



Direct Medical Costs of Diabetic Foot Management at Bouake University Teaching Hospital (Côte d'Ivoire)

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Abstract

Background: Diabetic foot is a major complication of diabetes and is associated with substantial healthcare expenditure, particularly when advanced lesions require surgery or amputation.

Objective: This study aimed to estimate the direct medical costs of diabetic foot management and to identify factors associated with these costs.

Materials and Methods: We conducted a descriptive and analytical cross-sectional observational study with prospective data collection from 1 January to 31 December 2024. The study included patients hospitalized for diabetic foot and managed in the Department of Trauma and Orthopaedic Surgery at Bouaké University Teaching Hospital. Sociodemographic, clinical, therapeutic, and economic data were collected. Direct medical costs were estimated from emergency and inpatient care. Multiple linear regression was used to identify factors associated with total direct medical costs.

Results: Thirty-four (34) patients were included. The mean age was 57.29 ± 11.93 years (range, 34-88 years); 13 patients (38%) were men and 21 (62%) were women. Mean blood glucose was 2.01 ± 1.04 g/L (range, 0.23-4.46), and mean glycated haemoglobin was $11.92 \pm 11\%$. Wagner grade 4 was present in 22 patients (65%) and grade 5 in 7 (21%). Minor amputation was performed in 5 patients (15%) and major amputation in 23 (67%). The mean total direct medical cost was 414,937 CFA francs (approximately US\$735.79). Emergency care accounted for 29% of total costs, whereas inpatient care accounted for 71%. Income above 100,000 CFA francs, Wagner grade 5, major surgery, anaesthetic package costs, and room charges were associated with higher direct medical costs; the model accounted for 82.9% of the observed variability.

Conclusion: Diabetic foot management imposes a substantial financial burden in this setting. The mean direct medical cost represented a considerable proportion of patients' available income, highlighting the importance of strengthening universal health coverage and improving early prevention and management of diabetic foot.

Keywords: Diabetic Foot; Direct Medical Costs; Health Economics; Amputation

Introduction

Diabetic foot is one of the most severe complications of diabetes mellitus [1]. It encompasses infection, ulceration, or destruction of deep tissues of the foot associated with diabetic neuropathy and/or peripheral arterial disease of the lower limb [2]. It is responsible for a substantial proportion (15-25%) of diabetes-related hospital admissions and is associated with high rates of lower-limb amputation, with major functional, socioeconomic, and psychological consequences [1]. The management of diabetic foot generates direct, indirect, and intangible costs [3]. These costs vary according to disease severity, treatment modality, duration of hospitalization, and the need for surgical intervention. In Mali, Traoré, *et al.* reported an average cost of 659,080 CFA francs (US\$1,169.16) for the management of diabetic wounds and diabetes, with higher costs for wounds with mixed components (1,083,500 CFA francs (US\$ 1,922.05) [4]. In Côte d'Ivoire, an economic evaluation conducted at Yopougon University Teaching Hospital reported mean direct medical costs of approximately 434,753 CFA francs (US\$771.22) [5].

Although data on diabetic foot management are available at Bouaké University Teaching Hospital, the associated direct medical costs have not previously been characterized [6]. This study therefore aimed to estimate the direct medical cost of diabetic foot management and to identify factors associated with increased expenditure.

Materials and Methods

Study design and setting

This descriptive and analytical cross-sectional observational study was conducted in the Department of Trauma and Orthopaedic Surgery at Bouaké University Teaching Hospital. Data were collected prospectively from 1 January to 31 December 2024.

Participants

The study included patients hospitalized and treated for diabetic foot during the study period. Patients who did not consent to participate, died during hospitalization, or were discharged against medical advice were excluded. Patients were recruited consecutively during the study period. Data were collected using a standardized questionnaire. The study complied with applicable ethical requirements. Patient anonymity and confidentiality were maintained, informed consent was obtained, and authorization

was granted by the hospital's scientific and medical authorities. Reporting was guided by the STROBE recommendations [7].

Study variables and cost assessment

The variables collected included age, sex, occupation, health insurance status, blood glucose, glycated haemoglobin, Wagner grade [8], treatment, complications, length of hospital stay, source of funding, monthly income, emergency care costs, hospitalization costs, and total direct medical costs.

The economic analysis focused primarily on direct medical costs. Emergency-care costs included admission fees, laboratory and imaging investigations, treatment, and medication. Hospitalization costs included hospitalization fees, the surgical kit when applicable, operating-room charges, pre- and postoperative investigations, and pre- and postoperative medication.

Costs were expressed in CFA francs. For presentation, the conversion used in the original dataset was US\$0.0018 per CFA franc.

Statistical analysis

Statistical analysis followed the SAMPL guidelines for reporting and reading statistical methods and analyses [9]. Statistical analyses were performed using Jamovi version 2.6.2. The Shapiro-Wilk test was used (5% margin of error and a 95% confidence interval [10]) to assess the distribution of quantitative variables. Quantitative variables were summarized as means and standard deviations, with ranges where appropriate; categorical variables were summarized as absolute and relative frequencies. Management costs were compared according to patients' income using Student's t-test after assessment of group homogeneity. Multiple linear regression was then used to identify factors associated with total direct medical costs. Candidate explanatory variables included lesion grade, sex, type of surgery, length of hospital stay, laboratory investigation costs, medication costs, anaesthetic package costs, operating-room rental costs, surgical kit costs, and room charges. Variables with $p \leq 0.05$ were considered statistically significant. Regression estimates were reported with 95% confidence intervals.

Results

Patients characteristics

A total of 34 patients were included. The mean age was 57.29 ± 11.93 years (range, 34-88 years). There were 13 men (38%) and

21 women (62%). Mean blood glucose was 2.01 ± 1.04 g/L (range, 0.23-4.46), and mean glycated haemoglobin was $11.92 \pm 11\%$ (range, 7.04-14.84).

Wagner grade 4 was observed in 22 patients (65%) and grade 5 in 7 (21%); grades 2 and 3 were observed in 3 (8%) and 2 patients (6%), respectively. Six patients (18%) underwent necrosectomy or incision and drainage, 5 (15%) underwent minor amputation, and 23 (67%) underwent major amputation. Three patients (8%) developed complications. The mean length of hospital stay was 11 ± 6 days (range, 2-22 days).

Economics characteristics and direct costs (US\$ 0.0018)

Eighteen patients (53%) reported a monthly income of $\leq 50,000$ CFA francs, 10 (29%) reported 51,000-100,000 CFA francs, 2 (6%) reported 101,000-200,000 CFA francs, and 4 (12%) reported 201,000-300,000 CFA francs. No patient reported an income above 300,000 CFA francs.

All patients received financial support from relatives. Twenty-four patients (71%) contributed directly to their care, while six (18%) had health insurance coverage. All patients received medical treatment, including analgesics, antibiotics, heparin therapy, antidiabetic medication, and dressings, both in the emergency department and during hospitalization.

The mean cost of emergency care was 118,769 CFA francs, representing 29% of the total direct medical cost. The mean

hospitalization cost was 296,168 CFA francs, representing 71%. The mean total direct medical cost was 414,937 CFA francs, with a range of 141,600-844,550 CFA francs.

Within emergency care, medications represented 38% of expenditure, laboratory investigations 28%, and imaging 30%. During hospitalization, surgical procedures accounted for 47% of expenditure, pre- and postoperative medication for 35%, and room charges for 15%.

Factors associated with direct medical costs (US\$ 0.0018)

Patients with a monthly income above 100,000 CFA francs had higher management costs than those with an income below this threshold (Table I). In the multiple linear regression model, income above 100,000 CFA francs, Wagner grade 5, major surgery, the anaesthetic package cost, and room charges were significant factors associated with higher direct medical costs (Table II). Together, the identified factors accounted for 82.9% of the variability in total direct medical costs.

Variables	Test	Statistic	d	p
< 100000	Student's t-test	3.576	32.0	0.999
>100,000	Student's t	3.635	32.0	0.001

Table I: Treatment costs comparison with income.

			95% confidence interval		
Predictors	Estimate	Standard error	Min	Max	p
Income					
< 100,000 CFA francs	0.900	0.605	0.3775	2.177	0.156
>100,000 CFA francs	0.277	0.102	0.0627	0.492	0.014
Wagner score:					
Grade 3	-194727.597	79,008.448	-361,420.8501	-28,034.343	0.365
Grade 4	-141141.841	78898.795	-307,603.7477	-25,320.066	0.091
Grade 5	79,355.832	76772.553	241,331.7610	82,620.097	0.025
Gender:					
M - F	45920.612	31,967.712	21,525.3645	113,366.589	0.169
Type of surgery:					
Minor - Major	108356.602	38,743.160	190,097.5241	26,615.680	0.012

Stay < 7 days - >7 days	-2,206.422	2,430.368	-7,334.0500	-2,921,206	0.377
Cost of biological balance sheets	-2,935	1,761	-6,649.8	0.779	0.114
Ticket price	-26,094	14.845	-57,4138	5,225	0.097
Cost of medicines	1,084	0.549	-0.0740	2.241	0.065
Fixed cost of anaesthesia	41,442	19.123	1.0960	81.788	0.045
Operating theatre rental cost	461,113	287,655	-145,786.5	1,068,013	0.127
Cost of surgical kit	103,508	63,595	-30,6659	237,681	0.122
Cost of accommodation	2,358	0.495	1,3142	3,401	0.000
Cost of surgical procedure	-93,738	59,338	-218,9309	31,454	0.133

Table II: Factors influencing the overall direct medical costs of treatment.

The estimated additional amount required relative to income was 89,118 CFA francs (US\$158.09) for patients with an income below 100,000 CFA francs and 432,787 CFA francs (US\$767.73) for those with an income above 100,000 CFA francs.

Discussion

This study estimated the direct medical cost of diabetic foot management at Bouaké University Teaching Hospital and identified the principal factors associated with increased expenditure. The mean total direct medical cost was 414,937 CFA francs (approximately US\$735.79), with inpatient care accounting for the largest share of expenditure.

Emergency care accounted for 29% of total direct costs, mainly because of medication and imaging expenses. This high expenditure may reflect the advanced stage at which many patients present. In this series, Wagner grades 4 and 5 accounted for 86% of cases, and major amputation was required in 67% of patients. Advanced disease commonly requires stabilization, assessment of limb viability, management of infection and metabolic complications, and extensive diagnostic investigations.

Hospitalization accounted for 71% of total direct costs. Surgical procedures and pre- and postoperative medications were the main contributors. The predominance of major amputations in this cohort likely contributed substantially to the overall expenditure and illustrates the economic consequences of late presentation.

The mean cost observed in this study was broadly comparable to that reported in Côte d'Ivoire by Abrogoua, *et al.* [5], who reported a cost of approximately 443,043 CFA francs (US\$785.93).

It was lower than the 659,080 CFA francs (US\$1,169.16) reported by Traoré, *et al.* [5] in Mali. Ongoth, *et al.* [11] reported a mean cost of 519,461 ± 100,000 CFA francs in Brazzaville, increasing when surgery was required. International studies have reported considerably higher costs, particularly when major amputation is necessary [4,5,11].

The association between Wagner grade 5 and higher costs is clinically plausible because advanced lesions require more complex treatment and are more likely to require major surgery. Similarly, the association with major surgery, anaesthetic package costs, and room charges reflects the direct resource requirements of more complex hospital management.

The financial burden is particularly important in this population because more than half of the patients reported a monthly income of ≤50,000 CFA francs. Consequently, even the mean cost of care represents a substantial economic burden for households. Strengthening early detection, glycaemic control, foot-care education, multidisciplinary management, and access to affordable treatment may help reduce both clinical complications and healthcare expenditure [4,5,11-13].

This study has several limitations. Its cross-sectional design and single-centre setting limit the generalizability of the findings. The sample size was small, and indirect and intangible costs were not included in the main economic analysis. The estimates should therefore be interpreted as direct medical costs incurred within the hospital rather than as the complete societal cost of diabetic foot.

Despite these limitations, the study provides locally relevant economic data from a university hospital in Côte d'Ivoire and highlights the substantial financial burden associated with advanced diabetic foot disease.

Conclusion

The mean direct medical cost of diabetic foot management at Bouaké University Teaching Hospital was approximately 414,937 CFA francs (US\$735.79). Advanced Wagner grade, major surgery, anaesthetic costs, and room charges were associated with increased expenditure. These findings underscore the economic burden of diabetic foot in a population with limited financial resources and support efforts to strengthen universal health coverage, early detection, prevention, and coordinated management of diabetic foot in Côte d'Ivoire.

Conflicts of Interest

None.

Funding

None.

Use of Artificial Intelligence

None.

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