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## Cost of Illness Study of Regular Out Patient Department Diabetic in a Low Income Country: A Cross Sectional Study

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### Abstract

**Background:** The burden of Diabetes in South Asia is alarming as the prevalence is higher compared to other region, living cost is low after Sub Saharan Africa and health care system are in state of expanding to be more accessible and adequate.

**Objectives:** The objective of the study was to assess the direct cost of illness among diabetic patient regularly visiting at outpatient department (OPD) in BPKIHS.

**Methods:** This was a cross sectional study done in year 2018. 142 patients with at least nine visit per year were enrolled. The direct cost were calculated from the pattern of prescription of medications and laboratory investigations carried out over a year of the individual patient. The data were tabulated and analyzed.

**Results:** Among the 142 patients on 37.5% were in mono-therapy and 62.5% were in poly-therapy. The direct cost of illness was USD 103 per annum that includes drug and investigation cost expensed at OPD visit. The average indirect cost was USD 102 per annum including travel and food. Among 142 patient the cost of illness on inpatient due to DM was USD 85.47 per event.

**Conclusion:** The financial burden of being a diabetic in Nepal is high. Comprehensive quality care by expansion of health system and service with nominal charges to patient seems to be one of the challenges in Nepal.

**Key Words:** Burden, Cost of illness, Diabetes, Nepal

### Introduction

Diabetes Mellitus (DM) is a metabolic disorder of multiple etiology characterized by chronic symptoms and signs of hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion and/or insulin action. The global burden of DM has been increasing throughout the globe as a pandemic morbidity. WHO reports 8.8% prevalence of diabetic cases globally accounting 422 million adults at year 2014 and mortality due to DM as 1.5 million during year 2012. Obesity, sedentary life styles, stress, increase life expectancy and genetic

factors are driving force for the dramatic increase in the burden of DM.<sup>1</sup> By 2017 US department of health and human services estimated 23.1 million diabetic patient in the United States with the cost burden of more than USD245 billion per year.<sup>2</sup> The global cost of diabetes for 2015 was USD 1.31 trillion (95% CI 1.28–1.36) or 1.8% (95% CI 1.8–1.9) of global gross domestic product (GDP).<sup>3</sup>

Cost-of-illness on DM studies typically include direct and indirect costs of DM. Direct costs comprise all expenditures for the treatment of diabetes, including medication, hospital stays, and treatment of complications. Indirect costs are defined as productivity or production losses associated with morbidity and premature mortality.<sup>4</sup> Thus DM is a

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cost threat disease with significant morbidity and mortality especially in geography where point of diabetic care are still being developed. There are challenges of diabetic care in developing world like political commitment not addressing adequacy in trained manpower, development of diabetic care unit that compromise different specialties, accessibility and affordability's of existing private based services. This study was conducted in one of the referral provincial governmental hospital of Republic of Nepal to estimate the direct and indirect cost of regularly visiting outpatient based diabetic patient.

**Methodology**

This was a cross sectional study conducted at BP Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal. Those diabetic patient who visit at least nine outpatient department per year were enrolled in the study. Considering 8.8% prevalence of diabetes in Nepal we calculated the sample size of 128 with 95% confidence interval and 95% power of the study. Adding 10% as biases the final sample size was 142. A pretested questionnaire on case recording form (CRF) was used for the collection of the data. The confidentiality of the patients were maintained by generating a code system in CRF. The data were tabulated in Microsoft Excel Program 2007 and were analyzed by using Statistical Package for Social Sciences (SPSS) software version 11.5. Ethical clearance were taken from the Institutional Review Committee (IRC) of the institute. The direct cost were calculated from the pattern of prescription of medications and laboratory investigations carried out over a year of the individual patient. The indirect cost included were travel and food expenses and cost equivalent to productivity loss during that hospital visit.

**Results**

Among 142 cases the mean and median age was 56.7±12.4 and 58 years respectively. Majority of the patient were Hindu by religion. Most of them were unemployed, had sedentary life style, consumed alcoholic beverage and tobacco (Table 1)

**Table 1: Socio demographic characteristics (n=142)**

S.N	Demographic characters	Measurement
1.	Age	
	1. Mean	56.7±12.4
	2. Median	58
2	Gender Female/Male	0.9/1
3	Religion	116
	1. Hindu	12
	2. Muslim	9
	3. Buddhist	4
	4. Christian	1
	5. Others	
Life style and Daily Activity	1. Sedentary	86
	2. Mild to moderate	49
	3. Severe	7
4	Occupation	
	1. Profession	9
	2. Semi-Profession	9
	3. Clerical, Shopkeeper, Farmer	17
	4. Skilled Worker	8
	5. Semi-Skilled	9
	6. Unskilled	7
7. Unemployed	83	
5	Family history of Diabetes	52
6	Living with diabetes	
	Mean duration of Diabetes	6.4±5.2 years
	1. Less than 1 year	11
	2. 1 to 5 years	56
	3. >5-10 years	47
	4. More than 10 years	28
7	Substance use	
	1. Alcoholic beverage	49
	a. Safe	14
	b. Unsafe	25
	2. Nicotine	76

On examination more than 47% of these patients had BMI more than upper normal limit. About two third of the patients were screened for diabetic complications. Nephropathy (26.1%) was the most common microvascular complication detected. Tuberculosis (45.45%) was the most common

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comorbid condition associated with diabetic patient (Table 2).

**Table 2: Diabetes and its associated determinants (n=142)**

S.N.	Determinants associated with diabetes	Measurement
1	BMI Mean BMI 1. Less than 18.5 2. 18.5-25 3. >25-30 4. >30-35 5. >35	25.27±3.4 3 68 57 9 5
2	Screening for diabetic complications over last year 1. No 2. Yes a. Eye Disease b. Kidney disease c. Heart disease d. Vitamin deficiency e. Joint & Musculoskeletal disease f. Genitourinary disease g. Nerve disease h. Foot disease i. Brain disease j. Skin disease	7(4.9%) 135 (95.1%) 117 108 79 92 49 37 29 13 11 9
3	Prevalence of Micro vascular complications 1. Retinopathy 2. Nephropathy 3. Neuropathy	67 (47.18%) 31 37 29
4	Admission to the hospital due to diabetes related issue	41 (28.7%)
5	Presence of other disease 1. None 2. Systemic HTN 3. COAD 4. CKD 5. CAD 6. Subclinical Hypothyroidism 7. Tuberculosis	26 49 12 9 7 19 64

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Among the 142 patients on anti-diabetic medication 37.5% were in mono-therapy whereas 62.5% were in poly-therapy (Table 3).

**Table 3: Treatment Characteristics (n=142)**

S.N.	Treatment Characteristics	Measurement
1	Diabetic care 1. Dietary and Lifestyle modification 2. Anti-diabetic medications only 3. Dietary modification and Anti-diabetic medications 4. Dietary and Lifestyle modification and Anti-diabetic medications	2 (1.4%) 11 (7.9%) 70 (49.2%) 59 (41.5%)
2	Control of Diabetes throughout last nine visits 1. Uncontrolled 2. Partial controlled 3. Fair controlled 4. Very well controlled	3 (2.1%) 8 (5.8%) 57 (40.1%) 74 (52.1%)
3	Change in anti-diabetic agents pattern (n=140) No Yes 1. Monotherapy to polytherapy 2. Monotherapy to other group of monotherapy 3. Polytherapy to monotherapy	17 (12.1%) 123 (87.6%) 61 (43.6%) 18 (12.9%) 44 (31.4%)

Metformin (77.46%) was most commonly prescribed drug followed by sulfonylureas (38.03%) and DPP-4 inhibitors (28.17%) (Table 4). Out of 140, 50 (35.7%) patients reported adverse drug reactions (ADR) to the prescribed antidiabetic medications.

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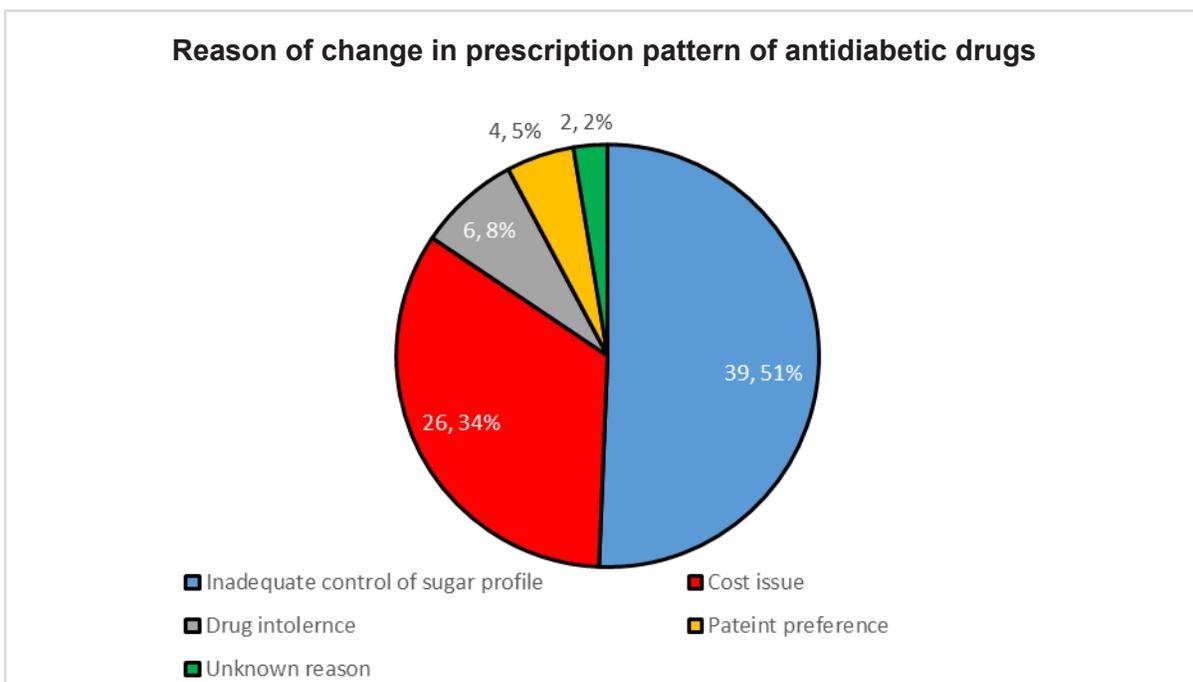
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**Table 4: Prescription pattern and ADR of antidiabetic drugs (n=140)**

S.N.	Anti-diabetic drugs	Monotherapy (n=53)	Poly-therapy (n=87)	Total (%)	Adverse Reaction (%)
1.	Metformin	31	79	110 (78.57)	28/110 (25.4)
2.	Sulfonylurea	2	52	54 (38.57)	7/54 (12.9)
3.	Alpha glucosidase inhibitors	0	6	6 (4.28)	0
4.	DPP-4 inhibitors	3	37	40 (28.57)	3/40 (7.5)
5.	Thiozolidinediones	0	2	2 (1.42)	0
6.	Insulin	11	6	17 (12.14)	4/17 (23.5)
7.	Insulin Analogue	6	21	27 (19.28)	8/27 (29.6)

The most common reason for change in anti-diabetic drug pattern was inadequate control of sugar profile (51%) followed by cost issue (34%) and drug intolerance (8%) (Figure 1).

**Figure 1: Reason of change in prescription pattern of antidiabetic drugs (n=77)**



The average cost spent on drug and investigations was USD 73 per annum and USD 30 per annum respectively. The average indirect cost was USD 102 per annum. The average cost of illness for outpatient

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care was USD 205 per annum. Six patients (4.2%) got admitted and the average inpatient cost was USD 85.47 per event (Table 5).

**Table 5: Cost of treatment**

S.N.	Characteristics	Cost in USD per annum
1	Average drug cost/annum	73
	1. Metformin	46.1
	2. Sulfonylurea	67.7
	3. Alpha glucosidase inhibitors	73.8
	4. DPP-4 inhibitors	92.3
	5. Thiazolidinediones (Glitazones)	40
	6. Insulin	215.4
	7. Insulin Analogue	410.3
2	Average investigation cost/annum	30
	Average inpatient cost/event	85.47
3	Average indirect cost/annum	102
	1. Travel cost	30.8
	2. Food cost during travel	20.5
	3. Loss of daily wages cost	50.7

**Discussions**

DM is a severe public health problem in Nepal. Diabetic care is being developed in this part of the world struggling to deliver comprehensive, quality treatment and services. Cost is a vital component for people with non-communicable disease including DM as treatment is expected to be lifelong. The economic burden resulting from diabetic care is a major concern for developing countries like Nepal. This is so because the burden of infectious disease is priority program in developing world. However burden of infectious and non-communicable disease is alarming in developing world. Lack of inadequate governmental health budget against non-communicable disease give space for private set up to invest on these arena however the cost of illness remains crucial for sustainable quality

care. It is critical to have an understanding of the cost-of-illness of diabetes in order to develop and implement policies to reduce this cost. This study has estimated the direct and indirect cost-of-illness of diabetic care in patients visiting outpatient department on regular basis in a referral center in Eastern Nepal.

Our study showed a higher prevalence of DM in male gender. This could be due to better health care-seeking behaviors for males leading to their treatment at referral centers especially in developing world. Similar findings had been also reported from another Nepalese studies where the female to male ratio was 1:1.02.<sup>5</sup> Upadhyay et al had also reported a higher prevalence of DM in male gender.<sup>6</sup> The study finding was different to Lisha et al in which a

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high proportion female patients were diabetic.<sup>7</sup>

Mean age of the diabetic patients was 56 year in our study. A higher mean age of 59.81 years was reported in another study conducted in Nepal by Karki et al.<sup>8</sup> Similar findings were also reported by Maskey et al in which average age was 55 year.<sup>5</sup> In contrast, a lower mean age of 49.14 years was reported by Upadhyay et al.<sup>6</sup>

In our study, most of the patients were unemployed, had sedentary life style, consumed alcoholic beverage and tobacco. Upadhyay et al had also documented that most of the diabetic patients (40.7%) were unemployed, alcoholic and smoker.<sup>6</sup> A cross-sectional study by Gautam et al reported association between strong alcohol and tobacco use and DM.<sup>9</sup> In contrast to our study, higher percentage of the patients were physically active and exercised adequately, at least 30 min/day in a study conducted in South India.<sup>10</sup> This is likely due to inclusion of only type 1 DM in their study where as in our study both type 1 and 2 DM were included. Older people are less active compared to the adults. Besides lack of education regarding benefit of physical activity over diabetes and causal risk could be another likely cause for this finding. Lack of physical activity is one of several risk factor for DM.<sup>5,11</sup> Lifestyle modifications and regular exercise play an important role in diabetes management however antidiabetic drugs become unavoidable in many patients. Regular physical activity of at least 30 minute per day helps in achieving good glycemic control in DM. There is an urgent need to sensitize and motivate the patients about the benefits of regular exercise in management of DM. Almost half of the patients had higher body mass index (BMI). Similar finding on lifestyle modification was also reported by Mehta et al and Maskey et al.<sup>5,12</sup>

About two third of the patients were screened for diabetic complications. Nephropathy (27%) was the most common microvascular complication detected. In contrast to our study retinopathy was the commonest complication in a study conducted by Maskey et al.<sup>5</sup> DM is known to cause morbidity

and mortality due to its micro-vascular and macro-vascular complications. Diabetic retinopathy, nephropathy and neuropathy are common microvascular complications among poorly controlled and prolong diabetic patient. These complications has been associated with increased cost burden and decrease productivity. Prevention of these complications require package care of diabetes that involves multidisciplinary services which includes good control of blood sugar throughout the year, regular screening of these complications and early diagnosis and management of the complications. Around 50% (67/135) screened diabetic patient had microvascular complication which is really alarming in resource limited set up. This fact exist among median age of 58 years diabetic cohort with mean duration of diabetes of 6.4 years. This could be challenge for health system especially with high prevalent geography (more than 8% prevalence in Nepal) to focus on training and treating more manpower against diabetic complication.

Tuberculosis (45.45%) was the most common co-morbid condition associated with DM followed by systemic hypertension (34.5%). In contrast to this finding, hypertension (21%) was the most common co-morbid condition in diabetic patients in Canada.<sup>13</sup> The burden of latent tuberculosis is higher in developing world and risk of reactivation among diabetic is higher. However a study in India reported systemic hypertension as common comorbidity.<sup>14</sup> This could be because tuberculosis could have been not subject of interest by the author though Nepal and India share similar prevalence of latent tuberculosis. The risk of having TB is three times higher in DM than in normal patients.<sup>15</sup>

Three fifth of the patients were on poly-therapy for DM. In contrast to our study, almost half of the patients (51.4%) were on poly-therapy in a Canadian study.<sup>13</sup> Poly-therapy is expected to increase the cost of treatment. Treatment in developing world are based upon cost factor. Higher doses of drugs are expected to be produce adverse drug effects. This could be associated with poor compliance and

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poor control of diabetes. As the disease progress poly-therapy remains as effective glycemic control tools in DM.

Metformin (79%) was the most common drug prescribed. Sulphonylureas represented the next largest class of medications in our study. Similar finding was also reported by Das et al in which metformin (24.5%) was prescribed more than sulphonylureas (19.9%).<sup>16</sup> A higher percentage of patients (85.2%) were prescribed metformin in Canada.<sup>13</sup> Metformin remains the most preferred oral antidiabetic drug throughout the globe the reason being cheaper, no weight gain and lesser hypoglycemic attack as compared to others. However dyspepsia, intolerance and methycobalamine deficiency have been commonly associated with metformin. In contrast to our finding sulfonylurea was the most commonly prescribed antidiabetic drug in India.<sup>17</sup> Guidelines recommend metformin as first-line treatment for DM.<sup>18</sup> The percentage of dipeptidyl peptidase-4 (DPP-4) prescription in our study was extremely low compared with that in Japan where 34.6% prescription consisted of DPP-4.<sup>19</sup> This could be because of cost issue.

Our study found that the average cost of DM for outpatient care was USD 205 per annum. In contrast to our study, a higher cost was reported by Shrestha et al where total cost incurred in the treatment and care of DM per annum was USD 445.<sup>20</sup> The higher cost was due to fact that their study was conducted in private diabetic clinics. Mukherjee et al had reported that financial constraints was second most common cause for non-compliance to antidiabetic drugs in India.<sup>21</sup> Similar annual mean cost of USD 197 had been reported by Khowaja et al.<sup>22</sup> Total annual healthcare costs for diabetic care was USD 15,175 in 2012 in the USA.<sup>23</sup> This reflect vast difference in cost of illness in diabetic care in resource limited setup and developed nations. The point of care facilities for diabetic patients in Nepal are inadequate and inaccessible.<sup>24</sup> This is likely to increase the direct and indirect cost of illness in terms of diagnosed at late stage and expenses

made to travel respectively. Diabetes imposes a large economic burden on the society to all types of community it remains lesser priority health issue in developing nation. The extensive treatments for diabetes and its complications account for much of the costs, making it one of the most expensive diseases to treat in many parts of the world.<sup>25</sup>

Nepal's GDP Per Capita was 1,003.64 USD in Jul 2018.<sup>26</sup> Nepal spends only 6% of its GDP on health care.<sup>27</sup> The direct cost of managing diabetic at outpatient department in Nepal is 103 USD which accounts for 2.18% of GDP of Nepal (25.47 billion USD) assuming 8.4% as diabetic prevalence in Nepal that is 555 million USD. The investment by government in diabetic care is demands increase in health budget by more than one third of present health budget. Comprehensive quality care at low cost to patient seems to be one of the challenges in developing nation like Nepal.<sup>24</sup> Thus diabetic care in public hospitals had large space to advance in Nepal. Absence of adequate multidisciplinary diabetic care point is barrier against accessible quality health care services. Government and private healthcare insurance do not cover the diabetic care in Nepal therefore these patients have to pay from their pocket to avail the acquired healthcare services, travelling cost and other indirect cost related to diabetic care.

The limitation of the study was that the diabetes patients were selected from only one hospital of Eastern Nepal and hence the study findings may not be able to generalize to the entire diabetic population of the country.

### Conclusions

There is a high cost burden on the patient with DM in Nepal as the cost is not covered by health insurance. Lack of political commitment on investment is likely to deprive diabetic patient from cost effective quality diabetic care. This would land up with higher rate of conversion to complications that would further increase the cost of illness on diabetes in developing world.

**Conflict of Interest:** The author declares no conflict

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of interest during this research activity.

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