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Original Research Article

Factors Influencing Outcomes of Diabetic Foot Management: Retrospective Study at Mwananyamala Regional Referral Hospital

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Abstract: ***Background*:** Diabetic foot ulcers (DFUs) contribute to significant morbidity and mortality worldwide, with the global prevalence of diabetes expected to rise to 12.2% by 2045, an increasing number of people are at risk for complications like DFUs, which affect 19% to 34% of diabetic patients. People with DFUs carry a 20% lifetime risk of limb amputation and mortality rate of 50% to 70%. In Tanzania DFUs account for 41.9% of major limb amputations and mortality rate of 54%. ***Methods*:** A retrospective observational study aimed to investigate the clinical factors, and treatment modalities that influence the management outcomes of diabetic foot among patients attending Mwananyamala Regional Referral Hospital (MRRH). The study reviewed existing patient records. ***Results*:** A total of 143 participants were enrolled in the study, of which 94 (65.73%) were female. The participants had a mean age of 57 ± 13.9 years. And approximately half (50.35%) were married. Nearly, all patients, 140 (97.90%), underwent surgical treatment, nearly half (41.96%) had DFU Wagner Class 3 while most of participants (69.93%) had hypertension. The mean hospital stay was 9.2 days. In binary logistic regression model output, marital status, level of education, working diagnosis, surgical management, patient progress and number of readmissions were identified as determinants of the outcome (P-value < 0.05). ***Conclusion*:** This study identified key factors influencing diabetic foot outcomes, including gender, marital status, co-morbidities and ulcer grade. These findings underscore the importance of early diagnosis, targeted interventions, and comprehensive management to improve patient outcomes.

Keywords: Diabetic Foot Ulcer (DFU), Ulcer Management Outcomes, Co-Morbidities in Diabetes, Limb Salvage, Ulcer Grade, Amputation Risk.

INTRODUCTION

Background

Diabetic foot, a complication primarily marked by infection, ulceration, or tissue destruction in individuals with diabetes, poses a substantial ongoing public health concern (van Netten *et al*., 2020). The pathophysiology often involves neuropathy and peripheral artery disease (PAD), affecting the lower extremities (Atinafu *et al*., 2022). The prevalence of diabetes worldwide has risen significantly, from 10.5% (536 million people) in 2021 to a projected 12.2% (783.2 million people) by 2045 (Sun *et al*., 2022). A considerable number of people with diabetes remain undiagnosed, placing them at heightened risk for severe complications, including diabetic foot ulcers (Saeedi *et al*., 2019).

The lifetime risk of developing a DFU in diabetic patients ranges from 19% to 34%, making it one of the most common and dangerous complications of diabetes. The recurrence rate for DFUs is high, with a staggering 65% of patients experiencing a recurrence within three to five years (Edmonds *et al*., 2021). Furthermore, 20% of individuals with DFUs face a lifetime risk of lower-extremity amputation, and the five-year mortality rate for individuals with a DFU ranges from 50% to 70% (Armstrong *et al*., 2023).

Tanzania, like many resource-limited countries, faces immense challenge in managing diabetes and its complications, including DFUs. The healthcare system is burdened by the limited resources, insufficient healthcare provider knowledge, and poor patient compliance. Essential medications, such as insulin and metformin, are often in short supply, complicating

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diabetes management (Chillo *et al*., 2024). Studies in Tanzania have shown that poor glycemic control is a leading factor in the progression of DFUs, often resulting in amputation (Shabhay *et al.*, 2021). Cultural practices, such as dietary habits and traditional medicine use, further hinder diabetes care and prevention efforts. In developed countries, DFU management strategies include advanced pharmacological treatments, wound care, and revascularization, whereas in Tanzania, treatment approaches are limited, contributing to higher amputation rates and prolonged hospital stays(Chalya *et al*., 2011; Hellar & Mbembati, 2011).

Problem Definition

Diabetic foot ulcers (DFUs) are a major complication of diabetes, contributing to significant morbidity and mortality worldwide, with an estimated 18.6 million individuals affected annually(Armstrong *et al.*, 2023). In Sub-Saharan Africa, the situation is dire, with a 13% prevalence of DFUs, major amputations in 15% of cases, and a mortality rate of 14.2% among hospitalized patients (Rigato *et al*., 2018). Tanzania, in particular, faces a severe burden with DFUs accounting for 41.9% of major limb amputations and a mortality rate reaching up to 54% in untreated cases (Chalya *et al*., 2012; Gulam-Abbas *et al*., 2002). Despite ongoing efforts to improve diabetes care, the prevalence of advanced-grade DFUs and associated amputations remains high. This situation is compounded by the limited healthcare resources in Tanzania, which restrict access to essential care such as revascularization procedures, specialized wound management and effective pharmacological interventions (Hellar & Mbembati, 2011).

There is a need to understand the specific factors contributing to poor outcomes in the management of diabetic foot complications in Tanzania. Factors like neuropathy, PAD, ulcer severity, and delays in seeking medical care play a crucial role in determining patients outcomes (Gershater *et al.*, 2009; Ugwu *et al*., 2019). A comprehensive analysis of these factors within the Tanzania healthcare context can provide critical insights into improving treatment strategies and reducing the burden of DFUs. Therefore, this study aims to examine the factors affecting the outcomes of diabetic foot management among patients at Mwananyamala Regional Referral Hospital in Dar es Salaam, Tanzania.

Literature Survey

Introduction

A diabetic foot involves infection, ulceration, or tissue destruction in the foot of someone with diabetes, typically accompanied by neuropathy and/or peripheral artery disease in the lower extremity (van Netten *et al*., 2020). The global diabetes prevalence in 2021 was estimated to be 10.5% (536.6 million) and 12.2% (783.2 million) by 2045(Sun *et al*., 2022). Alarmingly, one in two (50.1%) people living with diabetes are unaware of their condition. Additionally, the global prevalence of impaired glucose tolerance, a precursor of diabetes, was estimated to be 7.5% (375 million) in 2019, with projections indicating an increase to 8.0% (454 million) by 2030 and 8.6% (548 million) by 2045 (Saeedi *et al*., 2019). These numbers underscore the growing burden of diabetes worldwide, which in turn heightens the risk of complications such as DFUs (Dunachie & Chamnan, 2019).

The lifetime risk of developing a foot ulcer in individuals with diabetes is alarming high, ranging from 19% to 34%. This risk is exacerbated by increased longevity and the growing medical complexity of the diabetic complication. Once DFU occurs, the chances of recurrence are substantial, with the rates reaching 65% within 3-5 years. Furthermore, the lifetime incidence of lower-extremity amputation following a DFU is around 20%, and the 5-year mortality rate can be as high as 50-70%. Notably, recent data indicate that amputation rates, after a period of decline, have surged by up to 50% in some regions, particularly affecting younger individuals and racial; ethnic minorities (Edmonds *et al*., 2021), (McDermott *et al*., 2023), (Armstrong *et al*., 2023).

The detrimental impact of DFUs on overall health status and quality of life is well documented (Edmonds *et al*., 2021). Patients with DFUs often report poor quality of life, especially in terms of physical functioning. Persistent ulcers, major amputations, and limited mobility contribute to a significant decline in quality of life for both patients and their caregivers. Conversely, healing, including after minor amputation, is associated with a marked improvement in self-reported physical functioning, with individuals who have healed DFUs reporting a quality of life nearly comparable to those without diabetes (Rathnayake *et al*., 2020).

Demographic and Clinical Factors of Diabetic Foot

Globally, several demographic and clinical factors have been linked to the development and progression of diabetic foot ulcers (DFUs), as demonstrated by studies conducted across various countries. In a Swedish study by Gershater *et al*., (2009), revealed that primary healing of DFUs was significantly related to comorbidities, diabetes duration, peripheral vascular disease, and the type of ulcer. In neuropathic ulcers, the depth of foot infection, the site if ulcer, and the number of comorbidities were closely linked to the probability of amputation. How ever, age, sex, diabetes duration, neuropathy, foot deformity, and ulcer site were not shown to significantly influence the risk of amputation in this cohort (Gershater *et al*., 2009).

The development of diabetic foot ulcers (DFUs) in Africa is influenced by a range of demographic and clinical factors. In Nigeria, a study by Ugwu *et al*., (2019) followed 119 subjects, 35.4% of whom underwent lower-extremity amputation (LEA) during the study period. The key predictors of LEA included an ulcer duration of more than one month prior to

hospitalization, peripheral artery disease (PAD), Wagner grade ≥4, wound infections, proteinuria, leukocytosis, and osteomyelitis. Three independent predictors of LEA emerged: ulcer duration of more than one month, PAD, and the presence of osteomyelitis. Interestingly, factors like age, gender, diabetes type and duration, neuropathy, glycemic control, and anemia did not predict LEA in this population, indicating a strong association between the duration and severity of DFU with LEA (Ugwu *et al*., 2019).

Several studies in Tanzania highlight several demographic and clinical factors significantly associated with the development of diabetic foot ulcers (DFUs) among patients with Type 2 diabetes (T2DM). In a study by Shabhay *et al*., (2021) investigated a cohort of 60 diabetic patients, of whom 98.33% had T2DM. The study found that half of the patients (56.67%) had diabetes for more than five years, and 70% of the population had poor glycemic control (random blood glucose level above 10.0 mmol/L). Poor glycemic control was associated with severe outcomes, as 54.76% of these patients underwent major limb amputations, making up 74.19% of the total amputations. The study revealed that more advanced DFU stages (Meggitt-Wagner classification grade 3) resulted in higher rates of amputation with 60.71% of those patients requiring major limb removal *(Shabhay et al*., 2021).

Management of Diabetic Foot

Effective management of diabetic foot ulcers (DFUs) hinges on several key strategies, with approaches varying significantly between developed and resource limited settings. Proper management involves controlling glycemia, infection, and peripheral vascular issues, alongside regular debridement and offloading (Akkus & Sert, 2022).

Glycemic Control

In both developed and developing contexts, glycemic control is foundational to the prevention and management of diabetic foot complications. Several studies underscore the importance of tight glycemic control in delaying the progression of complications such as diabetic retinopathy, nephropathy, and neuropathy. Intensive glycemic control has been shown to delay the inset of diabetic peripheral neuropathy, especially in patients with type 1 diabetes. However, tight control must be accompanied by cautious monitoring to avoid episodes of hypoglycemia, which can be a significant concern in both developed and resource-limited setting (Frykberg & Banks, 2016; Lim *et al.*, 2017).

Pharmacological Therapy

Pharmacological interventions play a critical role in managing DFUs, especially in addressing neuropathic pain and preventing further complications. In developed countries, patient education and improved diabetes knowledge have been linked to better adherence to medications, improving glycemic control (Lim *et al*., 2017). First-line agents like duloxetine and pregabalin have been recommended for managing diabetic neuropathy and related pain. Additionally, reducing atherosclerotic risk factors through smoking cessation, the use of statins, and antiplatelet medications is essential in preventing the progression of peripheral vascular disease (Frykberg & Banks, 2016). In resource-limited settings, however, access to these pharmacological agents may be constrained. Studies from Tanzania have been shown to indicate that polymicrobial infections, particularly with resistant strains like *staphylococcus aureus*, pose significant challenges. Antibiotics such as meropenem and imipenem have shown effectiveness, but their high-cost limits widespread use (Hellar & Mbembati, 2011).

Revascularization and Vascular Health

Improving vascularization of ischemic limbs through revascularization procedures can significantly reduce the amputation rate in diabetic patients (Setacci *et al*., 2020). This procedure, which is more accessible in developed countries, enhances perfusion and promotes healing in critically ischemic legs (Amin & Doupis, 2016). However, in resource-limited settings like Tanzania, revascularization is often not readily available, contributing to higher amputation rates (Hellar & Mbembati, 2011). Chalya *et al.*, (2011) reported that over 56% of DFU cases in northern Tanzania, required lower-limb amputations, with surgical site infections being a major complication (Chalya *et al.*, 2011).

Debridement and Wound Management

Debridement is a cornerstone in the treatment of diabetic foot ulcers in both developed and resource-limited settings. Regular debridement removes necrotic tissue, reducing the risk of infection and promoting wound healing (Setacci *et al.*, 2020). In developed countries, this process is supported by advanced techniques and specialized teams, leading to better outcomes (Roberts *et al.*, 2024). Studies from Tanzania emphasize the need for timely and aggressive debridement, especially in cases where ulcers have progressed to Wagner Grade 4 or 5 (Hellar & Mbembati, 2011).

Wound dressing, including moist and silver-impregnated dressing, offer protection and absorb exudate. While there is limited evidence supporting the superiority of any particularly dressing type (Lim *et al*., 2017), proper dressing techniques are crucial (Amin & Doupis, 2016). In developed settings, more advanced wound care options, including negative pressure wound therapy, have shown promise, though studies suggest no significant difference in healing times compared to standard care (Roberts *et al.*, 2024).

Offloading strategies aim to reduce pressure on ulcerated areas of the foot, promoting healing. In developed countries, devices such as total contact casts, orthotic devices, and custom-fabricated shoes have been

used to redistribute weight and relieve pressure on the foot (Lim *et al*., 2017). Studies support the effectiveness of these strategies in reducing ulceration and preventing amputations (Frykberg & Banks, 2016), (Akkus & Sert, 2022). In resource-limited settings, offloading devices may not be as readily available, but the concept of offloading through locally fabricated footwear could still prove beneficial.

Multidisciplinary Team Approach

The importance of a multidisciplinary team in managing diabetic foot ulcers cannot be overstated. In developed countries, teams typically consists of diabetologist, podiatrists, surgeons, and microbiologists who coordinate care to reduce amputation rates and improve patient outcomes (Huang *et al.*, 2014). Studies have shown that specialist teams can optimize glycemic control. Address vascular issues, and manage infections more effectively, resulting in lower morbidity (Barshes *et al*., 2013; Wang *et al*., 2020).

In resource-limited settings, however, the lack of specialized personnel and resources complicates care. Abbas (2017) noted that limited government funding, a lack of trained professionals, and the absence of podiatry services contribute to the poor outcomes in managing DFUs. Educational programs like Step-by-step foot care program, which was introduced in Tanzania and India, have demonstrated success in providing essential knowledge to health care workers and patients. The program emphasizes prevention, education, and early management of diabetic foot ulcers, and has led to reductions in morbidity and mortality *(Abbas, 2017; Das et al*., 2020), (Abbas, 2020).

Challenges in Resource-Limited Settings

Resource-limited settings face unique challenges in managing DFUs, including a lack of awareness among patients and healthcare providers, inadequate podiatry services, and delayed access to care. Hellar and Mbembati (2011) highlighted that in Tanzania, major amputations were performed in nearly 45% of DFU patients, often due to late-stage ulcers. Addressing these challenges through cost effective educational efforts and training for healthcare providers is critical for improving outcomes (Abbas, 2017).

Purpose

Diabetic foot is a severe complication of diabetes mellitus, often leading to significant morbidity, including chronic infections, amputations and even death. The burden of the diabetic foot complications is particularly high in low- and middle-income countries, where the access to specialized care and early intervention is often limited. Mwananyamala Regional Referral Hospital, serving a large population in Dar es Salaam, Tanzania, encounters numerous cases of diabetic foot each year.

Understanding the factors that influence the outcome of diabetic foot management is essential for enhancing patient outcomes. This study aims to identify the key clinical determinants that contribute to both positive and negative outcomes in diabetic foot management. The findings will offer valuable insights to inform clinical practice, guide resource allocation, and ultimately improve the quality of care for patients with diabetic foot in our setting.

Conducting this retrospective observational study on existing patients' data allows for an in-depth analysis of real-world outcomes and the factors influencing them. The knowledge gained from this study will contribute to the broader understanding of diabetic foot management in resource-limited settings and help develop targeted interventions to reduce the burden of this complication among diabetic patients in Tanzania.

EXPERIMENTAL SECTION

Study Design

A retrospective observational study investigated the clinical factors, and treatment modalities that influence the management outcomes of diabetic foot among patients attending Mwananyamala Regional Referral Hospital (MRRH). The study reviewed existing patient records from July 1st, 2023 to June 30th, 2024.

Study Population

The study recruited diabetic patients that attended the surgical department at Mwananyamala Regional Referral Hospital between July 1st, 2023 and June 30th, 2024.

Inclusion Criteria:

- All patients diagnosed with diabetic foot
- Patients who received treatment for diabetic foot at Mwananyamala Regional Referral Hospital within the study period
- Complete medical records, including demographic information, clinical data, treatment details and follow-up outcomes

Exclusion Criteria:

- Patients with incomplete medical records.
- Patients who were treated for diabetic foot but whose records are missing key data points relevant to study.

Sampling Method

This study employed consecutive sampling method to recruit participants from existing patient data in the AFYA CARE patient database system; that were attended at the surgical department at Mwananyamala Regional Referral Hospital from July 1st, 2023 to June 30th, 2024.

Sample Size

Sample size was estimated using the Scalex SP 1.0.01 calculator (Naing *et al*., 2022). And the estimated sample size was found to be 158 participants(Abdissa *et al*., 2020).

Data Sources

Data was collected from AFYA CARE patient database from Mwananyamala Regional Referral Regional Hospital spanning from 1st July 2023 to 30th June 2024.

Data Extraction and Management

Data was extracted by trained researchers and in collaboration with ICT officers and medical records team from MRRH using Data Grip v2020.1. Quality control measures including double checking a random sample of records and resolving discrepancies were undertaken to ensure the accuracy of data that was collected. Data was reviewed for completeness and accuracy. Inconsistencies or missing data was addressed through consultation with medical records team and exclusion of some data was done.

Ethical Considerations

Approval for conduction of the study was provided by Hubert Kairuki Memorial University ethics board (HKMU) and patient names were not included in the extracted data to ensure anonymity and confidentiality of the patient data. Data was safely and secured stored and was used solely for the purpose of this study.

Data Analysis

Descriptive Analysis:

- Summary statistics for demographic and clinical characteristics of the study population.
- Distribution of treatment modalities and outcomes

Inferential Analysis:

- Univariate Analysis- We used chi-square tests (for categorical variables) and t-tests to identify factors associated with diabetic foot outcomes.
- Multivariate Analysis: Logistic regression to determine independent predictors of poor outcomes (i.e., amputation, death), we paid more attention on variables that were significant in univariate analysis at p-value <0.05.
- Outcome measures: The primary outcome was success rate (limb salvage without major complication). Secondary outcome included incidence of major complication and mortality rate.
- Study variables
- Demographic information: Age, Gender, Education level, Marital status
- Clinical factors: Co-morbidities, type and grading of Diabetic foot
- Treatment details: Type of treatment received (surgery, wound care, antibiotics), duration of hospital stay, other supportive treatment offered

Timeline

- Data collection: 1 months
- Data analysis: 1 months
- Report writing: 1 months

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of the Participants

A total of 143 participants were enrolled in the study, of which 94 (65.73%) were female. The participants' ages ranged from 2 to 103 years, with a mean age of 57 ± 13.9 years. The most affected age group was 41-59 years, with 77 participants (53.85%), followed by the 60-78 age group, which included 39 participants (27.27%). The majority of participants, 80 (55.94%) were from Kinondoni district. Additionally, 48 participants (33.57%) had a primary school education, and approximately half (50.35%) were married.

Table 1: Shows the demographic characteristics of the participants

Variable	Category	Frequency	Percentage (%)
Age group	22-40	15	10.49
	41-59	77	53.85
	60-78	39	27.27
	79-97	11	7.69
	98-116	1	0.70
Sex	Male	49	34.27
	Female	94	65.73
Residence	Kinondoni	80	55.94
	Ubungo	35	24.48
	Ilala	14	9.79
	Temeke	9	6.29
	Kigamboni	5	3.50
Marital status	Single	5	3.5
	Married	72	50.35

Variable	Category	Frequency	Percentage (%)
	Others*	66	46.16
Education level	None	41	28.67
	Primary school	48	33.57
	Secondary school	41	28.67
	College	18	9.09
*Widow, divorced			

Management patterns of DFU

The management approaches included conservative management, medical management to compliment surgical intervention, and surgical management, depending on the working diagnosis at the time of admission. Nearly, all patients, 140 (97.90%), underwent surgical treatment. Among them, the majority, 73 (51.05%), were managed with insulin injections, nearly half (41.96%) had DFU Wagner Class 3 while most of participants (69.93%) had hypertension. The mean hospital stay was 9.2 days and most of participants (76.22%) were not readmitted.

Table 2: Shows the management patterns of patients with DFUs at MRRH

Variable	Category	Frequency	Percentage (%)
Working diagnosis	Cellulitis	5	3.50
	DFU 2	4	2.80
	DFU 3	60	41.96
	DFU 4	55	38.46
	DFU 5	19	13.29
Surgical management	Conservative	3	2.10
	Sloughectomy	66	46.15
	Amputation	26	18.18
	Disarticulation	48	33.37
Other managements	None glycemic	21	14.61
	Oral hypoglycemic(s)	49	34.27
	Insulin	73	51.05
Co-morbidities	None	28	19.58
	HIV/AIDS	25	10.49
	Hypertension	100	69.93
Length of hospital stay(days)	< 7	60	41.96
	7-14	63	44.06
	15-21	16	11.19
	22-28	4	2.80
Readmitted	Yes	34	23.78
	No	109	76.22

Outcome of the Management

The management outcomes were categorized into limb salvage, amputation, disarticulation, and death. The majority of participants (58.74%) experienced limb salvage (Figure 1).

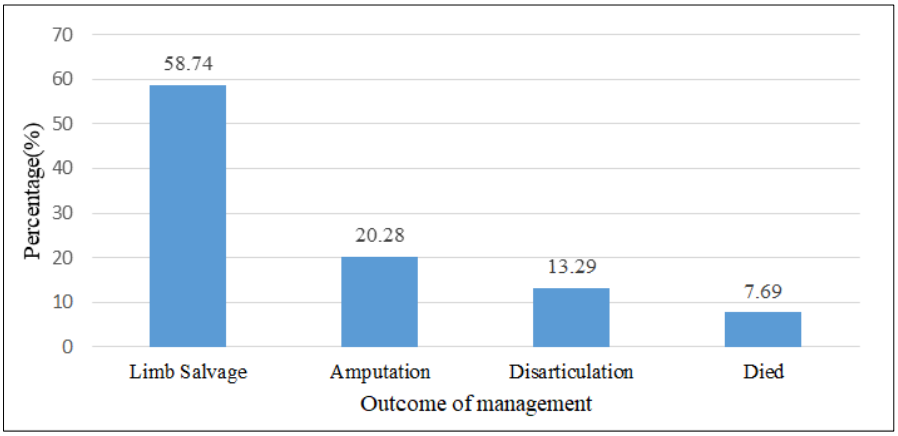

Figure 1: The chart shows management outcomes of the participants

Factors Associated with the Outcome of the Management

In binary logistic regression model output, marital status, level of education, working diagnosis, surgical management, patient progress and number of readmissions were identified as determinants of the outcome (P-value < 0.05) (Table 3 & 4)

Participants who were single had lower risk of poor outcomes (P=0.015, crude OR = 0.25) compared to those who were married and widowed. Interestingly, higher levels of education did not correspond to better outcomes (limb salvage) as participants with no formal education were three times more likely to achieve limb salvage compared to those with college education, who had equal chances of either outcome.

Patients diagnosed with DFU grade 4 were eight times more likely to have poor outcomes compared to those with cellulitis, who were less likely to have poor outcomes (P=0.020, crude OR= 0.35). Those who were managed through surgical approaches had a significantly higher likelihood of poor outcomes such as amputation (P=0.046, crude OR=15.33) and disarticulation (P=0.042, crude OR=0.64), compared to those receiving conservative management (P=0.2, crude OR=0.64).

Participants who were discharged had a 48-fold likelihood of good outcomes (P=0.000, crude OR=48.13) compared to those who were referred, who had equal chances of either outcome (crude OR=1). Additionally, participants who were not readmitted were 2.83 times more likely to experience good outcome compared to those who were readmitted (P=0.000, crude OR=2.83).

Table 3: Shows univariate regression analysis for factors influencing the outcome of diabetic foot management

Variable	Outcome				
	Others (%)	Limb Salvage (%)	Crude OR	95% CI	P-value
					Age group(years)
22-40	4(26.67)	11(73.33)	0.55	0.266-1.124	0.101
41-59	26(33.17)	51(66.23)	2.68	0.227-31.583	0.434
60-77	21(53.85)	18(46.15)	0.33	0.037-2.910	0.316
78-97	7(63.64)	4(36.36)	0.71	0.040-12.829	0.819
98-116	1(100.00)	0(0.00)	1		
					Sex
Male	25(51.02)	24(48.98)	0..402	0.083-1.938	0.256
Female	34(36.17)	60(63.83)	0.402	0.083-1.938	0.256
					Residence
Kinondoni	27(45.76)	32(54.24)	1.28	0.622-2.651	0.498
Temeke	18(40.00)	27(60.00)	0.74	0.201-2.732	0.652
Ilala	10(29.41)	24(70.59)	1		
Ubungo	3(100.00)	0(0.00)	0.19	0.014-2.418	0.198
					Marital status
Single	0(0.00)	5(100.00)	0.25	0.082-0.760	0.015*
Married	25(34.72)	47(65.28)	11.67	0.893-167.479	0.071
Widow	32(51.61)	30(48.39)	2.25	0.208-24.356	0.505
Divorced	2(50.00)	2(50.00)	1		
					Level of education
Non formal	18(43.90)	23(56.10)	3.11	1.247-7.729	0.015*
Primary school	19(39.58)	29(60.42)	3.09	0.744-12.8	0.121
Secondary school	18(43.90)	23(56.10)	8.24	0.964-70.317	0.054
College	4(30.77)	9(69.23)	1		
					Working diagnosis
Cellulitis	0(0.00)	5(100.00)	0.35	0.150-0.816	0.020*
DFU 2	0(0.00)	4(100.00)	1		
DFU 3	9(15.00)	51(85.00)	1		
DFU 4	37(67.27)	18(32.73)	7.73	1.291-46.310	0.025*
DFU 5	13(68.42)	6(31.58)	2.67	0.634-11.208	0.181
					Surgical approach
None	2(66.67)	1(33.33)	0.64	0.323-1.266	0.200
Sloughectomy	5(7.58)	61(92.42)	1		
Amputation	17(65.38)	9(36.62)	15.33	1.046-224.779	0.046*
Disarticulation	35(72.92)	13(27.08)	14	1.095-178.997	0.042*
					Other approaches
Non glycemic	9(42.86)	12(57.14)	0.82	0.338-2.000	0.666

Variable	Outcome				
	Others (%)	Limb Salvage (%)	Crude OR	95% CI	P-value
Oral hypoglycemic	17(65.38)	32(65.31)	0.56	0.059-5.357	0.617
Insulin	33(45.20)	40(54.79)	0.56	0.059-5.357	0.599
Patients' progress					
Discharged	46(40.35)	68(59.65)	48.13	9.887-234.239	0.000*
Referred	5(27.78)	13(72.22)	1		
Died	8(72.73)	3(27.27)	48.71	10.115-234.105	0.000*
Readmission history					
Yes	24(70.59)	10(29.41)	0.82	0.205-3.275	0.777
No	35(32.11)	74(67.89)	0.82	0.205-3.275	0.777
Others (Amputation, Disarticulation and Died)					
*P-value <0.05 (Statistically significant)					

Table 4: Shows multivariate regression for the determinants of the outcome of diabetic foot management

Variable	Outcome				
	Others (%)	Limb Salvage (%)	Adjusted OR	95% CI	P-value
Age group(years)					
22-40	4(26.67)	11(73.33)	0.02	-0.218- 0.181	0.853
41-59	26(33.17)	51(66.23)			
60-77	21(53.85)	18(46.15)			
78-97	7(63.64)	4(36.36)			
98-116	1(100.00)	0(0.00)			
Sex					
Male	25(51.02)	24(48.98)			
Female	34(36.17)	60(63.83)	0.20	-0.083-0.491	0.162
Residence					
Kinondoni	27(45.76)	32(54.24)	0.10	-0.040-0.243	0.157
Temeke	18(40.00)	27(60.00)			
Ilala	10(29.41)	24(70.59)			
Ubungo	3(100.00)	0(0.00)			
Marital status					
Single	0(0.00)	5(100.00)			
Married	25(34.72)	47(65.28)	0.25	-0.506-0.003	0.053
Widow	32(51.61)	30(48.39)			
Divorced	2(50.00)	2(50.00)			
Level of education					
Non formal	18(43.90)	23(56.10)			
Primary school	19(39.58)	29(60.42)			
Secondary school	18(43.90)	23(56.10)			
College	4(30.77)	9(69.23)	0.04	-0.111-0.191	0.603
Working diagnosis					
Cellulitis	0(0.00)	5(100.00)			
DFU 2	0(0.00)	4(100.00)			
DFU 3	9(15.00)	51(85.00)	0.10	-0.287-0.081	0.269
DFU 4	37(67.27)	18(32.73)			
DFU 5	13(68.42)	6(31.58)			
Surgical approach					
None	2(66.67)	1(33.33)			
Sloughectomy	5(7.58)	61(92.42)	0.46	-0.636-0.280	0.000*
Amputation	17(65.38)	9(36.62)			
Disarticulation	35(72.92)	13(27.08)			
Other approaches					
Non glycemic	9(42.86)	12(57.14)			
Oral hypoglycemic	17(65.38)	32(65.31)			
Insulin	33(45.20)	40(54.79)	0.10	-0.267-0.102	0.377
Patients' progress					
Discharged	46(40.35)	68(59.65)	0.59	0.288-0.897	0.000*

Variable	Outcome				
	Others (%)	Limb Salvage (%)	Adjusted OR	95% CI	P-value
Referred	5(27.78)	13(72.22)			
Died	8(72.73)	3(27.27)			
Readmitted					
Yes	24(70.59)	10(29.41)			
No	35(32.11)	74(67.89)	2.83	1.692-3.966	0.000*
Others (Amputation, Disarticulation, Died)					
*P-value<0.05(Statistically Significant)					

A One-Way ANOVA was conducted to compare the mean differences in the outcomes of diabetic foot management between and within the age groups of the participants as shown in Table5. The test revealed a statistically significant (P=0.038) difference in management outcomes across the age groups (Table 5). This indicates that the outcomes of diabetic foot management varied significantly among participants from different age groups.

Table 5: Shows ANOVA for the mean difference between the outcome of diabetic foot management and age group

Source of Variation	SS*	Df*	MS*	F*	P-value
Between age group	9.42	4	2.35	2.61	0.038
Within age group	124.65	138	0.90		
Total	134.07	142	0.94		
*SS-*Some of Square*	***Df**-*Degree of freedom*		***MS**-*Mean Square*	***F**-*F statistic*	

A Chi-square test was also conducted to explore the factors associated with the outcomes of diabetic foot ulcer (DFU) management, with Fisher's exact test used to provide more accurate significance results for the variables. A P-value of <0.05 was considered statistically significant in determining the associations (Table 6 & 7).

Table 6: Shows outcome of management in relation to gender

Outcome of management	Gender		Total
	Male	Female	
Limb Salvage	24	60	84
	48.98	63.83	58.74
Others	25	34	59
	51.02	36.17	41.26
Total	49	94	143
	100.00	100.00	100.00
Pearson chi2=9.69 P=0.021			

Table 7: Shows the relationship between outcome of management and Co-morbidities

Outcome of management	Gender			Total
	None	HIV/AIDS	Hypertension	
Limb Salvage	19	11	54	84
	67.86	73.33	54.0	58.74
Others	9	4	46	59
	32.14	26.67	46.00	41.26
Total	28	15	100	143
	100.00	100.00	100.00	100.00
Pearson chi2=13.41 P=0.037				

DISCUSSION

Diabetic foot ulcer is a common complication affecting individuals with diabetes mellitus worldwide. It is estimated that approximately one in six people with diabetes will develop a foot ulcer in their lifetime. DFUs contribute to increased mortality and morbidity and significantly elevate the risk of amputation, leading to a reduced quality of life (Polikandrioti *et al*., 2020).

This study revealed a significant gender difference in outcomes. Majority of the female patients (63.83%) experienced limb salvage (P=0.021), a finding that aligns with a study conducted at a tertiary hospital in Belem-Para, Brazil, but contrasts with research from a tertiary hospital in Singapore. While women generally have a higher prevalence of diabetes mellitus, men are at greater risk of developing diabetic foot and its complications. One contributing factor may be that men are less likely to seek primary health services, possibly

due to belief that they have less time to focus on their own health. This gender disparity may also be attributed to the increase physical labor often undertaken by men (Abuhay *et al*., 2022; Costa *et al*., 2022; Maciel *et al*., 2017).

The study's findings also indicated that marital status played a role in the outcomes of diabetic foot management. Single participants were less likely to experience poor outcomes (Crude OR=0.25, P=0.015) compared to those who were married, which contrasts with a study by Vedhara *et al*., (2012) that highlighted the positive impact of social life on the overall health and wellbeing. Individuals with diabetic foot ulcers often experience loneliness, making it harder for them to relate to and share their illness with others. In this context, social support becomes a crucial preventive factor during health-related stress, as it enhances the patients' ability to accept their condition, cohabitate, and practice better foot care (Matricciani & Jones, 2015; Siddiqui *et al*., 2013; Vedhara *et al*., 2012).

It is noteworthy that co-morbidities significantly influenced the outcome of diabetic foot management (P=0.037). This finding aligns with previous studies(Monfared *et al*., 2015), which show that diabetic foot ulcers are often associated with co-morbidities and complications, leading to a substantial impact on the cost of care. The economic and social burdens are considerably for diabetes patients with additional co-morbidities compared to those with only diabetes diabetes(Sheen *et al*., 2018).

Furthermore, the grade of diabetic foot ulcer was closely linked to the management outcome, with advanced grades being associated with poorer outcomes. This is consistent with a study conducted at Johns Hopkins Hospital, which highlighted that both the grade of the ulcer and the timing of the diagnosis were crucial in determining the success of diabetic foot management. Delayed diagnosis plays a significant role in poor treatment outcomes, particularly terms of patient survival. Generally, poor outcomes are not only due to late presentation but also to barriers in adequate diagnostic and treatment barrier(Hicks *et al*., 2019).

Limitations

- Retrospective Design: It relies on existing medical records, which may have incomplete or inaccurate data and can affect the reliability of the findings.
- Single Centre: Conducting our study at one hospital (Mwananyamala Regional Referral Hospital) may limit the generalizability of the results to other settings or population with different healthcare infrastructures or demographic characteristics.
- Small sample size: a small sample size may limit the statistical power to detect associations between variables or accurately represent the broader population.
- Bias in Data collection: Since the study involves patient records, there may be variability in how health care providers documented the clinical information, leading to information bias or inconsistencies.

Benefits

- **Improved Clinical Practices:**

By identifying key factors influencing Diabetic foot ulcers (DFU) outcomes, our study can help healthcare providers refine their approaches to DFU management, leading to more effective treatment protocols and better patient care

- **Targeted Interventions:**

Our findings, such a significance of gender, marital status, co-morbidities, and ulcer grade outcomes, can enable more personalized, patient centered care. For instance, early interventions can be tailored for high-risk groups like men or those with advanced ulcer grades, potentially reducing amputation rates.

- **Enhanced Resource Allocations:**

The study provides data that healthcare institutions and policy makers can use to allocate resources more effectively. Identifying the factors leading to poorer outcomes, such as late diagnosis or co-morbidities ca guide investments in diagnostic tools, wound care, or patient education programs.

- **Support For Future Research:**

Our research contributes to the growing body of literature on diabetic foot management, helping inform future studies and filling gaps in local and regional data. It may also serve as a basis for longitudinal or multicenter studies aimed at further understanding DFU management.

CONCLUSION

This study highlights several key factors that influence the outcomes of diabetic foot ulcer management. Gender differences were evident, with women having higher likelihood of limb salvage compared to men, possibly due to men's reduced healthcare seeking behavior and increased physical labor. Marital status also played a role, as single participants had better outcomes that those who were married, underscoring the importance of social support in managing diabetic foot ulcers. Co-morbidities significantly impacted outcomes, increasing the economic and social burdens for patients, while the grade of the ulcer was strongly associated with prognosis, with advanced grades linked to poorer outcomes. These findings emphasize the need for early diagnosis, targeted interventions, and a comprehensive approach to diabetic foot management to improve patient outcomes.

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