relatively large in poorer countries because premature deaths due to diabetes occur at a much younger age [15].

In the near future, diabetes is likely to pose a severe burden on the already fragile and under-resourced healthcare system in Bangladesh. The per-capita expenses of diabetic patients highly vary from country to country, depending, however, on the available resources, training and interest of the treating doctor in diabetes, and the patients' ability to pay for it. Due to scant resources and burgeoning costs, healthcare planners and providers worldwide are being forced to cut resources. To be able to plan and allocate resources, adequate background data are required, which include an estimate of current costs of care. So far, initiatives on healthcare cost of diabetes in Bangladesh are very little. The present study was conducted to estimate the healthcare cost of T2DM incurred by patients in a tertiary care hospital of Bangladesh. Results of the study may help deal with healthcare cost of T2DM to a certain extent. The evidence gathered in the study may also help estimate the total burden of the disease and conceptualize strategies at the local, regional, and national levels.

Methods

Subjects and settings

This cross-sectional study was conducted among registered patients with T2DM at the outpatient department (OPD) of the Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) Hospital, the only national level tertiary healthcare and research institute for diabetes in Bangladesh. The institute has been recognized as the WHO collaborating center for research on the prevention and control of diabetes. BIRDEM has the largest diabetic OPD turnover in the world under a single roof and has an inpatient hospital with about 700 beds with all modern disciplines of medicine [16]. The registered diabetic patients, aged ≥18 years, of either gender, with more than 1 year of diabetes (to get annual estimation of expenditure) and those willing to participate voluntarily were included in the study. The sample size was determined using the appropriate statistical formula ($n=z^2*s^2/d^2$, where $z=1.96$, s^2=variance, d=degree of accuracy desired). The BIRDEM hospital attracts patients with different demographic and socioeconomic backgrounds from all over the country; it has about 497,756 registered patients with diabetes and serves more than 4000 diabetic patients daily [17]. The average number of patients per day in the BIRDEM OPD is sufficient to cover the total sample-size of this study.

In total, 531 patients with T2DM, who met the inclusion criteria, were interviewed using a pretested structured questionnaire. A pilot study was conducted to test the suitability of the questionnaire, and based on the findings of the pilot study, minor modifications were made in it. All the treatment-related records of the last 1 year (to get the annual estimation) along with the degree and extent of complications, such as cardiopathy, retinopathy, and nephropathy, were collected from the patients' guidebooks. The direct cost (costs of medical advice, investigations, medical and other treatments) and the indirect cost [costs of productivity loss and accompanying person(s)]

relating to the management of diabetes were calculated from the consumers' point of view.

Cost-estimation procedure

The direct cost covered direct medical cost, which included costs of outpatient visits, laboratory tests, medicines, and other medical services and direct non-medical cost, including transportation expenses, food on the way to the hospital and other personal maintenance service expenses borne by patients and their attendants. Costs of outpatient visits and laboratory tests and medicines were calculated using the regular charges of the BIRDEM hospital and BIRDEM pharmacy records respectively, which were almost similar to those of other city hospitals. By adding all the cost components for a single visit, the average per visit cost per patient was calculated. The annual average expenditure on medical care was estimated by multiplying the average per visit expenditure by the number of visits per year.

The indirect cost included the opportunity cost of time lost due to morbidity (temporary disability). The morbidity-related component included the productivity loss of time invested by the patient and his/her accompanying person. The indirect healthcare cost was calculated using the human capital approach. The human capital approach considers the value of loss of productivity as a result of disability and premature death using the lost earnings as a surrogate for the impact that premature death and disability had on individuals and society [18]. To quantify the loss of production due to short-term and long-term absence due to sickness, the average working hours (40 h/week) for men and women were used. The average cost of labor for an individual was used for the value loss of production. The wage rate of housewives was estimated using the minimum wage rate of Bangladesh [19]. The costs were initially determined in Bangladeshi taka (BDT) and then converted to US dollar (BDT 80=US$1).

Ethical approval

The Ethical Review Committee (ERC) of the Bangladesh Diabetic Somiti (BADAS) accorded the ethical approval. Written informed consent was taken from each subject using a form which was originally developed in English but was later translated into Bangla (local language). All the literate subjects themselves read the consent form and signed. For the illiterate subjects, the data collector read out the consent paper before them, and if they agreed, their thumb impressions were taken.

Statistical analysis

The SPSS software (version 16 for Windows) (SPSS, Inc., Chicago, IL, USA) was used for analyzing data. Control of data entry was secured through both program appliance and manually. Descriptive measures included mean, standard deviation (SD), median and range, and percentages. Data were checked for normality plots with tests (histogram with normal curve, Q-Q plot, etc.), which clearly showed non-normality. The Mann-Whitney *U* test and Kruskal-Wallis test were performed for comparing the groups, and Spearman's correlation was done to see the association between continuous variables. A linear regression analysis was performed to investigate the effect of independent variables (age, monthly household income, duration of diabetes, number of co-morbidities/complications, and mode of treatment) on the cost of care. The statistical tests were considered significant at a level of 5 % ($p \leq 0.05$), and all the p values presented are two-tailed.

Results

Of the 531 patients with T2DM, 284 (53.5 %) were female. The mean (±SD) age of the patients was 53±10 years, and the mean (±SD) duration of diabetes was 9±6.7 years. About half (49.4 %) of them were aged 41–55 years. Forty-three percent had up to higher secondary (HSC) education, 29 % completed primary education, 26 % either graduated or had higher education, and only 2 % were illiterate. The majority (48 %) were housewives, 19 % were service holders, 12.6 % were businessmen, only 1 % were day laborers, and 19.2 % were unemployed. The median monthly household income was US$312, ranging from US$19 to 1875. Fifty-eight percent managed their glycemic level by oral hypoglycemic agents (OHA), 18 % by insulin, and 24 % by a combination of OHA and insulin. Around 40 % had 2 or more co-morbidities or diabetic-related complications (Table 1).

Annual cost of diabetes care

The average annual cost of diabetes care was US$314 with interquartile range (IQR) US$185–395. The average direct cost was US$283 (IQR US$163.7–354.6), and the indirect cost was US$31 (IQR US$2.1–38.8). The direct cost accounted for 91.5 % and the indirect cost accounted for 8.5 % of the total annual cost of care.

Most (97 %) of the total direct cost was due to direct medical cost and only 3 % for direct non- medical cost. Drugs accounted for the largest share (68 %) of the direct medical cost, followed by cost of laboratory investigations (12.5 %) and consultation fees (11.7 %).

The indirect cost of diabetes care was not calculated for those whose productivity was forgone. Excluding the unemployed persons, the average loss of productivity by the patients without and with attendants was US$28 (IQR US$ 3.4–34.9) and US$71 (IQR US$ 23.3–76.8), respectively.

Table 1 Distribution of socio-demographic and clinical characteristics of the study patients (n=531)

Variables	Number	Mean±SD/ Percentage	
Gender	Male	247	46.5
	Female	284	53.5
Age (years)	26–40	66	12.4
	41–55	262	49.4
	>55	203	38.2
Mean age		Mean±SD 53.0(±10)	
Education	Illiterate	12	2.3
	Primary	154	29.0
	Upto HSC	229	43.1
	Graduate and above	136	25.6
Occupation	Service holder	101	19.0
	Businessmen	67	12.6
	Housewife	256	48.2
	Day labor	5	1.0
	Unemployed	102	19.2
Monthly household income (US$)		Median (min-max) 313 (19–1875)	
Duration of diabetes (year)	1–5	212	39.9
	6–10	147	27.7
	11–15	88	16.6
	More than 15	84	15.8
		Mean±SD 9±6.7	
Mode of treatment	OHA	308	58.0
	Insulin	94	17.7
	Combination	129	24.3
Number of co-morbidity/complication	No co-morbidity/complication	148	27.8
	1	171	32.3
	2 or more	212	39.9

Results are expressed as number, percentage, mean±SD, median (min-max)

The average annual indirect cost of care was US$31 (IQR US$2.1–38.8). The indirect cost of care was 2.5 times higher for patients with attendants due to loss of productivity by attendants compared to patients without attendants (Table 2).

Cost of diabetes care in different groups

The annual direct cost of diabetes care was higher for males [median US$ 254 (IQR 168.5–372.7)] than that for females [median US$250 (IQR 157.8–345.3)], although the difference was not significant (p=0.196). However, the annual indirect cost was significantly (p=0.001) higher for males [median US$ 47 (IQR 23.3–83.4)] than that for females [median US$4 (IQR 3.4–13.5)] due to higher earning by males. The direct cost of care was significantly (p=0.048) higher for illiterate persons. The indirect cost of the patients gradually increased with level of education, and the difference was significant (p=0.001) (Table 3).

The direct cost of patients without any co-morbidity/complication [median US$ 210 (IQR 131.7–306.2)] was significantly (p=0.001) lower compared to those having at least one or more than one co-morbidities/complications [median US$265 (IQR 173.7–379.5)]; however, the difference was not significant (p=0.350) for the indirect cost between two groups of patients. The direct cost increased with an increasing number of co-morbidities or complications. The direct cost significantly differed (p=0.001) between the mode of treatment groups. Those who were treated with insulin only or a combination of both had significantly higher direct (p=0.001) and indirect (p=0.001) costs compared to those who were treated with OHA only (Table 3).

All the cost components significantly (direct cost ρ=0.174, p=0.001, indirect cost ρ=0.238, p=0.001) correlated with the monthly income. On the other hand, age (ρ=0.125, p=0.001) and duration of diabetes (ρ=0.352, p=0.001) significantly correlated with the direct cost (Table 4).

Table 2 Component-wise of annual direct and indirect cost (US$) of the study patients

Variables	Average cost	Median (IQR)
Direct medical cost		
Outpatient visits	23.9	23.4 (18.8–28.1)
Investigations	27.2	26.1 (17.1–34.3)
Medicine cost	126.7	165.4 (68.4–164.2)
Self-monitoring of blood sugar	25.7	15 (7.5–45)
Direct non-medical cost		
Food cost on the way to hospital	3.4	2.3 (1.6–3.8)
Travel cost	6.2	3.8 (1.9–7.5)
Total direct cost	282.9	250.6 (163.7–354.6)
Indirect cost		
Lost productivity of the patients[a] (n=427)	28.1	4.7 (3.4–34.9)
Loss of productivity of the patients with attendants[a] (n=68)	71.4	40.7 (23.3–76.8)
Total Indirect cost (n=443)	37.1	13.5 (3.4–48.5)

IQR inter quartile range

[a] Lost productivity has been estimated by using specific wage rate per hour

Associated variable for describing direct cost

The annual direct cost (log-transformed) was fitted by multiple linear regressions to the variables, such as age, monthly household income, duration of diabetes, number of co-morbidities/complications, and mode of treatment, which explained 40 % of the total variation in costs. In the multivariate model, except age, all the variables were significant ($p<0.05$) (Table 5).

Discussion

The present study was carried out taking into consideration the consumer's perspective where all the costs, including direct and indirect costs, were included in analysis. The annual cost per person of this study was US$314 in 2010, which was higher than that reported by a study in China in 2006 (US$165) [20] and also in another OPD-based study in a clinic in Pakistan (US$197) [21].

Table 3 Socio-demographic and clinical characteristics with cost (US$) of diabetes management among study patients

Characteristics	Direct cost		Indirect cost	
	Median (IQR)	p value	Median (IQR)	p value
Sex[a]				
Male	254 (168.5–372.7)	0.196	47 (23.3–83.4)	0.001
Female	250 (157.8–345.3)		4 (3.4–13.5)	
Education[b]				
Illiterate	314 (139.3–391.9)	0.048	5 (3.4–39.9)	0.001
Primary	235 (143.4–315.2)		4 (3.3–20.4)	
Upto HSC	264 (172.6–363.6)		18 (17.4–48.5)	
Graduate and above	235 (159.3–379.6)		47 (19.4–85.3)	
No of co-morbidity/complication[a]				
≥1 co-morbidity	265 (173.7–379.5)	0.001	14 (3.8–51.7)	0.350
No co-morbidity/ complication	210 (131.7–306.2)		13 (3.4–37.8)	
Mode of treatment[b]				
OHA	182 (130.0–253.3)	0.001	8 (3.4–38.8)	0.001
Insulin	345 (281.8–498.8)		12 (3.7–45.0)	
Combination	364 (277.6–489.4)		34 (4.0–81.5)	

p is significant at the 0.05 level (2-tailed)

[a] Mann-Whitney U test

[b] Kruskal-Wallis test was done

Table 4 Correlation of age, monthly household income, and duration of diabetes with annual direct and indirect cost of diabetes management

Variable	Direct cost		Indirect cost	
	ρ	*p* value	*ρ*	*p* value
Age	0.125	0.004	0.016	0.734
Monthly household income	0.174	0.001	0.238	0.001
Duration of diabetes	0.352	0.001	0.111	0.202

Spearman's correlation was done. *p* is significant at the 0.05 level (2-tailed)

In the present study, the direct cost per person was US$283, which comprised 91.5 % of the total annual cost; the remaining 8.5 % (US$37) comprised the indirect cost. Results of a study in 2007 in India showed that the mean direct annual cost for outpatient care for all patients with diabetes was US$94.5, and the indirect cost was estimated to be US$155 [22]. An OPD-based study at a clinic in Karachi, Pakistan, reported that the cost of medicine was 46 %, which differs substantially from the findings of our study where 68 % of expenditure was incurred for medicine. However, the cost of investigations was 32 % for that population [21] compared to only 13 % in our study.

In our study, a higher monthly income and higher education positively correlated with the increased cost of diabetes. Two studies in India reported a significant correlation with educational status [11, 23], which is similar to our study. This may be because of more awareness of the disease among people with higher educational status and the fact that more educated people earned more money; hence, they could afford to spend more money for their health. It is well-established that the cost of managing diabetes is dominated by old age [24], and this phenomenon was also supported by our study.

The findings of our study indicate that the cost of healthcare increases with the duration of diabetes and the number of co-morbidities and complications. This pattern was also observed in studies in several developed countries, such as Iran [25], Norway [26], and Canada [27]. Diabetes-related complications escalate the cost of managing the disease, and diabetes is associated with many complications, which will ultimately impact on the healthcare system [22]. Likewise, a longer duration of the disease makes the condition worse which eventually results in the higher cost of treatment. A study in Germany stratified the per patient cost according to the mode of treatment [28]. The present study support the stated finding that patients had a higher direct cost and the total cost for those treated with insulin monotherapy or a combination of insulin and OHA compared to those treated with OHA only. Overall, the duration of diabetes, the number of co-morbidities/complications, and the mode of treatment were found as the major contributor components of the treatment cost.

Diabetes has been creating a huge burden on patients, family, and society in Bangladesh. The results of the present study showed that the annual cost of diabetes care per person at the OPD of a tertiary care facility was US$314, and with an estimated 5.1 million adult (20–79 years) diabetic patients, the total annual burden will be US$1.5 billion (BDT 11,654 billion), which is huge [1]. Even without the cost of inpatient services, the total cost of diabetes care in the country would constitute nearly 5.1 % of our gross domestic product (US$28.9 billion) [29].

The present study estimates provide information on the use of resources for diabetes care, which may help describe the impact that society faces because of such a disease. This initial study, to our best knowledge, is the first documented study in Bangladesh, the findings of which can lead to further investigations in which cost-effective interventions could be evaluated leading to a potential reduction in the economic burden of diabetes.

The samples were drawn from a tertiary-level hospital in Dhaka. The transportation cost of a fair number of patients from outside Dhaka was not included while calculating the

Table 5 Multiple linear regression analysis of explanatory variables considering annual direct cost of diabetes/year (log transformed) as dependent variable

Variables	Unstandardized coefficients (β)	Sig	95 % Confidence interval for β	
			Lower bound	Upper bound
Age	−0.001	0.220	−0.003	0.001
Monthly household income	1.896	0.001	0.000	0.000
Duration of diabetes	0.004	0.007	0.001	0.007
No. of co-morbidity/complication	0.045	0.001	0.027	0.062
Mode of treatment				
OHA	Reference			
Insulin	0.225	0.001	0.208	0.303
Combination	0.251	0.001	0.207	0.295
(Constant)	4.129	0.001	4.038	4.220
Adjusted R^2	0.400			

cost of care, considering their permanent residence, which might further increase the total cost of care.

The results of cost-burden analysis of diabetes care in this study cannot be matched with other studies in developed countries [10, 24, 28] mainly because of their social and economic differences. A very few studies were conducted on the total cost of diabetes in developing countries [21, 30, 31], and the cost analyses undertaken different techniques and conduct in different time, which makes the attempt of comparison problematic.

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Conflict of interest The authors (AA, SHH, MS, HAC, DP, MAH, MNH, LA) report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

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References

1. International Diabetes Federation. Diabetes atlas, 6th edition, IDF diabetes atlas: www.idf.org/diabetesatlas. ISBN: 2-930229-85-3.
2. Hussain A, Vaaler S, Sayeed MA, et al. Type 2 diabetes and impaired fasting blood glucose in rural Bangladesh: a population based study. Eur J Pub Health. 2007;17(3):291–6.
3. Rahim MA, Hussain A, Khan AKA, et al. Rising prevalence of type 2 diabetes in rural Bangladesh: a population based study. Diabetes Res Clin Pract. 2007;77:300–5.
4. Hussain A, Rahim MA, Khan AKA, et al. Type 2 diabetes in rural and urban population: diverse prevalence and associated risk factors in Bangladesh. Diabet Med. 2005;22:931–6.
5. Sayeed MA, Mahtab H, Khanam PA, et al. Diabetes and impaired fasting glycemia in a rural population of Bangladesh. Diabetes Care. 2003;26:1034–9.
6. Sayeed MA, Ali L, Hossain MZ, et al. Effect of socioeconomic risk factors on the difference in prevalence of diabetes between rural and urban population of Bangladesh. Diabetes Care. 1997;20:551–5.
7. Sayeed MA, Khan AR, Banu A, Hussain MZ. Prevalence of diabetes and hypertension in a rural population of Bangladesh. Diabetes Care. 1995;18:555–8.
8. Mahtab H, Ibrahim M, Banik NG, et al. Diabetes detection survey in a rural and semi-urban community in Bangladesh. Tohoku J Exp Med. 1983;141:211–7.
9. Sayeed MA, Hossain MZ, Banu A, et al. Prevalence of diabetes in a suburban population of Bangladesh. Diabetes Res Clin Pract. 1997;34:149–5.
10. Barcelo A, Aedo C, Rajpathak S, Robles S. The cost of diabetes in Latin America and the Caribbean. Bull World Health Organ. 2003;81:19–27.
11. Shobhana R, Rao PR, Lavanya A, Williams R, Padman C, Vijay V, et al. Cost incurred by families having Type 1 diabetes in a developing country—a study from Southern India. Diabetes Res Clin Pract. 2002;55:45–8.
12. American Diabetes Association. Economic consequences of diabetes mellitus in the United States in 1997. Diabetes Care. 1998;21:296–309.
13. Hart WM, Espinosa C, Rovira J. Cost of unknown diabetes mellitus in Spain. Med Clin (Barcelona). 1997;109:289–93.
14. Gray AM, Fenn P. The cost of insulin-dependent diabetes mellitus in England and Wales. Diabet Med. 1995;12:1068–76.
15. American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. Diabetes Care. 2013;36:1033–3.
16. Morkrid K, Ali L, Hussain A. Risk factors and prevalence of diabetic peripheral neuropathy: a study of type 2 diabetic outpatients in Bangladesh. Int J Diabet Dev Ctries. 2010;30:11.
17. DAB: Statistical Year Book vol. July 2013- June 2014. Dhaka: diabetic association of Bangladesh. 2014. web version www.dab-bd.org.
18. Moore R. Economic burden of illness in Canada: Canadian public health association for health Canada. 1993.
19. Wikipidia. List of minimum wages by country. https://en.wikipedia.org/wiki/List_of_minimum_wages_by_country. (Accessed 28 February 2014)
20. Wang W, McGreevey WP, Fu C, Zhan S, Luan R, Chen W, et al. Type 2 diabetes mellitus in China: a preventable economic burden. Am J Manag Care. 2009;15(9):593–1.
21. Khowaja LA, Khuwaja AK, Cosgrove P. Cost of diabetes care in out-patient clinics of Karachi, Pakistan. BMC Health Serv Res. 2007;7(1):189. doi:10.1186/1472-6963-7-189.
22. Kapur A. Economic analysis of diabetes care. Indian J Med Res. 2007;125(3):473–2.
23. 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(956):391–5.
24. Dall T, Nikolov P, Hogan P. Economic costs of diabetes in the US in 2002. Diabetes Care. 2003;26:917–2.
25. Oddvar S, Trond J, Ivar K. Diabetes: cost of illness in Norway. BMC Endocrine Disorders. 2010, 10:15, http://www.biomedcentral.com/1472-6823/10/15.
26. Nolan J, O'halloran D, McKenna T, Firth R, Redmond S. The cost of treating type 2 diabetes (CODEIRE). Ir Med J. 2006;99(10):307.
27. Dawson KG, Gomes D, Gerstein H, Blanchard JF, Kahler KH. The economic cost of diabetes in Canada, 1998. Diabetes Care. 2002;25(8):1303–7.
28. Köster I, Von Ferber L, Ihle P, Schubert I, Hauner H. The cost burden of diabetes mellitus: the evidence from Germany—the CoDiM Study. Diabetologia. 2006;49(7):1498–4.
29. December 2010. Bangladesh national health accounts (BNHA-III) 1997-2007 (Part 1). Ministry of health and family welfare.
30. Kirigia J, Sambo H, Sambo L, Barry S. Economic burden of diabetes mellitus in the WHO African region. BMC Int Health Hum Rights. 2009;9(1):6. doi:10.1186/1472-698X-9-6.
31. Rayappa P, Raju K, Kapur A, Bjork S, Sylvest C, Dilip KK. Economic cost of diabetes care: the Bangalore urban district diabetes study. Int J Diab Dev Countries. 1999;19(3):87–6.