

EVALUATION OF PHARMACOECONOMIC DIRECT COST IN DIABETES PATIENTSKAMALA SANGAM¹, MOHAMMED ANIFA¹, SWATHI K¹, VENKATESWARLU K^{2*}, RAM MOHAN REDDY T²¹Department of Clinical Pharmacy, St. Peter's Institute of Pharmaceutical Sciences, Warangal, Telangana, India. ²Department of Pharmacy, Mewar University, Chittorgarh, Rajasthan, India. Email: venkipharmd@gmail.com

Received: 30 September 2015, Revised and Accepted: 31 December 2016

ABSTRACT

Objective: Diabetes mellitus (DM) is a major cause of disability, morbidity and mortality Worldwide. The objective of this study is to evaluate the pharmacoeconomic (PE) direct health-care cost in Type 2 diabetes with complications and diabetes alone: A cost of illness study.

Methods: A prospective observational study was conducted for 1 year at the care diabetes center, Warangal. The enrolled patients were followed and the information collected contains: Total direct costs, which include direct medical costs and direct nonmedical cost. The data observed was analyzed for the average cost incurred in treating the diabetic patient.

Results: The total average costs per diabetic patient without complications was Rs. 8695.7±1341, this includes the average direct medical cost Rs. 6366.50±561.12, the average laboratory cost Rs. 1368.84±64.8, the average direct nonmedical cost was Rs. 960.36±14.04 compared to those with DM complications, the total average cost was Rs. 12960.73±549.96 for macrovascular complications, Rs. 11039.11±265.36 for microvascular complications. To treat diabetes with comorbidities which include both micro and macro complications the total average cost was Rs. 16658.13±1393.44, the average direct medical cost was Rs. 14071.77±2884.68, the average laboratory cost Rs. 1628.04±51, the average direct nonmedical cost was Rs. 958.32±13.08. The costs were found to increase progressively with the increase in the number of complications. Costs also vary significantly across the types of complications.

Conclusion: Our study concludes that the cost of diabetes with complications resulted about 2 times higher than compared to diabetes alone.

Keywords: Cost analysis, Diabetes, Economics, Health care, Direct medical cost, Nonmedical cost.

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INTRODUCTION

Diabetes mellitus (DM) is a common form that develops especially in adults and most often in obese individuals and that is characterized by hyperglycemia arising from impaired insulin utilization coupled with the body's inability to compensate with increased insulin production called noninsulin-dependent DM. Obesity, stress, lack of exercise, diet rich in cholesterol and carbohydrates, aging and genetics are the causes of insulin resistance.

Complications of diabetes are to a large extent the consequence of macrovascular cardiovascular disease (CVD) and microvascular (retinopathy, neuropathy, and nephropathy) complications of the disease [1,2].

The objective of the study is to evaluate the health-care cost in diabetes and its comorbidities in out patients.

Global prevalence of Type 2 DM (T2DM) in the year 2000 among adults (≥20 years) was calculated to be 171 million and will rise to 366 million by 2030. In terms of country wise ranking of DM prevalence, India stands first, China second, Pakistan sixth, and Ukraine is at the bottom of the list [3].

As Indian population is 1.2 billion the economic effect of this increase in the diabetes population could cause distress to India. India is an emerging economy and will lose a billion dollars in National income due to diabetes, stroke, heart disease. Patients with diabetes use higher health-care resources [4]. The high cost is related to late diabetes complications, the money loss is due to lost man-days or lost economic opportunity [5]. The rise in prevalence of DM poses a major clinical, economic and social burden in India, which is being called as "the

diabetic capital of the world." The diabetic health-care cost is increasing throughout the World. Pharmacoeconomic (PE) analysis is one means of minimizing these expenditures [6].

PE is an established subdiscipline of health economics concerned with the estimation of pharmaceutical products in terms of their value of expenses. It is a "descriptive examination of the cost of drug therapy to the health-care system and also the society" [7].

PE evaluation consists of cost-minimization, cost-effectiveness, cost benefits, cost of illness, cost-utility, and cost-consequences [8]. Cost of illness is used to estimate the economic burden of disease. This method includes direct cost and indirect cost. The PE direct cost includes physician cost, therapy, travel cost, a hospital cost. We can calculate the incidence (life time cost) and prevalence (per year cost) through PE study [9].

METHODS

A prospective observational study was conducted in ambulatory patient's care diabetes center, Warangal, Telangana, India. Patient's data and cost details were collected from the bills for 1 year. The DM patients of age >18 years, both genders, patients who are diagnosed with DM and its mild comorbidities, were included in the study. In-patients, pregnant women, Type 1 diabetes patients, gestational diabetes patients and organ failure patients were excluded. The enrolled patients were followed during the study period and the relevant study data, including demographic details which contains, age, sex, education, occupation, past medical history, bills of both medical and laboratory were collected.

Cost of illness includes both direct and indirect cost, total direct costs consists of both direct medical and nonmedical costs. The direct medical cost includes the medical costs, cost of laboratory investigations and the

direct nonmedical costs include the transportation cost to the hospital. The costs of drugs, syringes, and any other invasive or noninvasive procedures along with laboratory tests were collected. All the relevant and necessary data were collected from a patient's case sheet, bills, laboratory reports, interviewing patients or patient caretakers, or other relevant sources.

Mean and standard deviation was calculated for medical cost, laboratory cost, travel cost and total cost and the p value calculated to compared male and female total cost.

RESULTS

A total of 550 patients were enrolled during the study period out of which most of the patients were males 276 (50.18%) than females 274 (49.81%).

Diseases wise distribution of patients

Among the patients enrolled, the patients with DM, DM+HTN (hypertension), DM+CVD, DM+CVD+HTN, DM+peripheral neuropathy (PN), DM+HTN+CVD+PN are present. The diseases wise distribution of patients' details was given in Table 1.

Table 1 shows that the patients with DM n=187(34%) are more followed by DM+HTN n=153 (27.8%).

Based on gender

Table 2 shown there is no differences between male Rs. 946±474.57 and female Rs. 888.44±404.57 total cost, the p=0.085.

Occupation wise distribution

In occupation wise distribution, the average total cost was more in officers Rs. 1149.67 (20.58%) followed by house wives Rs. 928.66 (16.62%), self-employees Rs. 913.68 (16.35%) is seen in (Fig. 1).

Per yearly cost

The total medical cost is high in patients with DM with both macro and micro complications (Rs. 14071.77±561.12) followed by DM+CVD+HTN

(Rs. 10659.85±328.44), DM+PN (Rs. 8789.47±522.36), DM+HTN (Rs. 8779.31±1072.44), DM+CVD (Rs. 8576.75±1444.92), and DM (Rs. 6366.50±561.12).

The laboratory cost is high in DM+CVD (Rs. 1948.2±194.16), followed by DM with both macro and micro complications (Rs. 1628.04±51), DM+HTN (Rs. 1509±2.04), DM (Rs. 1368.84±64.8), DM+PN (Rs. 1320±86.64), DM+CVD+HTN (Rs. 1308.6±91.68).

The total travel cost was high in DM+CVD+HTN (Rs. 992.28±28.32) followed by DM (Rs. 960.36±14.04), DM with macro and micro complications (Rs. 958.32±13.08), DM+PN (Rs. 929.64±0.36), DM+HTN (Rs. 917.4±5.04), DM+CVD (Rs. 815.28±50.76).

The total cost was high in DM with macro and micro complications (Rs. 16658.13±1393.44), DM+HTN+CVD (Rs. 12960.73±549.96), DM+CVD (Rs. 11340.23±152.76), DM+HTN (Rs. 11205.71±184.08), DM+PN (Rs. 11039.11±265.36) and DM (Rs. 8695.7±1341) the above information is seen in Table 3.

As the complication increases the cost also increases. The cost burden of diabetes with two or more complications is more compared to diabetes with single complication and diabetes alone is seen in (Fig. 2).

DISCUSSION

This is the first study assessing the health-care direct cost of diabetes with comorbidities in the south Indian setup. Our study includes the treatment costs of diabetes alone and with comorbidities. The total cost was high in DM with macro and micro complications (Rs. 16658.13±1393.44), DM+HTN+CVD (Rs. 12960.73±549.96), DM+CVD (Rs. 11340.23±152.76), DM+HTN (Rs. 11205.71±184.08), DM+PN (Rs. 11039.11±265.36), and DM (Rs. 8695.7±1341).

The comparison with developing countries in Asia and Africa is more difficult due to lack of information on patient health-care expenditures for most of these countries. However, where data are available, they suggest as expected, much lower levels of expenditure. For example, the study assessing the treatment costs of diabetes in Karachi - Pakistan [10] estimated the annual mean treatment costs per DM patient to be \$197 only. Another example is a study from Iran in 2009, which gave an annual cost figure of US \$ 152 per DM patient [11]. Similarly, in Tunisia, an analysis in 1994 estimated an annual cost figure as low as US \$ 117 [12], in Egypt costs were even lower and a study in Sudan showed direct costs to amount USD 175 per year [13]. Middle-income countries, such as those in Latin America and the Arabian region, tend to be in between Western and developing countries [14]. Of course, treatment costs exclude many intangible costs, which are also very high in developing countries. For example, the World Bank and WHO, together suggest that 80% of the annual intangible losses related to DM and its complications are incurred in developing countries.

The overall average, total health-care costs were found to be higher in males, i.e., Rs. 946.89 than females, i.e., Rs. 888.44 and it was found to be higher in the age group of 80-85 years Rs. 1224.98, 74-79 years Rs. 1121.73 followed by 68-73 years Rs. 1028.10 this might be due to

Table 1: Diseases wise distribution of patients

Diagnosis	ICD code	Number of patients (%)
DM	E11	187 (34)
DM+HTN	I15.2	153 (27.8)
DM+CVD	I70.9	17 (3.09)
DM+CVD+HTN	E11	42 (7.6)
DM+PN	E11.4	70 (12.7)
DM+HTN+CVD+PN	E11	81 (14.7)

DM: Diabetes mellitus, HTN: Hypertension, CVD: Cardiovascular disease, PN: Peripheral neuropathy

Table 2: Gender wise distribution based on the total cost of the patients

Gender	Total cost	p
Female	Rs. 888.44±404.57	0.085
Male	Rs. 946.89±474.57	

Table 3: Cost burden per year in patients with diabetes alone and its complication

Diagnosis	Mean±SD			
	Medical cost (INR)	Laboratory cost (INR)	Travel cost (INR)	Total cost (INR)
DM	6366.50±561.12	1368.84±64.8	960.36±14.04	8695.7±1341
DM+HTN	8779.31±1072.44	1509±2.04	917.4±5.04	11205.71±184.08
DM+CVD	8576.75±1444.92	1948.2±194.16	815.28±50.76	11340.23±152.76
DM+HTN+CVD	10659.85±328.44	1308.6±91.68	992.28±28.32	12960.73±549.96
DM+PN	8789.47±522.36	1320±86.64	929.64±0.36	11039.11±265.36
DM+PN+HTN+CVD	14071.77±2884.68	1628.04±51	958.32±13.08	16658.13±1393.44

DM: Diabetes mellitus, HTN: Hypertension, CVD: Cardiovascular disease, PN: Peripheral neuropathy, SD: Standard deviation

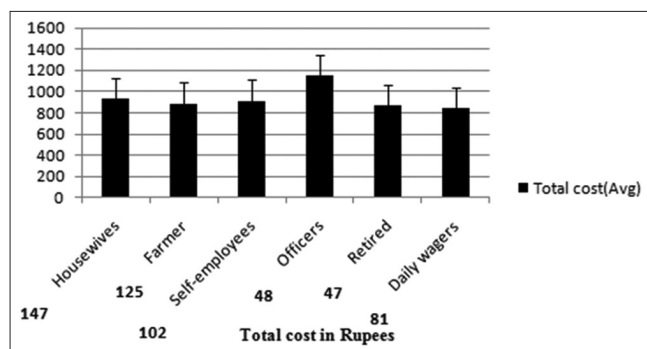


Fig. 1: Total cost in various occupations of patient

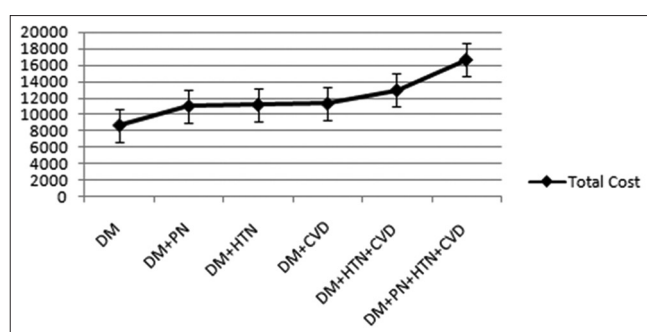


Fig. 2: Disease vs. total cost burden

increased number of comorbidities, similar results were found in the studies of Hogan *et al.*, 2003 and Henriksson *et al.*, 2000 [15,16].

The overall average health-care costs were found to be higher in the patients with micro and macro complications Rs. 1233.1±116.12 (21.11%) followed by only macro with single comorbidity DM+CVA Rs. 945.02±12.73 (16.18%) and DM+HTN Rs. 939.18±15.34 (16.07%) followed by only micro DM+PN Rs. 924.05±22.11 (15.82%). The results of this study showed increased total health-care cost with increased number of complications.

Out of 550 patients, most of the patients were house wives followed by farmers, whereas overall health-care costs were higher in officers with Rs. 1149.67 (20.58%) followed by house wives Rs. 928.66 (16.62%) and self employees Rs. 913.68 (16.35%) this might be due their busy schedules with the work. The average overall medical cost was high in patients taking insulin, i.e., Rs. 1276.44 compared to patients on oral hypoglycemic agents, i.e., Rs. 117.58.

Hospital monthly visits laboratory costs and travel cost accounts for the largest part of diabetes cost and for patients who have developed late macro complications will greatly affect the cost which includes cost for any surgery. Furthermore, most diabetics on oral hypoglycemic agents receive insulin soon after hospital admission for developing complications and these further increases the costs.

CONCLUSION

Diabetes with complications resulted in double the cost compared to diabetes alone, therefore, the burden of diabetes and its complications was significant for an individual, much of this cost associated with the disease is preventable through diet restriction and aerobic exercise, to reduce the prevalence of diabetes and its complications in mind. By keeping the burden of the disease on individuals on the society, the health-care policy makers should give importance to initiatives like preventing the disease prevalence and counseling diabetes patients should be done continuously to control the advancement of the disease and its complications. To avoid increased medical cost, early detection of complications through appropriate screening is important, such as adequate control of blood sugar, blood pressure, cholesterol with proper diet restrictions, and some lifestyle modification is important.

REFERENCES

- Shargel L, Mutnick AH, Souney PF, Swanson LN. Comprehensive Pharmacy Review. 7th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2009. p. 850-70, 1165-93.
- Chisholm-Burns MA, Wells BG, Schwinghammer TL, Malone PM, Kolesar JM, DiPiro JT. Pharmacotherapy: A Pathophysiologic Approach. 8th ed. New York: McGraw-Hill; 2008. p. 116-35, 217-36.
- Wild S, Roglic G, Green A, King H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27(5):1047-53.
- Siegel K, Narayan KM, Kinra S. Finding a policy solution to India's diabetes epidemic. Health Aff (Millwood) 2008;27(4):1077-90.
- Kapur A. Influence of socio-economic factors on diabetes care. Int J Diabetes Dev Ctries 2001;21:77.
- Iram M, Rani S, Hiremath R. Pharmacoeconomics need for the day. Indian J Pharm Pract 2009;2(3):16-8.
- Briggs AH, Levy AR. Pharmacoeconomics and pharmacoepidemiology: Curious bedfellows or a match made in heaven? Pharmacoeconomics 2006;24(11):1079-86.
- Bootman JL, Raymond JT, McGhan WF. Introduction to Pharmacoeconomics. Ohio: Harvey Whitney Books; 1996. p. 7-9.
- Zhang P, Engelgau MM, Norris SL, Gregg EW, Narayan KM. Application of economic analysis to diabetes and diabetes care. Ann Intern Med 2004;140(11):972-7.
- Khowaja LA, Khuwaja AK, Cosgrove P. Cost of diabetes care in outpatient clinics of Karachi, Pakistan. BMC Health Serv Res 2007;7:189.
- Esteghamati A, Khalilzadeh O, Anvari M, Meysamie A, Abbasi M, Forouzanfar M, *et al.* The economic costs of diabetes: A population-based study in Tehran, Iran. Diabetologia 2009;52(8):1520-7.
- Rekik M, Abid M, Hachicha J, Abbes R, Moujahed M, Jarraya A. Direct cost of the ambulatory management of diabetes at the outpatient clinic of the National Social Security Fund of Sfax (Tunisia). Bull World Health Organ 1994;72(4):611-4.
- Elrayah-Eliadarous H, Yassin K, Eltom M, Abdelrahman S, Wahlström R, Ostenson CG. Direct costs for care and glycaemic control in patients with Type 2 diabetes in Sudan. Exp Clin Endocrinol Diabetes 2010;118(4):220-5.
- Barceló A, Aedo C, Rajpathak S, Robles S. The cost of diabetes in Latin America and the Caribbean. Bull World Health Organ 2003;81(1):19-27.
- Hogan P, Dall T, Nikolov P; American Diabetes Association. Economic costs of diabetes in the US in 2002. Diabetes Care 2003;26(3):917-32.
- Henriksson F, Agardh CD, Berne C, Bolinder J, Lönnqvist F, Stenström P, *et al.* Direct medical costs for patients with Type 2 diabetes in Sweden. J Int Med 2000;248(5):387-96.