Research Article

Assessment of economic burden for management of diabetic foot ulcer in patients attending tertiary care hospital in Central Karnataka, India

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ABSTRACT

Background: The prevalence of diabetes mellitus has increased in lower income countries. Poorly managed diabetes leads to serious complications. Diabetic foot ulcer (DFU) is most common complication. Diabetes and its complications cause significant economic loss to patients and their families, health systems, and even national economies. **Objectives:** The objective of the study is (i) to assess the economic burden for the management of DFU among patients attending tertiary care hospital, in central Karnataka and (ii) to study the association of health expenditure with sociodemographic factors. **Materials and Methods:** This facility-based cross-sectional study was carried out among 100 patients with diabetic foot attending tertiary care hospital in central Karnataka. **Results:** 31% of participants reported in the age group of 61–70 years, 84% were males, 68% were from rural areas, 45% were illiterate, and 37% were currently not working. 55% of participants were belonging lower socioeconomic status. The major part of the health expenditure was the indirect expenditure. The mean direct expenditure was 431.40 INR and mean indirect expenditure was 611.98 INR. In direct health expenditure, major cost was for medication (mean 1165.8 INR) followed by investigation (mean 113.16 INR). In indirect health expenditure, major cost was loss of wages of patient and caregiver. No sociodemographic factors except age were associated with economic burden. **Conclusions:** The major part of the economic burden was the indirect expenditure. No sociodemographic factors except age were significantly associated with health-care expenditure for DFU.

KEY WORDS: Diabetic Foot Ulcer; Economic Burden; Direct and Indirect Health Expenditure

INTRODUCTION

Diabetes mellitus is a major global health problem. The WHO records from 2014 showed that about 422 million people were living with diabetes. Since 1980, the prevalence of diabetes has doubled from 4.7% to 8.5% in adults. It has been noticed that the prevalence has grown at a faster rate in lower income countries. In the next 20 years, the global prevalence of diabetes mellitus is expected to rise to almost 642 million, with developing countries contributing to 75% of the cases.[1]

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Delayed treatment and inefficient management of diabetes are known to lead to serious complications and eventually early deaths.[2] One of the most common complications is diabetic foot ulcer (DFU), and 15% of diabetic patients are estimated to suffer from foot ulcer during their lifetime.[3] It has been noted that the prevalence of DFU in India varies from 3% to as high as 14%.[4] The high prevalence and recurrence rates have been attributed to peripheral vascular diseases, neuropathy, and coexisting poor foot care practices.[5]

It has also been noticed that patients delay in approaching the physician for foot problems, and in the meantime, they resort to many non-validated and indigenous methods of

treatment. This clearly indicates lack of health-related education, nearby health services or financial resources. It has also been found that there is an acute shortage of trained multidisciplinary teams and dedicated foot centers.[6] There is a gross difference in the costs endured by patients toward treatment. While patients without foot problems spent 9.3% of their total income, those with foot problems spent as high as 32.3% of their total income.[7]

Diabetes and its complications pose as a significant financial burden directly and indirectly to the patients, their families and their countries.[1]

Direct costs for diabetes come from the cost of medicines to charges toward consultation, investigations, hospital stays, and surgeries done in case of complications. The indirect costs arise from the time lost, loss of productivity, cost of travel, and loss of income of family accompanying the patient and the patient himself.[8] The total medical cost for the management of diabetic foot disease in the United States ranges from $9 to $13 billion in addition to the cost for management of diabetes mellitus alone.[9] In 2007, the diabetes and its complications cost the US $174 billion, with direct costs of $116 billion and indirect costs such as disability and premature mortality making up for the rest of $58.3 billion.[10]

Considering the wide variability in the stage, severity, calculating the economic burden of diabetes foot ulcer is very challenging[8] and the present study was undertaken to assess the same.

Objectives

1. To assess the economic burden for the management of DFU among patients attending tertiary care hospital, in central Karnataka
2. To study the association of health expenditure with sociodemographic factors.

MATERIALS AND METHODS

This facility-based cross-sectional study was carried out among 100 patients with diabetic foot attending tertiary care hospital in central Karnataka, during the period from 1 March, 2018, to 31 July, 2018.

Inclusion Criteria

1. Patients with DFU diagnosed for a minimum of 3 months, attending tertiary care hospital.

Exclusion Criteria

1. Patients with other comorbidities
2. Those refuse to participate in the study.

Ethical clearance was obtained from institutional ethical review board, and written informed consent was taken from patients. Information was collected on direct, indirect, and total health-care expenditure for the past 3 months, and sociodemographic variables were collected using pre-designed, semi-structured questionnaire. The direct cost includes money spent on consultation, investigation, and medication for outpatient care. The indirect cot includes money spent on traveling of patient and caregiver, food expenditure, loss of wages of patient, and caregiver for outpatient care. The inpatient and treatment cost of any comorbidities were not included in the analysis of economic burden.

The results were analyzed using the Statistical Package for the Social Sciences and expressed as mean with standard deviation and proportions. Appropriate statistical tests such as *t*-test and analysis of variance applied.

RESULTS

Sociodemographic Characteristics of Study Participants

In the current study, 31% of participants reported in the age group 61–70 years, 84% were males, 68% were from rural areas, 45% were illiterate, and 37% were currently not working. 55% of participants were belonging to lower socioeconomic status. 55% of participants were belonging to lower socioeconomic status [Table 1].

Pattern of Cost Spent on Management of DFU (in INR) among Study Participants

The major part of the health expenditure is the indirect expenditure. The mean direct expenditure was 431.40 INR and mean indirect expenditure was 611.98 INR. In direct health expenditure, major cost was for medication (mean 1165.8 INR) followed by investigation (mean 113.16 INR). In indirect health expenditure, major cost was loss of wages of patient and caregiver [Table 2].

Association of Health Expenditure with Sociodemographic Factors

No sociodemographic factors except age were significantly associated with economic burden [Table 3].

DISCUSSION

This study shows that the major part of the health expenditure is the indirect health expenditure. The mean direct expenditure was 431.40 INR and mean indirect expenditure was 611.98 INR. In direct health expenditure, major cost was for medications (mean 1165.8 INR) followed by investigations (mean 113.16 INR). However, majority of indirect health expenditure was loss of wages of patient and caregiver.

Most of the study participants were males, nearly two-thirds were from rural areas, almost half of them were illiterate, one-third of them were currently not employed, and majority of participants were belonging to lower socioeconomic status.

Table 1: Sociodemographic characteristics of study participants (*n*=100)

Variable	Number	Percentage
Age group		
30-40	12	12
41-50	17	17
51-60	27	27
61-70	31	31
>70	13	13
Sex		
Male	84	84
Female	16	16
Residence		
Rural	68	68
Urban	32	32
Education		
Illiterate	45	45
Primary school	42	42
High school	6	6
PUC/diploma	7	7
Occupation		
Semi-professional	41	41
Unskilled	13	13
Housewives	9	9
Currently not working	37	37
Socioeconomic status		
Class I	10	10
Class II	11	11
Class III	24	24
Class IV and V	55	55

It is also noted that no sociodemographic factors except age were associated with health expenditure for DFU.

Almost similar sociodemographic data were observed in studies conducted by Jyothylekshmy *et al.* and Hopkins *et al.*, where 63% of DFUs were men compared to 37% being women[11,12]. Studies by Gadepalli *et al.* and Raja concluded that the male sex is appeared to be the risk factor for DFUs.[13,14] It has been studied that the aging leads to increased foot complication, which was explained by gradual decrease in functional capacity and self-care difficulties. Diabetics with duration of <10 years had foot complications associated with their age.[15,16]

Although our study found no sociodemographic features except age and expenditure on the management of DFUs, Chandra *et al*. studied a pattern between socioeconomic status and expenditure of diabetes. They studied the urban Indian population and observed that patients of lower socioeconomic status were found to spend a larger portion of their income in managing diabetes, which they explained to be the lacking awareness of risk factors of diabetes and the importance of compliance, in the lower socioeconomic groups.[17]

In our study, the indirect costs incurred were higher than the direct costs. A study by Chandra *et al*. concluded that 3.6% (735 INR) was spent on direct cost and 1.4% (INR 329) was spent on indirect cost. However, the breakdown of direct cost was in accordance with our study where 52.1% of the annual direct cost was spent on medicines. Others included 10% on clinician fees, 11.6% on investigations, 12.6% on surgical procedures, and the rest on lasers. The annual indirect cost was 3949 INR, out of this 91.3% was due to loss of wages, while the rest was spent on traveling, health classes, diet control, and supplements.[17]

Patients in European countries spend US $13561 annually, in France spend US $1265 monthly for DFUs, in UK spend

Table 2: Pattern of cost spent on the management of diabetic foot ulcer (in INR) among study participants

Variable	Mean	Median	Standard deviation	Minimum	Maximum
Direct expenditure					
Consultation	15.25	10	7.32	10	30
Investigation	113.16	60	86.66	40	315
Medication	1165.8	1000	887.24	180	4500
Total direct expenditure	431.4	113.16	520.8	15.25	1165.8
Indirect expenditure					
Traveling of patient	726.3	660	425.18	150	2250
Traveling of caregiver	318	50	423	0	1440
Food expenditure	100	100	129.73	0	1000
Patient loss of wages	1085	550	1225	100	5000
Caregivers loss of wages	830.9	600	523.54	100	2060
Total indirect expenditure	611.98	726.3	355.85	100	1085

Table 3: Association of health expenditure with sociodemographic factors

Variable	Number	Health expenditure	Significance
		Mean±SD	
Age group			
30–40	12	1509.62±487.832	F=10.229 *P*=0.000
41–50	17	1725.91±1054.46	
51–60	27	2579.94±2312.92	
61–70	31	4401.65±2039.79	
>70	13	3736.15±928.83	
Sex			
Male	84	524.56±644.92	*t*=−0.820 *P*=0.4140
Female	16	384.17±520.19	
Residence			
Rural	68	499.71±626.74	*t*=0.997 *P*=0.321
Urban	32	657.5±934.48	
Education			
Illiterate	45	593.06±777.93	F=0.136 *P*=0.938
Primary school	42	533.78±736.59	
High school	6	489.79±716.44	
PUC/diploma	7	425±516.88	
Occupation			
Semi-professional	41	669.53±894.17	F=0.628 *P*=0.598
Unskilled	13	558.90±687.90	
Homemaker	9	391.04±443.43	
Currently not working	37	468.70±634.47	
Socioeconomic class			
Class I	10	480.71±652.85	F=0.241 *P*=0.867
Class II	11	425.56±506.34	
Class III	24	636.55±847.20	
Class IV and V	55	550.08±744.56	

$7539/patient, in Belgium spend US $10572 per ulcer, in Sweden spend US $24965/patient, and in India spend US $1960.[18] Estimated NHS cost on DFU management is higher than the combined annual cost of three of the four common cancers.[19]

In the present study, cost incurred for DFU management is lower compared with other studies. This lower cost is due to the difference in study designs, patient selection, grades of DFUs, health-care system in different countries, treatment approaches, reimbursement strategies, and countries involved.

The strength of the current study is that it assessed the economic burden for outpatient management of DFU. This study helps government to reduce economic burden (more so, indirect expenses) by strengthening primary health care. Limitation of the study is that we had single visit recall period of 3 months which could lead to underestimation of health-care expenditure.

Recommendations

There is a current need for improvement in the availability of medication and investigations for the management of DFU within primary health-care centers which can reduce indirect health-care expenditures such as traveling, loss of wages of patient, and caregiver. Further community-based health-care expenditure studies need to be undertaken to get an actual picture.

CONCLUSION

In the present study, the major part of the health expenditure was the indirect expenditure, especially loss of wages of patient and caregiver. In direct health expenditure, major cost was for medication followed by investigation. No sociodemographic factors except age were significantly associated with health expenditure for DFU.

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REFERENCES

1. World Health Organization. Diabetes Fact Sheet N 312. Updated January 2015. World Health Organization, Diabetes Fact Sheet Updated November 2017. Available from: http://www.who.int/en. [Last accessed on 2018 Jul 12].
2. International Diabetes Federation. IDF Diabetes Atlas. 7th ed. Brussels, Belgium: International Diabetes Federation; 2015.
3. Schaper NC, Apelqvist J, Bakker K. The international consensus and practical guidelines on the management and prevention of the diabetic foot. Curr Diab Rep 2003;3:475-9.
4. Liapis CD, Balzer K, Valentini FB, Fernandes JF. Diabetic foot. Part of the European manual of medicine book series. In: Vascular Surgery. Berlin Heidelberg: Springer; 2007. p. 501-21.
5. Vijay V, Narasimham DV, Seena R, Snehalatha C, Ramachandran A. Clinical profile of diabetic foot infections in South India-a retrospective study. Diabet Med 2000;17:215-8.
6. Rastogi A, Bhansali A. Diabetic foot infection: An Indian scenario. J Foot Ankle Surg 2016;3:71-9.
7. Vijay V, Sharad P, Arun B. Diabetic foot India. Med Update 2005;47:220-2.
8. Singh S, Unnikrishnan AG, Vinya U, Vishnu R, Thakadiyal S. Economic burden of diabetes management in the university teaching hospital in South India. J Health Manage 2015;17:487-94.
9. Rice JB, Desai U, Cummings AK, Birnbaum HG, Skornicki M, Parsons NB, *et al.* Burden of diabetic foot ulcers for medicare and private insurers. Diabetes Care 2014;37:651-8.
10. American Diabetes Association. Economic costs of diabetes in the U.S. In 2007. Diabetes Care 2008;31:596-615.

11. Jyothylekshmy V, Menon AS, Abraham S. Epidemiology of diabetic foot complications in a podiatry clinic of a tertiary hospital in South India. Indian J Health Sci 2015;8:48-51.
12. Hopkins RB, Burke N, Harlock J, Jegathisawaran J, Goeree R. Economic burden of illness associated with diabetic foot ulcers in Canada. BMC Health Serv Res 2015;15:13.
13. Gadepalli R, Dhawan B, Sreenivas V, Kapil A, Ammini AC, Chaudhry R, *et al*. A clinico-microbiological study of diabetic foot ulcers in an Indian tertiary care hospital. Diabetes Care 2006;29:1727-32.
14. Raja NS. Microbiology of diabetic foot infections in a teaching hospital in Malaysia: A retrospective study of 194 cases. J Microbiol Immunol Infect 2007;40:39-44.
15. Al-Maskari F, El-Sadig M. Prevalence of risk factors for diabetic foot complications. BMC Fam Pract 2007;8:59.
16. Asha K, Aprana S, Aravind J. Microbiological profile of diabetic foot ulcer. Calicut Med J 2011;9:e2.
17. Chandra P, Gogate B, Gogate P, Thite N, Mutha A, Walimbe A, *et al*. Economic burden of diabetes in urban Indians. Open Ophthalmol J 2014;8:91-4.
18. Raghav A, Khan ZA, Labala RK, Ahmad J, Noor S, Mishra BK, *et al*. Financial burden of diabetic foot ulcers to world: A progressive topic to discuss always. Ther Adv Endocrinol Metab 2018;9:29-31.
19. Kerr M. Foot Care in Diabetes: The Human and Financial Cost. Insight Health Economics; 2017.

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