Original Article

The Economic Impact of Care & Treatment of Diabetic Foot Ulcers at a Tertiary Government Hospital in the Philippines: A Retrospective Cohort Study

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Abstract: Diabetic foot ulcer is a micro vascular complication of diabetes mellitus that commonly results in in-hospital admission and requirement for surgery. Significant healthcare expenditure is thus required to achieve care for this population of longstanding patients this study sought to determine the direct medical costs of treating patients with diabetic foot ulcers in East Avenue Medical Center, a tertiary government hospital in the Philippines retrospective review of medical records and hospital bills Records and hospital bills of 124 patients admitted for diabetic foot ulcers from January to June 2023 was reviewed to determine the direct costs of care the overall cost of managing 124 patients with diabetic foot ulcers in a span of 6-months was 30,051,927.58 Php (537,601.57 USD) with a mean cost of 242,354.25 Php (4,335.50 USD) per patient. Laboratory diagnostics (31.33%), medications from the pharmacy (20.10%), and room and board (18.65%) contributed the largest proportions of cost. High cost was associated with prolonged admission and delay in surgical procedure. Factors leading to prolonged admission were optimization of patients to meet laboratory targets, peri-operative availability of blood products, and operating room allotment care for diabetic foot patients is costly and highly variable. Policies to fast-track care may focus on allotment of blood products for optimization and peri-operative use as well as operating room availability. This study was limited only to direct costs and in-hospital care of patients with diabetic foot ulcers. Indirect costs were difficult to elucidate due to its inherent subjectivity per patient.

Keywords: Economic Impact, Treatment of Diabetic Foot Ulcers, Tertiary Government Hospital

1. INTRODUCTION

Diabetes Mellitus is a chronic disease showing increased incidence and prevalence worldwide. It expects a major impact among third-world countries including the Philippines [1]. In the Philippines, non-communicable diseases including those influenced by the presence of diabetes such as cardiovascular disease and chronic kidney disease are among the top causes of death with cardiovascular disease contributing about 31% of all deaths. Type 2 Diabetes Mellitus (T2DM) is the most common type of diabetes in the Philippines. Based on the 2014 prevalence estimates from the International Diabetes Federation (IDF), it is estimated that there are around 3.2 million cases of T2DM with a 5.9% prevalence rate in the Philippines [2]. The prevalence of micro vascular complications including foot problems (foot ulcers, amputation, or numbness/neuropathy), chronic renal disease, and retinopathy are much higher compared to macro vascular diabetic complications such as myocardial infarction or stroke [3]. Globally, the diabetic foot remains a major concern medically, socially, and

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economically in many countries. The term “diabetic foot” includes any foot lesion occurring because of diabetes and its complications including peripheral vascular disease. Diabetes remains a major cause for non-traumatic amputations reaching up to fifteen times higher than the general population [4]. Therefore, diabetic foot complications are a major health burden with substantial morbidity, mortality and economic costs. Outcomes of diabetic foot range from major amputations with rates as high as 56% in Southeast Asia to minor amputations and even mortality with rates as high as 11% [5]. Another important issue of diabetic foot ulcers is the relatively high rate of recurrence especially in the setting of peripheral vascular disease. Taken together, this specific complication of diabetes leads to a substantial utilization of healthcare resources [6]. From Saudi Arabia explored the economic impact of diabetic foot ulcers (DFU) on the healthcare system [7]. The estimated cost for DFU complicated by major amputation could reach up to 30,000.00 US dollars based on this study [8]. Specifically, Alshammary et al. described the different contributors to the increasing cost of managing DFU. They found out that 45.6% of the total cost was due to the overall hospital admission followed by requirement for wound debridement contributing about 14.5% of the total cost [9]. Around 10.4% of the cost was covered by antibiotics. In addition to this, the burden of recurrent DFU adds to the overall health expenditure as being admitted more than once for diabetic foot complications led to a higher mean total cost than patients who were admitted once. This is more so with patients requiring repeated wound debridement [10]. Locally, the burden of diabetic foot ulcer and consequent need for amputations is substantial given the high prevalence of diabetes among Filipinos. With this study, the goal was to examine the healthcare utilization costs for patients admitted for diabetic foot ulcers at a tertiary government hospital [11]. It also aimed to identify which components of the healthcare delivery contribute the most to the costs of treating this diabetic complication [12]. This can therefore help streamline healthcare delivery and provide the best medical management while minimizing costs and maximizing efficiency to benefit the greatest number of patients in need. Findings of this study may also be used as basis to encourage formulating institutional protocols in the handling of DFU cases [13].

2. MATERIALS & METHODS

This study is a retrospective review of records and hospital bills of patients admitted under the services of internal medicine, general surgery, and orthopedics with an impression of diabetic foot ulcer from the time period of January to June 2023. This time period was chosen as this was the period of transitioning between the pandemic and post-pandemic times with more policies for surgery becoming more lenient in COVID19 testing. Hospital expenses incurred during admission and hospital stay of patients were gathered from the hospital billing service. Total hospital expenses as well as itemization of component expenses were determined based on the following categories:

- Dietary, inclusive of nutritionals given to patients;
- Laboratories, including blood work ups and cultures collected from patients;
- Room rates, including ER stay, and ward or intensive care unit accommodations;
- Professional fees;
- Medications, including IV fluids, antibiotics, pressers, anticoagulants and antiplatelet, anti-hypertensive, and anti-hyperglycemic agents;
- Pulmonary services, including acid-base gas determinations, use of oxygen, high flow nasal cannula, or mechanical ventilation;
- Hospital supplies, including IV sets, cotton balls, syringes, dressings, etc.;
- Operating room procedures and supplies;
- Anesthesia and monitors used during surgeries;
- Post-anesthesia care;
- Ophthalmologic evaluation and procedures;

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- Rehabilitation;
- GI Endoscopy and ophthalmologic procedures.

This study was conducted at East Avenue Medical Center, of patients admitted under the services of internal medicine, general surgery, and orthopedics, who were managed for diabetic foot ulcers. Inpatient records were retrieved from the medical records office and hospital expenses were ascertained by the hospital billing service. Patients over a 6-month period from January to June 2023 were sampled. Sampling method involved cluster sampling with equal of patients sampled per month until sample size was reached. Converting this amount to Philippine Peso (1 USD = 3.75 SAR as stated in study, 1 USD = 56.66 PHP as of September 11, 2023), the computed standard deviation was 1,093,663.86 PHP. The sample size was calculated using the equation below:

$$n = \frac{(Z_{\alpha/2})^2 \sigma^2}{E^2}$$

Where n = sample size, σ = standard deviation of chosen population, E = margin of error, Z = 1.96 taken at significance level (α) of 0.05. Due to the high variability of costs of DM foot care from patient to patient, the margin of error was taken at 250,000 PHP. Substituting all above values, we calculated sample size as follows:

$$n = \frac{(1.96^2)(1{,}093{,}663.86^2)}{250{,}000^2} = 73.519$$

A sample size minimum of 74 would thus be adequate for data analyses. A sample of 124 patients were included in this study. Excess samples were taken to increase validity and to account for possible drop outs based on inclusion and exclusion criteria. Confidentiality and privacy was maintained by using random number generators in lieu of names and hospital numbers. Data gathering was done mainly via review of patient medical records. Patients admitted under internal medicine, orthopedics, or general surgery, with a chief complaint of lower extremity non-healing wounds assessed as diabetic foot ulcers were included in the study. Inclusion and exclusion criteria as previously outlined were applied. The hospital course of each patient was followed, along with total duration of hospital stay from admission to discharge or death, surgical plans, duration of days from admission to definitive surgery, and reasons causing delay of surgical procedures. Corresponding hospital expenses incurred per patient was determined from official receipts obtained from the hospital cashier. Indirect medical costs were not included as these were highly subjective per patient. Initial demographic data was taken to include age, sex, and comorbidities such as hypertension, dyslipidemia, peripheral vascular and coronary heart disease, and initial glycosylated hemoglobin (HbA1c). Data on peripheral vascular disease was judged present if there is clinical evidence of peripheral arterial disease and/or venous insufficiency. Similarly, coronary heart disease was present if a patient had clinical evidence of stable angina, prior or current MI, and/or ischemic cardiomyopathy causing heart failure. IBM SPSS Statistics 29.0.2.0 was used for statistical analyses. Discrete variables such were tested for normality using Shapiro-Wilk test. Variables with normal distribution were analyzed using means and standard deviations while non-normal variables were analyzed by median and interquartile ranges. Qualitative data were expressed as frequencies and percentages. Bivariate linear regression analysis was used to determine the relationship of number of hospital days to the total cost of admission per patient. Patients were divided into three (3) cost groups based on the Phil Health case rate for diabetes mellitus with gangrene/ulcer and average of total costs. One-way ANOVA and Kreskas-Wallis tests were used to determine factors associated with high cost. Significance level of 0.05 was used for statistical tests. Pearson correlation

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was used to determine associations between discrete variables. Chi square test was used to determine differences between categorical variables.

3. RESULTS & DISCUSSION

This study examined a total number of 124 patients admitted for diabetic foot ulcers in East Avenue Medical Center from January to June 2023. Each patient was taken as one sample regardless of number of admissions within the designated time. Table 1 shows the demographic data of the sampled population. The mean age was 58.42 (11.49) years comprising mostly males (57.26%). Only 21.77% of patients had acceptable HbA1c levels (≤ 7.5%) with median value of 8.57% which may indicate poor glycemic control in most of the sample. Hypertension (55.65%) and peripheral vascular disease (52.42%) were the identified most common comorbid conditions comprising more than half of sampled patients. Other comorbidities such as stroke, heart failure, coronary artery disease, and chronic kidney disease were identified among 8–33% of sampled patients and 19.35% requiring hemodialysis either as initiation or maintenance. Coronary artery disease was identified among 13.71% some of which expired and were signed out with acute myocardial infarction as the cause of death.

Table 01: Sociodemographic Data of the Study Population (n=124)

AGE	**Frequency**	**Percentage**
Range	30 – 92	
MEAN (STDEV)	58.42 (11.49)	
<40	7	5.65%
40-59	59	47.58%
>59	58	46.77%
SEX		
MALE	71	57.26%
FEMALE	53	42.74%
HbA1c		
Range	4.87 - 15.71	
Median (interquartile range)	8.57 (3.17 - 13.97)	
HbA1c <= 7.5	27	21.77%
HbA1c > 7.5%	84	67.74%
HYPERTENSION		
YES	69	55.65%
NO	55	44.35%
PERIPHERAL VASCULAR DISEASE		
YES	65	52.42%
NO	59	47.58%
STROKE		
YES	11	8.87%
NO	113	91.13%
HEART FAILURE		
YES	24	19.35%
NO	100	80.65%
CORONARY ARTERY DISEASE		
YES	17	13.71%
NO	107	86.29%
CHRONIC KIDNEY DISEASE		
YES	42	33.87%
NO	82	66.13%
HEMODIALYSIS		
YES	24	19.35%
NO	100	80.65%

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Table 02: Total Length of Hospital Stay, Outcomes, and Factors Causing Delay of Surgery

LENGTH OF HOSPITAL STAY	**Frequency**	**Percentage**
Range (Days)	3 – 98	
Median (interquartile range)	34.5 (21 - 56.75)	
NUMBER OF ADMISSIONS OF PATIENTS WITH DFU		
ONCE	121	97.58%
TWICE	2	1.61%
THREE OR MORE	1	0.81%
NUMBER OF DAYS TO AV DUPLEX SCAN		
N	73	58.90%
Range (Days)	0 – 40	
Median (interquartile range)	14.00 (10.00 - 19.00)	
NUMBER OF DAYS TO SURGERY		
N	72	54.80%
Range (Days)	1 – 87	
Median (interquartile range)	32.5 (19.25 - 48.75)	
NUMBER OF SURGICAL PROCEDURES DONE		
None	52	41.94%
One	64	51.61%
Two	7	5.65%
Three	1	0.81%
FACTORS CAUSING DELAY OF SURGERY		
Anemia correction (Hgb < 100mg/dL)	44	61.11%
Electrolyte correction	31	43.06%
Operating room slot	25	34.72%
Blood products for OR use	24	33.33%
Coagulation correction	10	13.89%
Perioperative event	5	6.94%
Delayed Clearances	4	5.56%
Quarantine (COVID positive)	2	2.78%
Evaluation and Treatment of TB	1	1.39%
INTENSIVE CARE UNIT ADMISSION		
YES	3	2.42%
NO	121	97.58%
Days in ICU	5 – 17	
PATIENT OUTCOMES		
Discharged Improved	73	58.87%
Discharged Against Medical Advice	26	20.97%
Expired	25	20.16%

Table 2 shows the course and length of hospital stay of patients, as well as outcomes, and factors causing delay of surgical procedures. The maximum length of hospital stay was 98 days with most patients having only one (1) admission (97.58%) and only three (3) patients being admitted more than once. Three (3) patients were admitted to the ICU due to respiratory failure or shock, only one (1) of whom survived and was discharged improved. Most patients (58.87%) were discharged improved, defined as having underwent surgical procedure with improvement of wound status, or resolution of infection circumventing need for surgical procedure. Twenty-six (26) patients were discharged against medical advice (20.97%) while twenty five (25) expired (20.16%). The most common reason for discharge against medical advice was refusal of contemplated surgery. Immediate causes of death were attributed to acute respiratory failure requiring mechanical ventilation or high flow nasal cannula, acute myocardial infarction, and shock attributed to sepsis or cardiac pump failure. Of the 124 patients, 72

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(54.8%) underwent surgical procedure for diabetic foot, most of whom underwent only one (1) procedure during admission. The median total hospital stay was determined to be 34.5 days (interquartile range 21-56.75) during which an arteriovenous duplex scan was done in a median of 14.00 days (interquartile range 10.0-19.0) and first surgery was performed in a median of 32.5 days (interquartile range 19.25-48.75). Major factors identified to cause delay were optimization of patients and preparations for surgery. Anemia correction to a target hemoglobin of 100mg/dL was most common (61.11%) as well as correction of electrolytes (43.06%), specifically serum sodium and potassium. Delays due to lack of preparedness included operating room unavailability (34.72%) and difficulty in securing blood products for surgery (33.33%).Table 3 shows the proportion of patients given certain treatments and services. For the entire study population (N=124), IV antibiotics were given to all patients with broad-spectrum coverage. Nutritionals from dietary service was provided to more than half (58.06%) of sampled patients. Surgical procedure was provided to 72 (58.06%) patients, with major amputation contributing to majority of cases. The ankle demarcates the type of amputation, with minor amputations comprising the toes and foot distal to the ankle, while major amputations comprise amputation above the ankle. Twenty three (23) patients with concomitant ESRD were provided with hemodialysis (18.55%). Invasive and non-invasive mechanical ventilation was provided to 26 patients who had a diagnosis of respiratory failure from various etiologies. Gastrointestinal endoscopy was provided to five (5) patients who had GI bleeding. Ophthalmologic evaluation and rehabilitation was provided only to a few patients (<5%). It was noted that revascularization procedures and pressure vacuum treatments were not provided.

Table 03: Treatment and Services Provided to Study Population (N=124)

DIETARY/NUTRITIONALS PROVIDED		
Yes	72	58.06%
No	52	41.94%
SURGICAL PROCEDURE		
NONE	52	41.94%
MAJOR	37	29.84%
ABOVE KNEE AMPUTATION	5	4.03%
BELOW KNEE AMPUTATION	32	25.81%
MINOR	35	28.23%
RAY AMPUTATION	20	16.13%
DEBRIDEMENT AND IRRIGATION	14	11.29%
TOTAL CONTACT CASTING	1	0.81%
HEMODIALYSIS/HEMOPERFUSION		
Yes	23	18.55%
No	101	81.45%
GI ENDOSCOPY		
Yes	5	4.03%
No	119	95.97%
OPHTHALMOLOGIC EVALUATION		
Yes	5	4.03%
No	119	95.97%
MECHANICAL VENTILATION / HIGH FLOW NASAL CANNULA		
Yes	26	20.97%
No	98	79.03%
REHABILITATION		
Yes	4	3.23%
No	120	96.77%

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Table 4 tabulates the overall costs of treating diabetic foot patients. The overall direct cost of treating 124 diabetic foot ulcers over a 6 month period in East Avenue Medical Center was 30,051,927.58 PHP with a mean cost of 242,354.25 PHP per patient. Figure 1 graphically depicts the proportion of each component expense. The top three (3) highest expenditures were laboratory diagnostics (30.80%), medications dispensed by the pharmacy (19.76%), and room and board (18.33%). The breakdown of expenses was influenced mainly by the designated "cost centers" of the hospital that charges patients on the needed supplies, rooms, procedures, medications, and diagnostics based on the orders of the handling physicians. The eye center (0.03%) and rehabilitation (0.03%) represented the lowest proportion of total expenses.

Table 04: Cost of Management of Diabetic Foot Ulcers

Component	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION	TOTAL	PERCENT OF OVERALL TOTAL
Professional fee	₱1,200.00	₱28,920.00	₱9,887.27	₱5,880.86	₱1,196,360.00	3.98
Room and board	₱400.00	₱137,700.00	₱45,196.77	₱31,301.94	₱5,604,400.00	18.65
Supplies	₱852.02	₱179,421.62	₱19,566.80	₱28,275.18	₱2,426,283.67	8.07
Radiology	₱550.00	₱47,225.75	₱5,346.45	₱7,159.24	₱657,613.25	2.19
Laboratory	₱3,440.00	₱277,668.21	₱75,936.02	₱50,611.85	₱9,416,066.81	31.33
Heart Station	₱400.00	₱13,400.00	₱6,037.23	₱2,691.20	₱567,500.00	1.89
Pulmonary	₱1,200.00	₱205,618.38	₱13,050.04	₱28,779.10	₱1,422,454.52	4.73
Eye Center (N=5)	₱2,600.00	₱5,655.28	₱2,833.54	₱1,412.49	₱20,361.03	0.07
Dietary (N=72)	₱120.00	₱54,570.00	₱6,618.17	₱8,931.62	₱476,508.00	1.59
Operating Room (N=72)	₱1,969.40	₱127,758.77	₱16,834.49	₱15,805.08	₱1,296,255.52	4.31
Anesthesia (N=42)	₱100.47	₱19,166.33	₱5,309.29	₱3,632.17	₱222,990.11	0.74
Post Anesthesia Care (N=34)	₱764.00	₱7,064.00	₱39,035.31	₱1,721.19	₱90,731.88	0.30
Pharmacy	₱1,648.57	₱309,057.67	₱48,715.74	₱55,332.52	₱6,040,751.14	20.10
Hemodialysis (N=23)	₱2,640.00	₱243,580.00	₱48,514.78	₱55,613.89	₱1,115,840.00	3.71
Rehabilitation (N=4)	₱1,050.00	₱3,500.00	₱2,537.50	₱1,191.20	₱10,150.00	0.03
GI Endoscopy (N=5)	₱1,479.12	₱2,899.86	₱1,831.71	₱603.12	₱9,158.57	0.03
Total Cost For All Patients (N=124)	₱19,898.50	₱1,029,253.50	**₱242,354.25**	₱188,581.58	**₱30,051,927.58**	100.00

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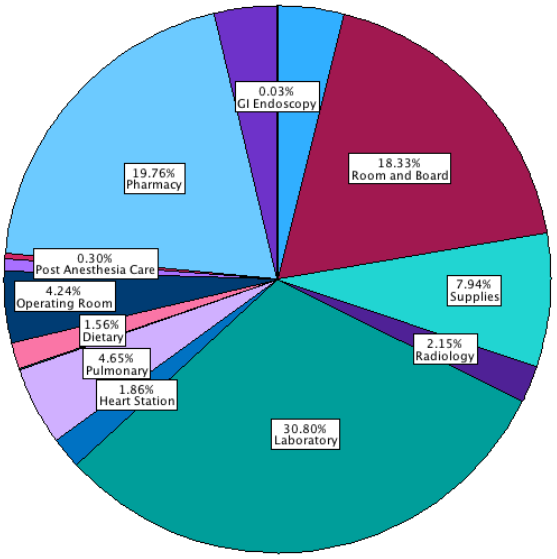

Figure 01: Breakdown of Component Expenses

Table 5 shows the statistical tests for cost of multiple admissions and types of surgery. The number of admissions was not associated with a significant difference in the mean cost per patient (p = 0.459) but this may be due to the low sample size of patients admitted more than once. The type of surgery had a significant difference (p = 0.019) with major operations having a higher cost compared to minor procedures. There was noted a positive correlation (r = 0.330, p < 0.001) between the number of surgeries and the total cost of treatment.

Table 05: Statistics of the Cost Per Admission and Surgery

	Cost (mean, stdev)	**N**	**P value**
NUMBER OF ADMISSIONS			0.459
Once	₱241,240.49 (189,387.27)	121	
Twice	₱227,148.60 (205,547.76)	2	
Thrice	--	1	
TYPE OF SURGERY			**0.019**
MAJOR	₱342,697.24 (222,784.06)	37	
MINOR	₱250,816.48 (184,059.64)	35	
NUMBER OF SURGERIES			**< 0.001**
0	₱165,260.63 (121,390.20)	52	
1	₱294,277.46 (219,525.56)	64	
2	₱327,849.16 (87,824.94)	7	
3	--	1	

Patients were divided into cost groups based on the Phil Health case rate and average total cost per patient as shown in Table 6. The Phil Health case rate was computed from the case rate given for patients with a diagnosis of diabetes mellitus with diabetic gangrene/ulcer (ICD E10.5, E11.5, E12.5, E13.5, E 14.5, 12,600.00 Php) and procedural case rate (ex. Most common RVS code 27880, 30,300.00 Php) with a sum of 42,900.00 Php. The average was taken from the mean total cost per patient (Table 4, 242,354.25 Php). From these two (2) amounts, the low cost, intermediate cost, and high cost groups were determined. The low cost group consisted of only 8 patients, none of whom underwent surgery. No significant difference was determined in the age and HbA1c among the 3 groups. An increased length of hospital stay was associated with the high cost groups (p < 0.001) and this was further demonstrated by the bivariate linear regression in Figure 2 that shows a positive relationship (R = 0.707,

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p > 0.001) between length of hospital stay with total cost per patient. Comorbidities were significantly different among groups in those with heart failure (p = 0.011), peripheral vascular disease (p = 0.003), coronary artery disease (p = 0.008), and patients requiring hemodialysis (p = 0.003). The type of surgery (p = 0.002) and the number of procedures (p < 0.001) was significantly different between groups but this may be skewed by the fact that no surgeries were performed among the low cost group. In terms of patient outcomes, the low cost group had the greatest proportion of patients discharged against medical advice (87.5%). The intermediate and high cost groups each had an estimated 60% proportion of patient who were discharge improved. The proportion of mortality was highest in the high cost group (30.43%).

Table 06: Univariate Analyses among Cost Groups

	Low Cost (≤ P42,600.00)	**Intermediate Cost** (P42,600 x ≤ P242,354.25)	**High Cost** (>242,354.25)	**P value**
N	8	70	46	
Age*	59.63 (11.06) (43 - 75)	55.99 (11.286) (31 - 92)	58.93 (10.827) (30 - 77)	0.316
Length of Stay**	6.5 (4.5 - 7.0)	28.5 (18.75 - 41.5)	59 (44.5 - 72.5)	**< 0.001**
HbA1c**	8.43 (7.2 - 10.25)	10.155 (7.54 - 12.68)	9.54 (7.78 - 12.06)	0.327
COMORBIDITIES				
Hypertension (Yes/No)	3 / 5 (37.5%)	41 / 29 (58.6%)	25 / 21 (54.3%)	0.511
Stroke (Yes/No)	1 / 7 (12.5%)	6 / 64 (8.6%)	4 / 42 (8.7%)	0.932
Heart Failure (Yes/No)	0 / 8	9 / 61 (12.9%)	15 / 31 (32.6%)	**0.011**
Peripheral Vascular Disease (Yes/No)	0 / 8	43 / 27 (61.4%)	22 / 24 (47.8%)	**0.003**
Coronary Artery Disease (Yes/No)	0 / 8	5 / 65 (7.1%)	12 / 34 (26.0%)	**0.008**
Chronic Kidney Disease (Yes/No)	2 / 6 (25%)	19 / 51 (27.1%)	21 / 25 (45.7%)	0.103
On Hemodialysis (Yes/No)	0 / 8	8 / 62 (11.4%)	16 / 30 (34.8%)	**0.003**
NUMBER OF ADMISSIONS				0.743
Once	8 (100%)	69 (98.57%)	44 (95.65%)	
Twice	0	1 (1.43%)	1 (2.17%)	
Thrice	0	0	1 (2.17%)	
TYPE OF SURGERY				**0.002**
Major	0	17 (24.29%)	20 (43.48%)	
Minor	0	22 (31.43%)	13 (28.26%)	
None	8 (100%)	31 (44.29%)	13 (28.26%)	
NUMBER OF PROCEDURES				**< 0.001**
None	8 (100%)	31 (44.29%)	13 (28.26%)	
One	0	38 (54.29%)	26 (56.52%)	
Two	0	1 (1.43%)	6 (13.04%)	
Three	0	0	1 (2.17%)	
PATIENT OUTCOMES				**< 0.001**
Discharged Improved	1 (12.5%)	44 (62.86%)	28 (60.87%)	
Discharged against medical advice	7 (87.5%)	15 (21.43%)	4 (8.70%)	
Expired	0	11 (15.71%)	14 (30.43%)	

*expressed as mean (standard deviation) (range)

**expressed as median (interquartile range)

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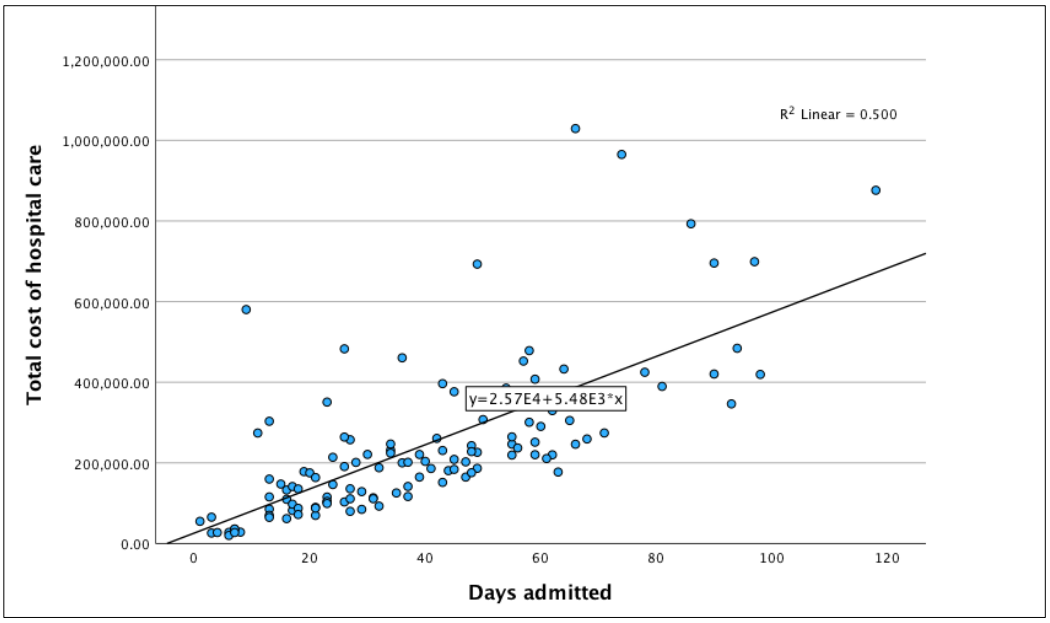

Figure 02: Scatter Plot and Linear Regression of Hospital Stay vs. Per Patient Total Cost

DISCUSSION

This study elucidated the direct medical cost of diabetic foot care requiring admission. The mean total cost per patient was approximately 240,000 Php (4,293.38 USD) and was highly variable (standard deviation 188,581.58 Php) depending on the length of stay, services rendered, and nature of procedure done on the patient [14]. In totality, the expenditure for care of 124 diabetic foot patients was as high as 30 million Philippine pesos (567,224.00 USD) for a span of six (6) months [15]. In a tertiary government healthcare institution such as East Avenue Medical Center, expenses are covered by the government through the Philippine Health Insurance Corporation (PhilHealth) through the case rates per disease and per procedure and through the Republic Act 10606 (National Health Insurance Act of 2013) enacting the "No Balance Billing Policy" [16]. This policy implements that "no other fees or expenses shall be charged or paid for by qualified patients above and beyond the packaged rates during their confinement period" [17]. This relieves the patient from out-of-pocket expenses, but the healthcare institution is responsible for accruing finances from available funds (PhilHealth Circular 2017-006). This applies only to direct medical costs while admitted as inpatient, and does not include indirect costs and basic necessities of patients and relatives not provided by the hospital [18]. The mean total cost per patient was 5.7 times the PhilHealth case rate, which implies that at present, the PhilHealth subsidy and allotment is inadequate to meet the cost of care for a patient admitted for diabetic foot ulcer [19]. This was further evidenced in the fact that none of the patients in the low cost group underwent surgery and their hospital stay was cut short due to their decision to be discharged prematurely. The most common reason for discharge against medical advice was refusal of contemplated surgery followed by transfer to another institution [20].Based on Table 2, the typical course of a patient admitted for diabetic foot ulcer was a 34 day hospital stay of medical treatment with antibiotics and optimization for surgery [21]. Patient optimization involved anemia correction through blood transfusions, as well as correction of deranged electrolytes and coagulation parameters. Specifically, optimization targets were defined with the following laboratory parameters: (1) hemoglobin ≥ 100, (2) serum sodium ≥ 130mEqs/L, (3) serum potassium ≥ 3.5, (4) prothrombin time international normalized ratio of around 1.00, and (5) prothrombin time percent activity ≥ 65%. At

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around the 14th hospital day, an arteriovenous duplex scan was done to evaluate for peripheral occlusion that would influence the extent and type of surgical procedure. Preparation for surgery involved operating room scheduling and supplying at least two (2) units of packed red blood cells for procedural use, especially for major surgeries. Surgery was performed at around the 32nd hospital day, followed by post-operative changes of dressing then eventual discharge. High cost was directly related to length of hospital stay (Figure 2) due to the accumulation of diagnostics and laboratories performed, medications and supplies provided daily room rates, and provision of other services. Prolonged hospitalization was due to delay in surgery resulting from stringent optimization parameters stated above, and inadequate preparation for surgery itself [22]. Most common causes of delay entailed the need for numerous blood transfusions to meet target hemoglobin and coagulation parameters. Availability of blood products was on a per replacement basis, in that blood products were granted to patients once able to provide donors to replenish products previously transfused. Electrolyte corrections contributed to costs due to treatments given and subsequent serial laboratory examinations. Schedules of surgeries were also limited to availability of operating rooms [23]. Procedures for diabetic foot may be bumped off for other more emergent procedures. This would lead to a further delay of 1-2 more days despite having optimized patients adequately. Blood products for surgical use may also be delayed due to lack of donors to replenish previous stores. Notable gaps in the care of patients with diabetic foot ulcers in East Avenue Medical Center was the lack of ophthalmologic evaluation and rehabilitation of post-operative patients. Evaluation for end-organ damage is an essential aspect of diabetes care [24], but referral to ophthalmology for baseline fundoscopy was done in only 4.03% of sampled patients. Post-surgical rehabilitation was also lacking with only 3.23% of patients referred for functional adaptation to manipulated limbs [25].

4. CONCLUSIONS

Based on the results of this study, the expenditure for care of patients with diabetic foot ulcers is costly and highly variable based on the duration of stay. Factors contributing to prolonged hospital stay include optimization of patients for OR to meet hemoglobin and electrolyte cut offs, availability of blood for peri-procedural use, and allocation of operating room slots. Additional observations included gaps in comprehensive diabetes care such as proper nutritionals from dietary service, ophthalmologic evaluation, and post-operative rehabilitation.

5. RECOMMENDATIONS

This study focused mainly on the direct expenses incurred by diabetic foot ulcer patients who were admitted inpatient. This does not include patients who followed up as outpatients. Indirect expenses were not included as these may be more subjective to each individual patient and more difficult to objectively quantify. The study was limited to the first half of the year 2023 as this reflected the post pandemic era wherein policies for swabbing for COVID19 prior to surgery was made more lenient. This study was conducted in East Avenue Medical Center, and prices were determined by the hospital's cashier service. Recommendations to fast-track care and surgery of patients with diabetic foot ulcer may focus on allotment of a dedicated operating room, modification of optimization parameters to less rigid targets, and less stringent requirements to obtain blood products for transfusion or surgical use. Hence, recommendations to further improve on this study may be (1) to continue further throughout the rest of the year or longer, (2) to follow patients prospectively to determine indirect costs such as transportation, clothing, food, and other outside expenses, and (3) to keep track of patients on their follow ups at the outpatient department.

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