DIABETIC FOOT: PREVALENCE, RISK FACTORS, KNOWLEDGE AND PRACTICES OF FOOT CARE AMONG DIABETIC PATIENTS ATTENDING PUBLIC DIABETIC CLINICS IN DAR-ES-SALAAM, TANZANIA

By

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A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Medicine (Internal Medicine) of the Muhimbili University of Health and Allied Sciences.

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DECLARATION

I declare that, this is my own work, and it has not been submitted for a degree in any other University.

Chiwanga .....

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DEDICATION

To my parents, Bishop Dr. Simon and Mrs Gladys Chiwanga.

ABSTRACT

Background: Diabetic foot is one of the devastating complications of Diabetes Mellitus. Diabetic foot ulcers are the leading cause of non-traumatic lower limb amputation resulting in considerable economic loss. It is estimated that, at the time of diagnosis of type 2 DM, about 10% of patients have one or two risk factors for developing foot ulcers and the lifetime risk for developing foot ulcer is estimated to be 15%. However, among the chronic complications of Diabetes Mellitus, foot ulcers are considered the most preventable especially through education on foot self care.

Objectives: The main objective of the study was to determine the prevalence and risk factors for foot ulceration among diabetic patients attending public diabetic clinics in Dar-es-Salaam Tanzania, and to assess their knowledge and practices of foot care.

Materials and Methods: Patients who were booked and attended the clinic on a particular day were recruited by systematic sampling technique. Questionnaire was administered to all study subjects and all underwent foot examination particular attention given for neuropathy, peripheral vascular disease, foot deformity and presence of foot ulcer or amputation. Knowledge questionnaire involved open ended questions and the total score was 23. Foot self care practice was adopted from the Summary for Diabetes Self Care Activities to assess how many days in the past week they have practiced foot self care.

Results: A total of 404 patients were included in the study, 15% had foot ulcers, 44% had peripheral neuropathy, and peripheral vascular disease was present in 15% of patients. In univariate analysis, factors that were significantly associated with presence of foot ulcer were Peripheral neuropathy (odds ratio [95% confidence interval] 8.14 (3.29 – 20.15) for moderate neuropathy, 24.19(10.40 – 56.30) for severe neuropathy, age > 55 years 1.19(1.10 – 3.30), non-alcohol drinking 8.29 (1.10 - 62.17), insulin treatment 2.04 (1.16 – 3.59) and history of previous ulcer 3.23 (1.85 – 5.64). In multivariate analysis, only peripheral neuropathy and insulin treatment were significantly associated with presence of foot ulcer. The mean score of knowledge of foot care was 11 (standard deviation ± 6)

out of possible 23 total scores. Low mean scores were significantly associated with lack of formal education (8 ± 6.1), diabetes duration of < 5 years (10.2 ± 6.7) and not receiving advice on foot care (8.0 ± 6.1). Among the 404 patients, 48% had received advice on foot care and 27.5% reported to have had their feet examined by the doctor at least once. Foot self care practices did not differ significantly across risk categories of patients. Self care behaviour practiced more was washing feet (93%), and least practiced was inspecting shoes (37%). Foot self care behaviour improved significantly in patients who had been given advice on foot care and in those whose feet had been examined by the doctor at least once.

Conclusions:

1. The prevalence of diabetic foot ulcers is high among patients attending public diabetic clinics in Dar-es-salaam.
2. PN is the major risk factor for foot ulcer in this population. Avoidance of injuries of an anaesthetic limb and appropriate foot care practice by both patients, and health care providers may reduce foot ulcers.
3. Level of knowledge regarding foot care is low among patients and can still be improved.
4. Proper foot care is not practised adequately by patients and health care providers

Recommendations:

1. To improve health education among doctors so as to increase knowledge on identifying risk factors for foot ulcers.
2. To put in place foot care programmes that will be able to identify patients with risk factors and those already having foot ulcers.
3. To improve patients' knowledge on risks of developing foot ulcers and on foot self-care.
4. T o encourage patients on foot self care behaviour.

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ABBREVIATIONS/ACRONYMS

AIDS	Acquired Immunodeficiency syndrome
ANOVA	Analysis of variance
BMI	Body mass index
C.I	Confidence interval
DFD	Diabetes foot disease
DM	Diabetes Mellitus
DNA	Deoxyribonucleic acid
EURODIAB	Europe Diabetes study
GDM	Gestational Diabetes Mellitus
HIV	Human immunodeficiency virus
IGT	Impaired glucose tolerance
MMed	Master of Medicine
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University College of Health and Allied sciences
NDS	Neuropathy disability score
O.R	Odds Ratio
PN	Peripheral neuropathy
PPG	Post prandial glucose
PVD	Peripheral vascular disease
SDSCA	Summary of Diabetes Self-Care Activities
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
UKPDS	United Kingdom prospective diabetes study
USA	United States of America
USD	United States Dollars
WHO	World Health Organization

DEFINITION OF TERMS

Alcohol drinking: Currently using any amount of any type of alcohol

Ankle brachia pressure index: Ratio of ankle systolic pressure to brachial systolic pressure

Arterial calcification: Ankle brachial pressure index of > 1.3

Cigarette smoking: Currently smoking any type of cigarette

Diabetic foot ulcer: A full thickness skin defect that has been present for the past 14 days.

Neuropathy disability score: Tool for assessing presence of peripheral neuropathy using objective assessment of sensation to pain, pressure, vibration and ankle reflexes

Past alcohol drinker: Used to drink any amount of any type of alcohol but currently not drinking

Past cigarette smoker: Used to smoke any type of cigarette

Peripheral neuropathy: Neuropathy disability score of ≥ 1.

Peripheral vascular disease: Ankle brachial pressure Index of < 0.9

Wealth Index: A composite measure of the cumulative living standard of a household. The wealth index is calculated using easy-to-collect data on a household's ownership of selected assets. Generated with a statistical procedure known as principal components analysis, the Wealth Index places individual households on a continuous scale of relative wealth.

CHAPTER 1.
INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Diabetes Mellitus (DM) comprises a group of common metabolic disorders that share the phenotype of hyperglycaemia. Several distinct types of DM exist and are caused by a complex interaction of genetics, environmental factors, and life-style choices. Factors contributing to hyperglycaemia may include: reduced insulin secretion, decreased glucose usage and increased glucose production.

Although all forms of DM are characterized by hyperglycaemia, the pathogenetic mechanisms by which hyperglycaemia arises differ widely. The recent classification of DM is based on pathogenic process that leads to hyperglycaemia and includes:

1. Type 1
2. Type 2
3. Those due to specific mechanisms and diseases and
4. Gestational diabetes mellitus.

Diabetes Mellitus type 1 is characterized by destructive lesions of pancreatic beta cells either by an autoimmune mechanism or of unknown cause. Diabetes Mellitus type 2 is characterized by combinations of decreased insulin secretion and decreased insulin sensitivity (insulin resistance).

Diabetes due to specific mechanisms and diseases is divided into two sub-groups; diabetes in which genetic susceptibility is clarified at the DNA level and diabetes associated with other diseases or conditions. Gestational diabetes is any glucose intolerance that developed or detected during pregnancy.

There are several criteria that are used in the diagnosis of Diabetes Mellitus. These include:

1. Symptoms of diabetes mellitus plus random plasma glucose concentration ≥ 200 mg/dl (11.1 mmol/L)
2. FPG ≥ 126 mg/dl (7.0 mmol/L)
3. 2hr PPG ≥ 200 mg/dl (11.1 mmol/L) after a 75-g glucose load.

In the absence of unequivocal hyperglycemias and acute metabolic decompensation, these criteria should be confirmed by repeat testing on different days. Oral glucose tolerance testing (OGTT), although still a valid mechanism for diagnosing DM, is not recommended as part of routine screening.

The morbidity and mortality associated with diabetes are related to the short- and long-term complications. Whilst evidence of tissue damage can be found in many organ systems, it is the kidneys, eyes, peripheral nerves and vascular tree, which manifest the most significant, and sometimes fatal, diabetic complications. The mechanism by which diabetes leads to these complications is complex, and not yet fully understood, but involves the direct toxic effects of high glucose levels, along with the impact of elevated blood pressure, abnormal lipid levels and both functional and structural abnormalities of small blood vessels. Diabetes is one of the major causes of blindness in adults aged 20-74 years, as well as the leading cause of end-stage renal disease (ESRD) and non-traumatic lower-extremity amputation. Lower extremity amputations are usually preceded by a foot ulcer in people with diabetes. The most important factors related to the development of these ulcers are peripheral neuropathy, peripheral vascular disease, foot deformities, and minor foot trauma .

The spectrum of foot lesions varies in different regions of the world due to differences in socio-economic conditions, standards of foot care and quality of footwear. Peripheral neuropathy is the most prevalent diabetic foot complication. It includes motor, sensory and autonomic neuropathy. Sensory loss to light touch, vibration

and pressure leads to ataxic gait and allows redistribution of pressure forces. Motor neuropathy leads to weakness and atrophy of intrinsic muscles of the foot. Stability of the foot arch during walking is impaired and unopposed extrinsic muscles leads to equinus deformity of the foot or varus deformity of the hind foot. Loss of sensation to noxious, thermal and painful stimuli leads to loss of protective mechanisms against harmful insults. Autonomic neuropathy usually results in formation of calluses that may break and become secondarily infected causing ulcers.

Peripheral vascular disease is also common among diabetic patients compared to non-diabetic population. It is among the important factors in developing diabetic ulcers. In diabetic patients, it occurs at much younger age group, and has rapid progression. Patients with PVD and diabetes fair much worse than patients with PVD alone. The distribution of PVD in diabetic patients is more distal involving tibia and peroneal vessels. In most patients with diabetes and PVD the symptoms are atypical and the presence of co-existing neuropathy, the classical symptoms of claudication my not be elicited.

Foot deformities predisposes to the development of foot ulcers by creating pressure points which may easily break and create a portal of entry for bacteria. Common sites for deformities are ankle region, midtarsal region, lateral or medial foot margins, and over the prominent metatarsal heads in the forefoot. Foot heels are also commonly affected because of the ankle equines deformity which results into ankle dorsiflexion.

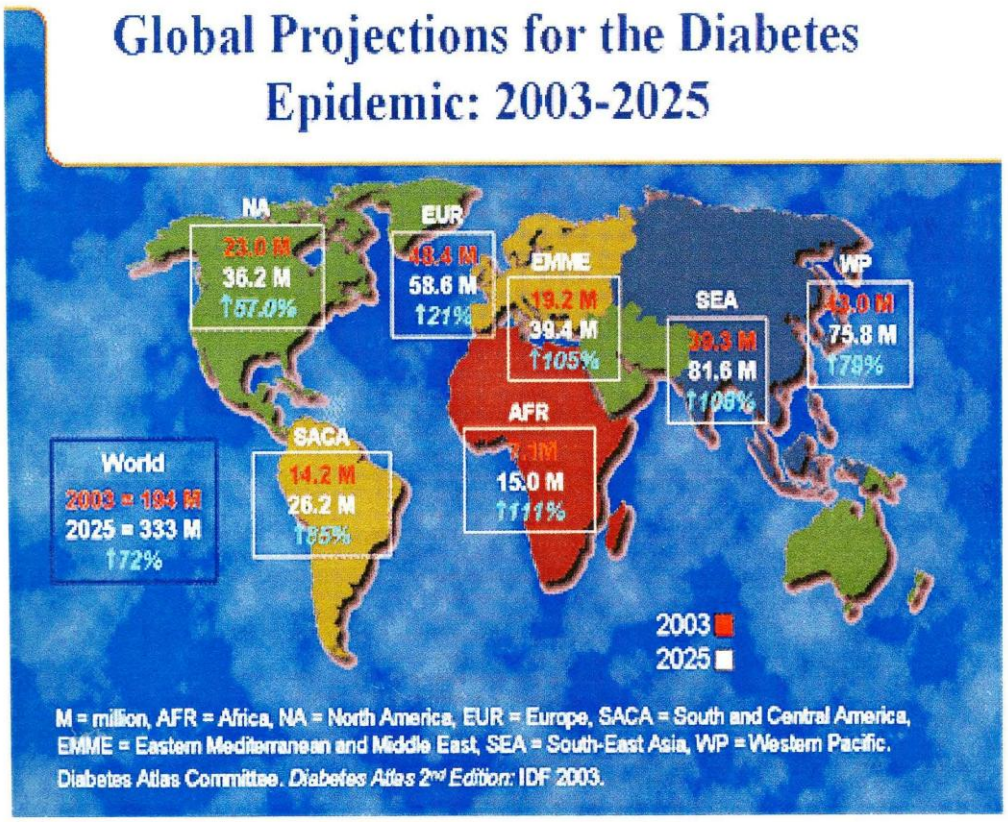
1.2. LITERATURE REVIEW

1.2.1. A KILLER EPIDEMIC

Diabetes is a silent epidemic that claims as many lives each year as HIV and AIDS. In 2007, diabetes was expected to cause 3.5 million deaths globally. [1] The epidemic particularly relates to type 2 DM, which comprise about 90% of all diabetes cases.

In 2003 the global prevalence of diabetes was estimated at 194 million people, giving a global prevalence of 5.1%. This figure is predicted to reach 333 million (62% increase) by 2025. [2] The reasons for the increase in prevalence include longer life expectancy, sedentary lifestyle and changing dietary patterns. The greatest increase in prevalence is expected to occur in Sub- Saharan Africa. In 1994, there were 7.1 million people with diabetes in Africa. [2,3] This figure is expected to reach 15 million in 2025 giving an increase of 111% as shown in figure 1.

Figure 1: Global projections of Diabetes Epidemic: 2003 – 2025.



Reproduced from the diabetes Atlas, 2nd edition 2003. [2]

In Tanzania the number of people living with diabetes has increased over the past few years. In the 1980s, the prevalence of type 2 diabetes was estimated to be 0.8% in towns and 0.9% in rural areas. By the year 2000, the prevalence rose to 4% in urban to 1.3% in rural areas. [4]

1.2.2. DIABETIC FOOT DISEASES

Diabetic foot disease is a sequel of Diabetes Mellitus that is a growing problem worldwide. In general, the term "diabetic foot disease" (DFD) refers to a spectrum of diseases that might involve any component of the tissues of feet of a patient with diabetes. Diabetic foot disease involves the skin, soft tissue and osseous structures of the foot; it is commonly termed as "diabetic foot". [5]

Diabetic foot diseases are common throughout the world, resulting in major economic consequences for the patients, their families and society. Rates of recurrence of foot ulcers are very high, being 34%, 61% and 70% at 1, 3 and 5 years respectively. [6]

It is estimated that, at the time of diagnosis of type 2 DM more than 10% of people have one or two risk factors for foot disease such as peripheral neuropathy or peripheral vascular diseases. The burden of diabetic foot disease therefore is set to increase with the increase in prevalence of type 2 DM in the world. World wide, 3-10% of those with diabetes have a foot ulcer and 15% of all those with diabetes will develop an ulcer during their lifetime. [6] Rates of foot ulcerations in Africa vary between regions and have been estimated to be between 4-19%.[3] These differences probably reflect variations in population characteristics and wound management strategies across geographic regions.

Foot complications in diabetes patients frequently progress to sepsis or gangrene, resulting in prolonged hospital stays and significant morbidity and mortality. Study of the clinical outcomes of patients with diabetic foot ulcers in Dar-es-Salaam showed that 15% of diabetic patients admitted at Muhimbili National Hospital had foot ulcers. The same study showed that mortality for diabetic foot ulcer patients was over 50%. [7] A study done in the United Kingdom showed cumulative survival of 87% at 36 months for the diabetic control group, and 72% for all foot ulcer patients. [8] Diabetic neuropathy is one of the commonest and an important risk for developing diabetic foot ulcers.[9] The prevalence of diabetic neuropathy varies between regions. Several studies have reported different prevalences, in part because of the differences in patient's selection or diagnostic criteria.

In developing countries there are several studies that have been done. A study done by Morbach et al showed the prevalence of PN to be 78% in Germany, 82% in Tanzania and 82% in India.[10] In the Seattle Prospective Diabetic Foot Study 50% of the study participants had peripheral sensory neuropathy at baseline.[11] The same high prevalence rates were also seen in the North- West diabetes foot care study. [12] Lower Prevalence of PN has been reported in Australia in 2003 where it was found to be only 13%.[13] In Tanzania it has been reported that 25% of diabetic patients attending one large diabetic clinic had varying degrees of symptoms or signs of peripheral neuropathy. [3, 14]

Detection of clinically significant sensorimotor deficits can be performed by attending Doctors with a Semmes-Weinstein monofilament. Inability to sense the monofilament has been associated with an increased risk of foot ulcer. [15] Loss of protective sensation is an indication that closer clinical follow-up, intensive education and consideration of special footwear are indicated. Shoe - related minor trauma has been reported as a frequent event leading to ulcers and amputations and protecting the insensate foot with appropriate footwear has been shown to be effective in ulcer prevention .[16, 17,]

1.2.3. ECONOMIC IMPACT

The economic impact of diabetes is considerable. Its costs affect health services, national productivity as well as individuals and families. The annual direct healthcare costs of diabetes worldwide, for people aged 20-79 years, is estimated to be at least 153 billion international dollars. [2] This figure will rise to between 213 billion and 396 billion international dollars in 2025 for total direct healthcare expenditure on diabetes worldwide, if the predictions for increase in prevalence are fulfilled. [2] The cost of diabetic foot lesions is affected by interventions to prevent foot ulcers, management strategies to heal ulcers, and by management and care necessary for disability after amputations. [18] Tanzania is placing an increasing economic burden on the population and on the national budget for health care. Mechanisms for financing health care in most developing countries are either non-existent or cover only a minority group and therefore patients have to relay on their out of pocket money. A study done in Kilimanjaro region showed that the total direct costs relating to the insulin treatment of diabetes accounted for a quarter of the minimum wage, which results in financial difficulties [19]. Reports from Dar-es-salaam show, that out of five people with diabetes, only one was receiving government funding for treatment. [4]

A study that was done by Chale SS et al in 1992 showed that, the average cost of DM in 1989 – 1990 was $287 for patients requiring insulin and $104 for patients not requiring insulin. For patients requiring insulin, the purchase of insulin accounted for 68.2% average annual cost and for those not requiring insulin, treatment of chronic complications accounted for about half of the cost. [20] Hospital in-patient costs for diabetes are higher than the outpatient costs which may reflect the higher costs associated with diabetic complications. [21]

Diabetes is growing fastest in low- and middle-income countries. It is therefore the developing countries that will bear the burden of the spiraling costs. It is also known that long periods of insulin shortage are common in African countries and

lead to high mortality rates in acute diabetes complications and also increase the risk for long term complications including microvascular complications like PN. There is a known correlation between metabolic control and the development of late complications. [22] In addition to causing pain and morbidity, foot lesions in diabetic patients have substantial economic consequences. In India patients with diabetes without foot ulcers spend 9.3% of their total income towards treatment, while those with foot ulcers spend up to 32.2%. [16] In the US, diabetic foot ulceration and amputations were estimated to cost $10.9 billion in 2001. Corresponding UK estimates showed a total annual cost of diabetes-related foot complications to be £252 million. In addition to the direct costs of foot complications, there are also indirect costs relating to loss of productivity, individual patients' and family costs and loss of quality of life. [23, 24]

1.2.4. PREVENTION OF DIABETIC FOOT ULCERS

Diabetic foot ulcers and amputations can be prevented in many cases. It is estimated that up to 85% cases of amputations could be avoided. [18] Significant reductions in amputations can be achieved by well-organized diabetic foot care teams, good diabetes control and well-informed self care. [25] The main aim with diabetes management is for primary prevention of foot ulcer but secondary prevention is the goal of good foot ulcer care since the chance of recurrence of foot ulcer is high. The approach for secondary prevention requires multidisciplinary approach including physicians, surgeons, diabetic educators etc. [26] United Kingdom Prospective Diabetes Study (UKPDS) one of the diabetes Landmark studies, have shown that intensive control of blood glucose levels and tight blood pressure control reduce the risk of complications related to diabetes. [27] In addition, early identification of risk factors can help reduce the development and progression of diabetic microvascular complications, and improve patients' quality of life. [17]

Studies suggest that the majority of patients with diabetes do not receive regular foot examinations or the standards of foot care recommended [28, 29,]. A study done in United Kingdom by Subrata et al 2004 showed that 33% of patients with diabetes did not recall receiving information about foot care. [30] De Beradis et al 2005 showed that

diabetic patients did not receive foot education, even in the subgroups with increased risk of foot complications such as PVD and neuropathy. In this study that involved 3564 diabetic patients, 28% of patients reported they had never received education on foot care, and only 51% reported to have had a visual foot examination in the previous year. [31] In a study that was done at Muhimbili National Hospital (MNH) diabetic clinic, involving 153 diabetic patients, 87% reported to have never inspected their feet, and 66% of the patients reported that they were not interested in further knowledge of diabetes foot-care. [32]

CHAPTER 2.
PROBLEM STATEMENT AND STUDY RATIONALE

2.1. PROBLEM STATEMENT

It is believed that, every 30 seconds a lower limb is lost somewhere in the world as a consequence of diabetes. [18] In recent years, the level of interest and knowledge about diabetic foot ulcer has grown considerably, with an improving evidence-base for clinical practice and development of international consensus and guidelines to be used in both treatment and prevention of diabetic foot. There are numerous barriers to the implementation of good care in patients, which involves both health care professional and patients' attitude and beliefs toward diabetes itself and foot ulcers. These prevent diabetic patients from receiving the appropriate multidisciplinary care they need. Moreover, patients who are aware of the dangers of diabetic foot might not attend clinic when they develop a new ulcer because they fear losing their limb through amputation. [33] All patients, if given proper guidance and education regarding foot care, should be able to make significant improvements in their foot care. Patients' lack of understanding or attitude hinders proper guidance. Education is likely to be effective if we know the characteristics of the patients in terms of their current knowledge and practices on foot care.

2.2. STUDY RATIONALE

Among the chronic complications of diabetes, foot ulceration is considered to be the most preventable. Most risk factors associated with foot ulceration can be modified if identified early and if patients have adequate knowledge and put into practice foot care principles. Current guidelines for standardized care of feet in diabetic patients recommend annual screening for high risk feet and those identified should receive enhanced foot care education in addition to that given to all people with diabetes. [34, 35] The Tanzania Diabetes Association has established a network of diabetes clinics in the district, regional and referral hospitals. Consultations in these clinics are free of charge, while insulin and other medicines and laboratory tests are subsidized by the government.

In the city of Dar-es-salaam, diabetes clinics have been established in each of the three municipal hospitals in addition to MNH. The Ministry of Health has provided doctors and nurses to staff the clinics. Each hospital takes care of patients within the catchments areas. The clinics are run between two and 4 days in a week and a day's attendance is between 30-45 diabetic patients. Although there is a large amount of literature on diabetic foot and the importance of foot care, there are limited published data on knowledge, attitude and practices of foot care among diabetic patients, more so in Tanzania. Thus, this study was carried out with the main aim of determining knowledge and practices of foot care as well as assessing the prevailing risk factors for developing diabetic ulcers. The knowledge will help to improve the quality of care in diabetic patients so as to reduce the burden associated with diabetes foot complications.

CHAPTER 3
OBJECTIVES AND RESEARCH QUESTIONS

3.1. OBJECTIVES OF THE STUDY

Broad Objective: To determine the prevalence and risk factors of foot ulcers among diabetic patients attending public diabetic outpatient clinics in Dar-es-salaam and to assess the knowledge, and practices of foot care.

Specific Objectives:

1. To determine the prevalence of diabetic foot ulcers among diabetic patients attending outpatient clinics.
2. To determine the magnitude of risk factors for diabetic foot.
3. To assess the knowledge on diabetic foot among diabetic patients attending the clinics.
4. To assess foot care practices among patients attending the clinics.

2.2. RESEARCH QUESTIONS

What is the prevalence of diabetic foot ulcers in public outpatient diabetic clinics in Dar es Salaam?

What is the magnitude of risk factors for foot ulcers in these patients?

What is the level of awareness of diabetic foot among diabetic patients in the clinics?

What is the level of foot self-care practice among diabetic patients in the clinics?

CHAPTER 4
METHODOLOGY

4.1 STUDY SITE

This study was done in Dar-es-salaam city, and involved diabetic clinics in Public Hospitals. Dar-es-salaam is the largest city in Tanzania. According to the 2002 Tanzania census data, the city had a population of 2, 497,940. The city has three Municipal hospitals run by the government namely, Amana, Mwananyamala and Temeke and one national referral centre, the Muhimbili National Hospital. In all these hospitals, there is a well structured diabetic clinic that is largely funded by the Tanzania Diabetic Association. About 100 000 people with diabetes have access to these diabetic clinics.

4.2 STUDY DESIGN

This was a Cross-sectional descriptive study.

4.3 STUDY SUBJECTS

All patients who were booked and attended the clinic in a particular day were eligible for the study. Patients were identified through systematic sampling following the sequence on how they arrived at the clinic. Number of recruitments of patients per day was depending on the number of patients attending the clinic on that particular day but ranged from 5 to 15 patients per clinic day. For the Municipal hospitals, where clinics are run three times a week, each clinic was visited only once a week and the specific days of the week were alternating, except for MNH diabetic clinic which is run only once a week.

Patients who were unable to sign consent forms because of being under age were excluded from the study. No one declined to participate in the study; those who were randomly selected but could not wait for the examination of their feet because of various reasons were given appointment on a later day.

4.4 PROCEDURE

Each study participant was informed on the procedure and required to sign a consent form (Appendix 2). A Questionnaire which had three parts was then administered to each participant for 10-15 minutes by the principle investigator or a research assistant who was a medical doctor (Appendix 4). The first part consisted of Demographic data, social economic status and clinical characteristics of patients at the time of interview. The demographic information included gender, marital status, level of education, cigarette smoking and alcohol intake history. Information regarding diabetes included the duration of the disease (time since diagnosis), and method used for control of Diabetes. This part also had questions regarding adherence to the prescribed medications. Second part of the questionnaire was to assess the knowledge regarding foot care and to inquire about foot care practices and the third part was for physical examination.

Social economic status of the participants was obtained by calculating the wealth index. [36] The wealth index is an indicator of the level of wealth and was constructed using household ownership of items like houses, cars, television, and radio. Each item was assigned a weight factor and the scores were standardized and ranked into high socio-economic status and low socio-economic status. The cost of diabetic management was taken as the direct costs of consultation, blood glucose measurement, buying drugs and treatment of complications. Indirect costs including transportation costs were not included in this study.

Knowledge was assessed through open-ended questions, without multiple choices. Patients were categorized according to their response on pre determined answers (denoted as "correct" responses in this study) by whether they answered spontaneously or the participant was prompted to give the correct answer. Seven questions concerning foot care were included and scored as 2 for correct response, 1 for correct response after prompting and 0 if didn't know the answer. Exception was in question 1 which inquired about the common causes of diabetic foot ulcers, which had only one point for correct response. This method for assessing knowledge has been described by K. Kaliyaperomal

in the guideline for conducting a knowledge attitude and practice study [37].

Questions on foot self care practices were adopted from the Summary of Diabetes Self Care Activities (SDSCA) measure, which identifies the number of days in the past week a person has performed diabetes self care activities. [38] For diabetic foot care activities, it includes five questions for inspecting feet, inspecting shoes, washing feet, drying between toes and not soaking feet. This method of 7 days recall has been validated in several studies and found to be a valid tool in assessing foot care practices among patients with DM. For descriptive purposes in this study, activities done for 6 – 7 days were considered to indicate foot self care.

All patients underwent a physical examination which was conducted exclusively by the principle investigator. These included weight and height measured using local weighting scales and body mass index (BMI) calculated using the formula: Weight (Kg) /Height $(M)^{2.}$ Four categories of weight were used according to BMI as follows:-

Underweight: < 18

Normal weight: 18 – 24.9

Overweight: 25 – 29.9

Obesity: ≥30

Eyes were assessed for the presence of cataract, reduced vision and fundoscopic examination for retinopathy. Visual acuity was measured by using a handheld card to test for near vision. Fundoscopy was done without dilating the pupils in a room with minimal light. The findings were reported as absence or presence of retinopathy without further description of the lesions or grading of retinopathy.

Inquiry regarding co-morbidities was done either by directly asking the patient or by referring to clinical notes. Hypertension was regarded to be present if the patient had a blood pressure of ≥140/90mmHg recorded on two different occasions with evidence from the file or history of being prescribed with anti hypertensive medications in the past.

Patients who were on anti-Hypertensive medications were taken as having Hypertension regardless of the Blood Pressure level at the time of study.

Objective assessment for determining PN was performed by the use of pinprick for pain sensation, 128Hz tuning fork for vibration sense, 5.04g- Semmel- Wenstein monofilament was used for pressure sense and Patella hammer for testing ankle reflexes. Pressure sense was abnormal if a patient failed to sense the monofilament at one point of the 4 plantar areas (great toe, base of first, third, and fifth metatarsals), each foot tested separately. This method has been found to identify 90% of patients with feet that have lost sensation [39]. Loss of vibration sense was present if the patient could not feel the vibration while the examiner still felt vibration, using 128 Hz turning fork placed at the great toe or Malleoli of either foot. The ankle reflexes were recorded as either being present, present on reinforcement or absent. Scoring of the neuropathy was a modification from the Neuropathy Disability score for Diabetes Polyneuropathy [40]. The total score was calculated by summing up the points for each abnormal finding. Absent pain, vibration and pressure sense were given one point each for individual feet. Reflexes were given 2 points if absent and 1 if were present after re-enforcing manoeuvres were used. Range of neuropathy was categorized as follows:

0: No Neuropathy

1-3: Mild neuropathy

4-7: Moderate Neuropathy

7-10: Severe Neuropathy

Symptoms of PN were also inquired from the questionnaire and these included current history of numbness, burning or tingling sensation. Presence of Peripheral Vascular Disease was defined by Ankle Brachia Pressure Index (ABPI) of < 0.9 in either limb by using laser Doppler machine. Doppler measurement was done using 8 Heinz handheld laser Doppler device which is recommended for this test. The patient was put in supine position for about 5 minutes. First the brachia artery systolic pressure was determined for both arms by placing the cuff around the arm and using the radial artery at the wrist. The same cuff was placed just above the malleoli and inflated up to the point, 20mmHg above

the arm pressure. Posterior tibial artery and dorsalis pedis were examined and the one with higher pressure was used for calculation of ABPI. ABPI was calculated by dividing the ankle systolic pressure by arm systolic pressure. Subjects who had ABPI of > 1.3 were taken as having incompressible ankle arteries due to arterial calcification. [41, 42]

Oscillometric measurements using standard automated blood pressure machine from Sprenger electronics was also used to determine the presence of PVD. The device has a pressure accuracy of ± 3mmHg and pulse accuracy of ± 5%. Calibration of the devise was done after about 50 patients. Arm blood pressure was measured using the brachia artery and ankle blood pressure was measured by placing the cuff just above the malleoli.

Fountaine classification of PVD was made using findings of ABPI detected by Doppler as follows: [43]

Stage I: ABPI < 0.9 - Asymptomatic

Stage II: Intermittent claudication with ABI <0.9

Stage III: Daily rest pain with ABI <0.9

Stage IV: Focal tissue necrosis (non-healing ulcers)

Lower extremities were examined for the presence of wounds and the duration of wound noted. Diabetic foot ulcer was defined as full thickness skin defect that has been present for the past 14 days, definition adopted from the Seattle Diabetic Foot study. [11] Feet deformities were noted, including claw foot, hammer toe, charcoat foot or flat foot and presence of fungus documented.

Patients had their feet classified according to the risk of developing diabetic ulcer. This classification has been recommended by the International Diabetes Federation Global guideline for Type 2 Diabetes as a standard for foot care. [25] Patients with no PVD, no loss of sensation and no other risk factor were classified to have 'no added risk' for foot ulcer. 'At risk' patients were those with neuropathy or any other single risk factor. 'High risk' patients were patients with diminished sensation or foot deformities and previous ulcerations or amputation which are very high risk for foot ulcer.

4.5. STATISTICAL ANALYSIS

All data were entered and cleaned using Epi info version 6 statistical software. Statistical analysis was done using SPSS statistical package version 13. Frequency and percentages were used in description of variables. Comparison between two groups was done by using Pearson correlation (chi-square) and Fischer's exact test for categorical variables. Univariate and multivariate logistic regression was done to determine odds ratios. For continuous variables student's t-test or analysis of variance was used to assess difference between groups. For all these statistics, a p-value of less than 0.05 was taken to be significant. Validity of automated blood pressure machine in diagnosing PVD was assessed using Doppler measurement as the gold standard.

CHAPTER 5.
RESULTS

5.1. PREVALENCE OF FOOT ULCER

A total of 404 patients were included in this study, of which females were 224 (55.4%) and the mean age of population was 53.6 ± 12.7. Females were slightly younger than males, with mean ages of 52.7 ±11.2 and 54.8 ± 14.4 respectively but the difference was not significant (P=0.088). Social demographic and social economic characteristics of the population are shown in tables 1.

Foot ulcers were present in 64 patients (15.8%) but of these, two patients had ulcers for less than two weeks therefore, the actual point prevalence of diabetic foot ulcer was 15.3% (95% CI 2.17 – 5.92). As shown in table 1, social demographic characteristics did not differ significantly according to the presence of foot ulcer except for taking alcohol, of which most patients who were currently taking alcohol were in the group not having ulcer.

Patients who reported to have regular income were 221 (54.7%), with 165 patients (40.7%) reporting to be depending of relatives. Among patients who reported to have regular income, 45.2% reported that they were earning < Tsh 100,000. Social-economic status did not differ between patients with foot ulcers and those without foot ulcers, however there was a correlation between direct DM management costs and the presence of ulcers such that patients with ulcers had higher direct costs for diabetes management than those without ulcers (table 1).

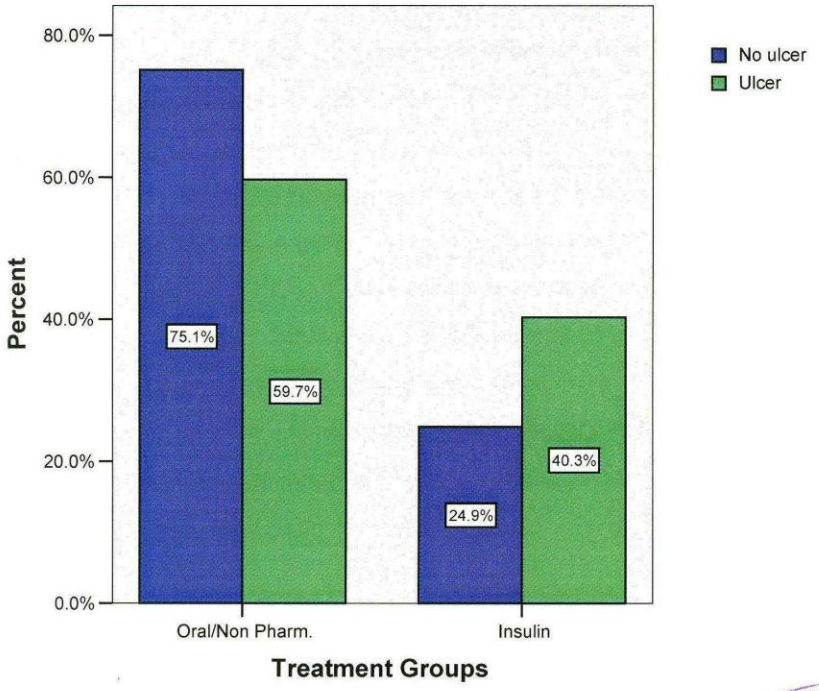
Table 1: Social demographic characteristics of diabetic patients at the time of interview by presence or absence of foot ulcer

Characteristics	Total population N=404 (%)	Ulcer present N=62	No Ulcer N=342	P-value X^2/Fisher 's test
Age (mean± S.D)	53.6±12.7	56.4 ± 13.1	53.1 ± 9.9	0.060
Gender				
Female	224 (100)	33 (14.7)	191 (85.3)	
Male	180 (100)	29 (16.1)	151 (83.9)	0.702
Marital status				
Married	305 (100)	49 (16.1)	256 (83.9)	
Never married	28 (100)	2 (7.1)	26 (92.9)	
Previously Married	71 (100)	60 (15.5)	11 (84.8)	0.455
Education level				
No formal education	46 (100)	10 (21.7)	36 (78.3)	
Primary education	253(100)	35 (13.8)	218(86.2)	0.519
Secondary and Vocational	87 (100)	14 (16.1)	73 (83.9)	
Post secondary education	18 (100)	3 (16.7)	15 (83.3)	*0.715
Smoking				
Currently smoking	13 (100)	3 (23.1)	10 (76.9)	
Past smoker	78 (100)	13 (16.7)	65 (83.3)	0.564
Never smoked	313 (100)	46 (14.7)	267(85.3)	
Alcohol Intake				
Currently drinking	42 (100)	1 (2.4)	41(97.6)	
Past drinker	142 (100)	24 (16.9)	118(83.1)	0.048
Never drunk alcohol	220 (100)	37 (16.8)	183(83.2)	
Social economic status				
Low	201 (100)	26 (12.9)	175 (87.1)	0.181
High	203 (100)	36 (17.7)	167 (82.3)	
Total direct costs of DM management/month	182 (100)	16 (8.8)	166 (91.2)	< 0.001
<=15,000/=	132 (100)	20 (15.2)	112 (84.8)	
16,000 – 30,000	90(100)	26 (28.9)	64 (71.1)	*< 0.001
> 30,000				

* P value for trend

Majority of patients in the study were on oral hypoglycaemic drugs (70.3%). Among 284 patients on oral hypoglycaemic agents, ~ 60% were Females, while 66% of those using insulin were Males. Seventeen patients reported to have been using local herbs in addition to the anti-diabetic drugs they were using, most of them were in the group using oral hypoglycaemic agents (76.5%). Patients who were on diet control alone were 10 (2.5%) only. For the purpose on description and because of there small number, these patients were grouped with those on oral hypogylcemic drugs to compare the occurrence of diabetic foot between insulin users and non-insulin users. The distribution of methods of diabetes control according to the presence or absence of foot ulcers is shown in figure 2. 40.3% of patients with ulcers were on insulin treatment compared to 24.9% without ulcer (P=0.012).

Figure 2: DM treatment categories by the presence or absence of foot ulcer in study subjects (N=404)



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5.2. MAGNITUDE OF RISK FACTORS

Table 2 shows the clinical characteristics of patients with foot ulcers and those without foot ulcers. Previous history of ulcer, previous amputation, peripheral neuropathy and foot deformity were all associated with presence of foot ulcer. Peripheral neuropathy was present in 177 patients (43.8%), of whom 16.4% had mild neuropathy, 39.5% had moderate neuropathy and severe neuropathy was present in 44.1%, p-value for trend was < 0.001. A total of 69 patients (7.4%) presented with only symptoms of peripheral neuropathy. Patients with foot ulcers had longer duration of diabetes than those without ulcers but this difference was not statistically significant (p-value for trend 0.055)

There was no significant difference among patients with ulcers and those without ulcers in regards to the presence of PVD. No patient among those with diabetic ulcer had arterial calcification (ABPI of > 1.3).

Several variables from social-demography and clinical characteristics were assessed using regression analysis (table 3). In univariate logistic regression analysis, age > 55 years, insulin treatment and PN all increased the likelihood of having a foot ulcer. Alcohol intake was associated with less likelihood of having foot ulcers. Variables that had p-value of < 0.1 in Univariate logistic regression analysis were assessed in multivariate logistic regression model. In multivariate analysis, PN and insulin treatment were significant predictors of foot ulcers. Patients with moderate PN were eight times more likely to have diabetic ulcers and those with severe neuropathy were 24 times more likely to develop ulcers. Patients on insulin treatment were twice as much to have foot ulcer than those on oral or non-pharmacological management. In univariate analysis, patients who were drinking alcohol or who drank in the past were eight times more likely to have foot ulcers than those who were non-drinkers.

Table 2: Clinical characteristics of diabetic patients at the time of interview by the presence or absence of foot ulcer (N =404)

Clinical parameters	Total	Ulcer	No ulcer	P-value
	N=404	N=62	N=342	
BMI				
Underweight	32 (100)	3 (9.4)	29 (90.6)	
Normal weight	139 (100)	23 (16.5)	116 (83.5)	
Overweight	153 (100)	23 (15.0)	130 (85.0)	0.778
Obesity	80 (100)	13 (16.3)	67 (83.8)	
PN by neuropathy disability score				
No neuropathy	227 (100)	8 (3.5)	219 (96.5)	< 0.001
Mild	29 (100)	2 (6.9)	27 (93.1)	
Moderate	70 (100)	16 (22.9)	54 (77.1)	*< 0.001
Severe	78 (100)	36 (46.2)	42 (53.8)	
Peripheral vascular disease	60 (14.9)	11 (17.7)	49 (14.3)	0.487
Arterial calcification	26 (6.4)	0 (0.0)	26 (7.6)	0.050
Food deformity	48 (11.9)	12 (19.4)	36 (10.5)	0.048
Previous ulcers	107 (26.5)	30 (48.2)	77 (22.5)	<0 .001
Amputation	25 (6.2)	12 (19.4)	13 (3.8)	< 0.001
Duration of Diabetes				
< 5 years	198 (100)	24 (12.1)	174 (87.9)	0.157
5 – 10 years	135 (100)	23 (17.0)	112 (83.0)	
> 10 years	71 (100)	15 (21.1)	56 (78.0)	*0.055
Method of DM treatment				
Oral/non-pharmacological	294 (100)	37 (12.6)	257 (87.4)	
Insulin	110 (100)	25 (22.7)	85 (77.3)	0.012

* P value for trend

Table 3: Univariate and multivariate analysis of predictors of foot ulcers in diabetic patients (N = 404)

Patients characteristics	Univariate O.R (95% C.I)	P-value	Multivariate O.R (95% C.I)	P-value
Age: < 55	1.00	0.022		0.473
> 55	1.91 (1.10 – 3.30)			
Gender: Female	1.00			
Male	0.90 (0.52 – 1.55)	0.702		
Smoking: Never	1.00			
Current	1.74 (0.46 – 6.57)	0.413		
Past smoker	1.16 (0.59 – 2.78)	0.664		
Alcohol: Current	1.00			
Past drinker	8.34 (1.09 – 63.60)	0.041		0.322
Never	8.29 (1.10 – 62.17)	0.040		0.718
Education				
No formal education	1.00			
Primary education	0.58 (0.26 – 1.27)	0.172		
Secondary education	0.69 (0.28 – 1.71)	0.422		
Post secondary	0.72 (0.17 – 2.99)	0.651		
Treatment: Oral/non-pharm	1.00			
Insulin	2.04 (1.16 – 3.59)	0.013	2.25 (1.17 – 4.32)	0.015
PVD: No	1.00			
Yes	1.18 (0.57 – 2.4)	0.660		
PN: No neuropathy	1.00		1.00	
Mild neuropathy	2.03 (0.41 – 10.1)	0.387	1.94 (0.4 – 9.7)	0.420
Moderate neuropathy	8.11 (3.3 – 19.9)	< 0 .001	8.14 (3.3 – 20.2)	< 0.001
Severe neuropathy	23.46 (10.2 – 54.0)	< 0.001	24.19 (10.4 – 56.3)	< 0.001
Previous ulcer: No	1.00			
Yes	3.23 (1.85 – 5.6)	< 0.001		0.185
Duration of DM: < 5 yrs	1.00			
5 – 10 yrs	1.49 (0.8 – 2.7)	0.208		0.552
> 10 yrs	1.94 (0.9 – 3.9)	0.068		0.962
Foot deformity : No	1.00			
Yes	2.04 (0.9 – 4.2)	0.052		0.887

Demographic and clinical characteristics of patients by the presence or absence of PN is shown in table 4 and that of PVD are shown in table 6. Patients with PN were more likely to be older with mean age of 56 ± 11, married and having longer duration of DM (table 4). The chance of having PN increased as the duration of diabetes increased with p value for trend of 0.004. In logistic regression model, age more than 55 years and diabetes duration of more than 10 years were both associated with the risk of having foot ulcer (table 5). Patients having PVD were older than those without PVD and were more likely to be non-alcohol drinkers although these differences were not statistically significant (P=0.088 for both) as shown in table 6. These variables were not significant statistically even when assessed by logistic regression (table 7). Of the 60 patients with Peripheral vascular disease, 86.7% were in Fountain class I, 10% in class II and 3.3% in class IV.

Out of the 404 patients, 33.7% had no added risk factor for developing diabetic foot ulcers apart from the diabetes itself (no added risk), 26.7% presented with one risk factor (at risk), and 24.3% had two or more risk factors (high risk) for developing foot ulcers. Peripheral neuropathy was the most prevalent risk factor in the groups with risks being 56.5% in at risk patients and 63.3% in the high risk patients although this difference was not statistically significant (P =0.321)

Among the eye complications, retinopathy was present in 19 patients out of 298 that were examined (6.4%) and cataract in 8.9% of patients. Among the co-morbidities, Hypertension was present in 56.7% of patients, five patients had stroke, six were on anti TB medications and four had HIV infection and were on Highly active antiretroviral treatment.

Table 4: Demographic and clinical characteristics of diabetic patients at the time of interview by presence or absence of PN.

Characteristics	Total population N=404 (%)	PN N=177	No PN N=227	P-value
Age (mean± S.D)	53.60±12.75	56.84±11.86	51.07±12.88	< .001
Gender				
Female	224 (100)	90 (40.2)	134 (59.8)	0.101
Male	180 (100)	87 (48.3)	93 (51.7)	
Marital status				
Married	305 (100)	138 (45.2)	167 (54.8)	
Never married	28 (100)	6 (21.4)	22 (78.6)	0.046
Previously Married	71 (100)	33 (46.5)	38 (53.5)	
Education level				
No formal education	46 (100)	27 (58.7)	19 (41.3)	
Primary education	253(100)	107 (42.3)	146 (57.7)	0.184
Secondary	87 (100)	35 (40.2)	52 (59.8)	
Post secondary	18 (100)	8 (44.4)	10 (55.6)	*0.155
Smoking				
Currently smoking	13 (100)	7 (53.8)	6 (45.6)	
Past smoker	78 (100)	32 (41.0)	46 (59.0)	0.675
Never smoked	313 (100)	138 (44.1)	175 (55.9)	
Alcohol Intake				
Currently drinking	42 (100)	16 (38.1)	26 (61.9)	
Past drinker	142 (100)	59 (41.5)	83 (58.5)	0.488
Never drunk alcohol	220 (100)	102 (46.4)	118 (53.6)	
Treatment groups				
Oral/Non-pharm	294 (100)	125 (42.5)	169 (57.5)	
Insulin	110 (100)	52 (47.3)	58 (52.7)	0.391
Duration of Diabetes				
< 5 years	198 (100)	75 (37.9)	123 (62.1)	0.014
5 – 10 years	135 (100)	61 (45.2)	74 (54.8)	
> 10 years	71 (100)	41 (57.7)	30 (42.3)	*0.004

* P value for trend

Table 5: Univariate and multivariate analysis of predictors of PN in diabetic patients at the time of interview (N=404).

Patients characteristics	Univariate O.R (95% C.I)	P-value	Multivariate O.R (95% C.I)	P-value
Age				
< 55	1.00		1.00	<0.001
> 55	2.30 (1.5 – 3.40)	< 0.001	2.13 (1.4 – 3.2)	
Gender				
Female	1.00			
Male	1.39 (0.94 – 2.07)	0.101		0.220
Marital status				
Married	1.00			
Never married	0.33 (0.13 – 0.84)	0.020		0.050
Previously married	1.05 (0.63 – 1.76)	0.851		0.649
Smoking				
Currently	1.00			
Past smoker	1.48 (0.49 – 4.50)	0.490		
Never smoked	0.88 (0.53 – 1.46)	0.625		
Alcohol				
Current	1.00			
Past drinker	1.16 (0.57 – 2.34)	0.689		
Never	1.41 (0.71 – 2.76)	0.325		
Education				
No formal education	1.00			
Primary education	0.52 (0.27 - 0.98)	0.042		0.529
Secondary education	0.47 (0.22 – 0.98)	0.044		0.664
Post secondary	0.56 (0.19 – 1.69)	0.306		0.903
Method of Treatment				
Oral/non-pharm	1.00			
Insulin	1.21 (0.78 – 1.88)	0.391		
Duration of DM				
< 5 years	1.00		1.00	
5 – 10 years	1.35 (0.87 – 2.11)	0.183	1.26 (0.79 – 1.97)	0.327
> 10 years	2.24 (1.29 – 3.89)	0.004	1.87 (1.06 – 3.30)	0.030

Table 6: Demographic and clinical characteristic of diabetic patients at the time of interview by presence or absence of PVD.

Characteristics	Total population N=378 (%)	PVD N=60	No PVD N=318	P-value
Age (mean± S.D)	53.60±12.75	56.37±11.23	54.81±14.3	0.088
Gender				
Female	215 (100)	29 (13.5)	186 (86.5)	0.145
Male	163 (100)	31 (19.0)	132 (81.0)	
Marital status				
Never married	24 (100)	5 (20.8)	19 (79.2)	
Married	285 (100)	45 (15.8)	240 (84.2)	0.762
Previously Married	69 (100)	10 (14.5)	59 (85.5)	
Education level				
No formal education	45 (100)	5 (11.1)	40 (88.9)	
Primary education	235 (100)	34 (14.5)	201 (85.5)	0.285
Secondary	81 (100)	16 (19.8)	65 (80.2)	
Post secondary	17 (100)	5 (29.4)	12 (70.6)	
Smoking				
Currently smoking	11 (100)	3 (27.3)	8 (72.7)	0.284
Past smoker	75 (100)	15 (20.0)	60 (80.0)	
Never smoked	292 (100)	42 (14.4)	250 (85.6)	
Alcohol Intake				
Currently drinking	40 (100)	2 (5.0)	38 (95.0)	0.088
Past drinker	130 (100)	19 (14.6)	111 (85.4)	
Never drunk alcohol	208 (100)	39 (18.8)	169 (81.2)	
Method of treatment				
Oral/non pharmacological	274 (100)	46 (16.8)	228 (83.2)	0.426
Insulin	104 (100)	14 (13.5)	90 (86.5)	
Duration of Diabetes				
< 5 years	184 (100)	26 (14.4)	158 (85.9)	0.664
5 – 10 years	126 (100)	22 (17.5)	104 (82.5)	
> 10 years	68 (100)	12 (17.6)	56 (82.4)	

* P value for trend

Table 7: Univariate and multivariate analysis of predictors of PVD in diabetic patients at the time of interview (N=404).

Patients characteristics	Univariate O.R (95% C.I)	P-value	Multivariate O.R (95% C.I)	P-value
Age				
< 55	1.00			
> 55	1.11 (0.64 – 1.90)	0.708		
Gender				
Female	1.00			
Male	1.40 (0.81 – 2.40)	0.231		
Marital status				
Married	1.00			
Never married	1.06 (0.50 – 2.21)	0.886		
Previously married	1.33 (0.41 – 4.30)	0.630		
Smoking				
Currently	1.00			
Past smoker	1.90 (0.51 – 7.30)	0.331		0.875
Never smoked	1.54 (0.80 – 2.90)	0.196		0.277
Alcohol				
Current	1.00			
Past drinker	3.09 (0.69 – 13.85)	0.141	3.06 (0.67 – 13.97)	0.150
Never	4.31 (0.90 – 18.59)	0.050	5.54 (1.25 – 24.00)	0.024
Education				
No formal education	1.00			
Primary education	0.52 (0.39 – 1.27)	0.105		0.511
Secondary education	0.40 (0.10 – 1.20)	0.104		0.160
Post secondary	1.54 (0.80 – 2.90)	0.102		0.102
Method of Treatment				
Oral/non-pharm	1.00			
Insulin	0.79 (0.41 – 1.49)	0.435		
Duration of DM				
< 5 years	1.00			
5 – 10 years	1.29 (0.69 – 2.38)	0.420		
> 10 years	1.35 (0.64 – 2.84)	0.435		

5.4. KNOWLEDGE ON FOOT CARE

In this study, 84.7% of the patients knew that Diabetes Mellitus is a significant problem in Tanzania. Among the complications of diabetes, diabetic foot ulcer was known by 72.5%. Knowledge on diabetic foot risk factors and about foot care is demonstrated in table 6. The knowledge responses did not differ according to risk categories of patients, except that patients in the no added risk and at risk group knew the importance of examining inside shoes and reporting to the hospital once they develop foot lesions more than other groups of patients.

The total scores for all knowledge questions was 23 and scores from patients' responses ranged from 0 – 23 with a mean score of 11.2 ± 6.4 S.D (95% CI of 10.58 – 11.83). Using analysis of variance, level of education, duration of DM, and having received information on foot care significantly affected the mean scores as shown in table 7. Patients attending Amana and MNH clinics had higher mean knowledge scores than those attending other hospitals.

In this study, 194 (48.0%) admitted to have received information about foot care, duration of diabetes had no effects on whether patients received information or not (P=0.158). Information was obtained verbally in 93.3%, thirty patients received brochure as the only source of information or in addition to verbal education. Majority of the patients received education from the nurses (83.5%) with only 16.6% obtaining the information from doctors, 6.2% had addition information from the media.

Table 8: Correct responses of diabetic patients on knowledge of diabetic foot questions at the time of interview by different risk categories.

Question (correct response)	Total n=404	No added risk n=136	At risk n=108	High risk n=98	Ulcers n=62	P-value
What are the causes of diabetes foot?						
Minor injuries	256 (63.4)	86 (63.2)	62 (57.4)	62 (63.3)	46 (74.2)	0.313
Shoe related	76 (18.8)	34 (25.0)	18 (16.7)	11 (11.2)	13 (21.0)	0.173
Burns	52 (12.9)	22 (16.2)	14 (13.0)	9 (9.2)	7 (11.3)	0.734
Is it important DM patients to inspect feet? (Yes)	223 (55.2)	85 (62.5)	54 (50.0)	51 (52.0)	33 (53.2)	0.324
If Yes, how often? (Daily)	183 (45.3)	63 (46.3)	49 (45.4)	44 (44.9)	27 (43.5)	0.892
How often should shoes be inspected inside? (Daily)	181 (44.8)	69 (50.7)	53 (49.1)	36 (36.7)	23 (37.1)	0.017
How often should the feet be washed? (Daily)	243 (60.1)	86 (63.2)	67 (62.0)	58 (59.2)	32 (51.6)	0.448
How warm should water be? (Cold/lukewarm)	296 (73.3)	104(76.5)	81 (75.0)	68 (69.4)	43 (69.4)	0.415
If you see a blister in your feet what do you do first? (Report)	174 (43.1)	60 (44.1)	52 (48.1)	40 (40.8)	22 (35.5)	0.03
What will happen if the wound is left untreated? (Amputation)	260 (64.4)	92 (67.6)	63 (58.3)	58 (59.2)	47 (75.5)	0.580

Table 9: Mean score of knowledge on diabetes foot care among diabetic patients according to socio-demographic and clinical characteristics.

Characteristics	Total population N=404	Mean (SD)	P value
Age			
<55	211	11.5 (6.4)	
>55	193	10.9 (6.3)	0.343
Gender			
Female	224	11.0 (6.7)	
Male	180	11.5 (6.0)	0.435
Education level			
No formal education	46	8.3 (6.1)	
Primary education	253	11.3 (6.4)	
Secondary	87	12.7 (6.1)	0.002
Post secondary	18	10.1 (6.8)	
Clinic attending			
MNH	99	12.3 (6.2)	
Mwananyamala	107	8.3 (6.2)	
Temeke	97	10.9 (5.8)	
Amana	101	13.6 (6.3)	<0 .001
Duration of DM (years)			
< 5	198	10.2 (6.7)	
5 – 10	135	12.7 (5.7)	
> 10	71	11.2 (6.1)	0.002
Received advice on foot care			
Yes	194	14.1 (5.3)	
No	210	8.0 (6.1)	<0 .001
Source of information			
Doctor	30	14.8 (4.9)	
Nurse	152	13.6 (5.4)	
Others	12	13.7 (6.4)	0 .538
Previous history of ulcer			
Yes	107	11.6 (5.9)	
No	297	11.1 (6.6)	0.490
Current diabetic ulcer			
Yes	64	11.0 (6.0)	
No	340	11.3 (6.5)	0.732

5.5. FOOT CARE PRACTICES.

Table 10 summarises foot care practices for the patients in different risk categories and those with foot ulcers. Foot self inspection was done regularly (6-7 days a week) by 37.9% of patients, majority of which were among patients with diabetic ulcers. Feet were washed regularly in 92.8% of the patients. Among the risk behaviours practiced by patients, more than 80% used sharp instruments like razor blade or knife for cutting nails. The foot care practices were not statistically significant between different risk categories as shown in table 10.

Table 10: Foot care practices of diabetic patients at the time of interview by risk categories.

Practices	Total n=404(%)	No added risk n=136 (%)	At risk n=108 (%)	High risk n=98 (%)	Ulcers n=62(%)	P-value
Foot care practices performed for 6 – 7 days						
Inspecting feet	153 (37.9)	57 (41.9)	40 (37.0)	33 (33.7)	23 (37.1)	0.631
Inspecting shoes	149 (36.9)	58 (42.6)	41 (38.0)	31 (31.6)	19 (30.6)	0.241
Washing feet	378 (92.8)	127 (93.4)	101 (97.2)	85 (89.8)	59 (95.2)	0.573
Dry between toes	213 (52.7)	77 (56.6)	58 (53.7)	48 (49.0)	30 (48.4)	0.596
Not soaking feet	374 (92.6)	129 (94.9)	99 (91.7)	94 (95.9)	53 (85.5)	0.091
Walking barefoot						
Outside the house	236 (58.4)	84 (61.8)	60 (55.6)	53 (54.1)	39 (62.9)	0.699
Inside the house	53 (13.1)	18 (13.2)	14 (13.0)	17 (17.3)	4 (6.5)	0.493
Use of sharp instruments to cut nails	351 (86.9)	114 (83.8)	91 (84.3)	89 (90.8)	57 (91.9)	0.213

Foot self care was not influenced by gender, duration of diabetes or method of DM treatment. When comparisons were made between the group that had received information and those who had not received information on foot care, patients who had received information were more likely to care for their feet and avoid risk behaviours than those who had not received any information, as shown in table 11. Likewise, people who had at least one foot examination by the doctor were more likely to care their feet than those who had never been examined (table 12). Attending doctors performed feet examination in 111 patients (27.5%) of which 58.1% were having foot ulcers. They were therefore, 41.9% patients with foot ulcers who reported that they have never been examined by the doctor.

Table 11: Foot care practices of diabetic patients by whether they have received or not received information on foot care.

Foot care Practice done for 6-7 days and foot risk behaviours	Total N=404	Patients who had received information n=194	Patients who had not received information n=210	P value
Inspect their feet regularly	153 (37.9)	102 (52.6)	51 (24.3)	< 0.001
Inspect shoes	149 (36.9)	101 (52.1)	48 (22.9)	< 0.001
Wash feet regularly	375 (92.8)	186 (95.9)	189 (90.0)	0.022
Dry between toes after washing	213 (52.7)	123 (63.4)	90 (42.9)	< 0.001
Not soaking	374 (92.6)	176 (90.7)	198 (94.3)	0.172
Never walk barefooted	115 (28.5)	72 (37.1)	43 (20.5)	< 0.001
Uses nail cutter to cut nails	53 (13.1)	25 (12.9)	28 (13.3)	0.890

Table 12: Foot care practices of diabetic patients by whether they had feet examined by the doctor.

Foot care practices done in 6-7 days and foot risk behaviours	Feet examined N=111	Feet not examined N=210	P-value
Inspecting feet	58 (52.3)	95 (32.4)	<0.001
Inspecting shoes	53 (47.7)	96 (32.8)	0.005
Washing feet	107 (96.4)	268 (91.5)	0.087
Drying between toes	71 (64.0)	142 (48.5)	0.005
Not soaking	94 (84.7)	280 (95.5)	<0.001
Never walk barefooted	48 (43.2)	67 (22.9)	<0.001
Uses nail cut to cut nail	11 (9.9)	42 (14.3)	0.240

5.5. SENSITIVITY AND SPECIFICITY OF AUTOMATED BP MACHINE FOR DETERMINING ABPI

The automated (oscillometric) blood pressure machine diagnosed PVD in 48 patients (13.4%) of the study population. A total of 358 patients were assessed using the both methods, in 48 patients, the blood pressure using automated pressure machine could not be done because of technical faults. If Doppler measurement is taken as the gold standard, the automated (oscillometric) measurement has a sensitivity of 83%, specificity of 93%, positive predictive value of 71% and negative predictive value of 97%.

Table 13: Sensitivity and Specificity of automated (oscillometric) BP machine in establishing diagnosis of PVD

	Doppler measurement		
BP machine (Oscillometric)	PVD present	PVD absent	Total
PVD present	48	20	68
PVD absent	10	280	290
Total	58	300	358

CHAPTER 6
DISCUSSION

6.1 PREVALENCE OF FOOT ULCER

This study included 404 diabetic patients who were predominantly adults with a mean age of 53 years. Half of the total study population (404) had DM for less than five years and nearly three quarters were on oral hypoglycaemic agents for DM control. This population is therefore more likely to be predominantly of patients with type 2 DM.

The lifetime risk of developing foot ulcer in patients with diabetes has been estimated to be 15%; however recent studies have shown that lifetime incidence could be as high as 25%. [6, 34] In this study, the prevalence of diabetic foot ulcer among patients attending public diabetic clinics in Dar-es-salaam was 15.3%. A similar prevalence of 15% was demonstrated by Abbas et al, among diabetic patients admitted at the MNH in 1997 – 1998. [7] In 1989, Wikblad et al showed prevalence of diabetic foot ulcers to be 4.6% in his study of 153 diabetic patients who were attending Muhimbili University clinic in Dar-es-salaam [32], in the same setting, the prevalence was 6.5% in 1995 among diabetic patients with PN. [44] The rise from 4.6% in 1989 to 15.3% in 2007 may reflect the increase in utilization of health care services and improvement in diagnosing patients with diabetes which is evidenced by the number of patients attending the clinics. Moreover this high prevalence which has not changed for years calls for new strategies in the prevention of foot ulcers which starts with health educations to both patients and healthcare providers .Kenya reported a prevalence of 4.6% [45], while in the United States, a large incidence study that was conducted from Jan 1993 to Dec 1995 and included 8,905 type 1 and type 2 DM patients showed a cumulative incidence of 5.8 over 3 years. [8]

Patients with foot ulcers had significantly higher direct cost for diabetic management per month as compared to those without ulcers. Given that the 55% of patients who reported to have regular (monthly) income, 45% were earning less than 100,000Tsh; they had to

use more than 30% of their monthly salary on treatment. A study done by Neuhann et al in Kilimanjaro region 1996, showed that direct costs of DM treatment (transport, clinic services and medications) per person was equivalent to 25% of the official minimum salary by then. [19]

6.2 MAGNITUDE OF RISK FACTORS

PN has been described by Gayle et al, as the most common component cause in the ulcer pathway in patients with diabetes mellitus. [9] This long term complication of diabetes has a prevalence that varies between regions depending on criteria used for diagnosis. [10, 11, 12] For the past 10 years, published data on prevalence of PN in Africa has ranged from 25% in Tanzania to 84% in Algeria. [3]

In this study the prevalence of PN as determined by the modification from NDS was 44%. Patients included in this study were examined for PN regardless of whether they had symptoms of neuropathy or not, making it possible to include those patients who present with significant PN without having any symptoms. The prevalence of PN among patients with foot ulcer was 94%. The risk for having foot ulcer increased with severity of PN with p-value for trend of < 0.001. Similar finding was reported by Abbas in 1995 where 100% of patients with foot ulcers had symptomatic PN. [44]

Patients with moderate PN were 8 times more likely to have foot ulcers, while those with severe PN were 24 times more likely than those with no neuropathy. Patients with PN in this study were older with diabetes duration of more than 10 years compared to those without PN. Similar observations were made in the EURODIAB study where patients who developed PN were 3.8 years older and had diabetes for 3.3 years longer than those who did not develop PN. [46]

Patients on insulin treatment had twice risk for having foot ulcer than those on oral hypoglycaemic drugs or non-pharmacological treatment. This finding do not suggest that more patients with Type 1 diabetes get foot ulcers, but it may reflect that the patients had

more severe diabetes or that the treatment regimen was changed because of the presence of ulcer. This finding is similar to the findings from other large studies that patients (especially) type 2 are more likely to have foot ulcers than non-insulin users. [11]

Peripheral vascular disease as identified by ABPI of < 0.9 was present in 15% of patients. Presence of PVD was not found to be associated with foot ulcer in this study. Although Boyko et al in the Seatle diabetic foot study identified Ankle brachia pressure index to be an independent risk factor for developing foot ulcer [11], other case controlled studies have failed to show that it is a predictor for foot ulceration. [47] The prevalence of PVD in Tanzania has been increasing from 2.9% in 1980, 12.5% in 2000 and 21% in 2002. [3] The increase in PVD has been demonstrated in many countries across African continent and is attributed to change in lifestyle and urbanization. [3] Because of the co-existence with PN, majority of patients with DM do not exhibit the classical symptoms of vascular insufficiency like, intermittent claudication, and therefore may not have any complaint despite reduced blood flow. Of the 60 patients who had low ABPI in this study, only 13% presented with symptoms of claudication or rest pain.

In univariate analysis, patients who were drinking alcohol were protected against foot ulcers. Moderate alcohol intake has been shown to prevent cardiovascular risks including PVD. [48] Majority of patients with PVD in this study were non-alcohol drinkers. Although the amount of alcohol taken by patients was not quantified; but the survey that was done among Dar-es-salaam residency above 16 years showed that, on average majority of male drinkers drink only during weekends and female drinkers drink only occasionally. [49] This study has been done in the similar population and therefore likely to have similar pattern of drinking. Therefore the study population is more likely to be of people who are drinking moderately and therefore benefit from the protective effect of alcohol. Different studies have come up with different conclusions regarding alcohol intake. The North-West Diabetes Foot Care study showed no association between regular alcohol intake of > 7 units per day and incidence of foot ulcer. [12] Smoking had no influence on foot ulcer in this study. Different studies have come up with different

conclusions regarding the effect of smoking probably because of the variability of smoking habits between geographical locations. Similar findings to the current study were found in the Seatle diabetic foot study where smoking status was unrelated to foot ulcer. [11]

Similarly, age > 55 , past history of foot ulcer, history of amputation and foot deformity were significantly associated with presence of ulcer in univariate analysis but failed to reach statistical significant in multivariate analysis. At the time of interview, 27% of patients reported to have had diabetic foot ulcer in the past, and 48% of those with active foot ulcer had foot ulcer in the past. Mantey et al described poor glycemic control, PN and increased alcohol intake to be the main factors predicting recurrent ulcers. [50]

In this study, foot ulcers increased with increase in duration of diabetes, although did not reach statistical significance; the p value for trend was 0.05. Similar findings were obtained by Ndip et al in Cameroon. [51] Body weight has been described in the Seatle Diabetic foot study as an independent risk factor for foot ulcer with higher risk associated with greater weight. One explanation is that of body weight-plantar pressure link, which has intuitive appeal as an explanation for the higher rates of foot ulcer in patients with increased weight. Although this association was not seen in this study, patients who were underweight were less likely to have foot ulcers compared to those with normal weight, overweight or obese. Some other reports have concluded that BMI is a poor predictor of peak plantar pressure. [11]

In order to prevent foot ulceration and subsequent amputation, clinical guidelines for diabetic foot care recommend annual foot screening of all diabetic patients in order to identify patients at "high risk' so that preventive interventions can be reinforced. [4, 25] Criterion used in this study to classify patient was adopted from the Global Guideline for Type 2 Diabetes. [25] Among the 404 patients 34 % only had no added risk factor for developing foot ulcer. Since this study did not include laboratory investigations, it is not possible to determine the role of glycemic control in different risk groups; however PN

was the most prevalent risk factor in the groups with risks and those with foot ulcers. If the results of UKPDS study are to be applied, it may be assumed that these groups might have poor glycemic control since, in the UKPDS, tight glycemic control was associated with reduced risk of microvascular complications including PN. These findings also suggest that screening for PN may be the single most important tool in identifying risk patients and efforts to delaying the onset of PN by well controlled diabetes may be key factor in primary prevention in this study group.

6.3 KNOWLEDGE ON FOOT CARE

The aim of this study was to determine the awareness of foot care among diabetic patients given the importance of foot care knowledge that have been demonstrated in previous studies. [52, 53] Responses to specific questions regarding foot care were similar across different risk categories except that, higher percentage of patients with no added risk and those at risk knew that they had to inspect inside their shoes everyday or every time before putting on, and they had to report to health care professionals the first thing after they have noted any lesion on their feet. Although this study did not investigate for the causes of foot lesions among patients with foot ulcers, shoe related trauma has been described to be an important cause of trauma that precedes foot ulcers and the importance of inspecting shoes can not be overemphasized. [9]

Over half diabetic patients in this study reported that they have not received information regarding foot care and of the patients who did receive information on foot care, over 80% received information from the nurses. This fact is well recognized in less developed countries where there is scarcity of trained personnel. [54] The duration of diabetes had no effect on whether a patient has received information or not.

The mean knowledge score was influenced by level of education, duration of diabetes, clinic attending and advice on foot care. Patients with no formal education were less knowledgeable, as were those with diabetes for less than 5 years and those who had not received advice on foot care. Patients with longer duration of diabetes may have more

chance of having diabetic education or having repeated sessions which may have influenced their knowledge scores. Khamsel et al had the same conclusion that low knowledge scores were attributed to low level of education and not receiving advice on foot care but in his study the duration of diabetes had no effects. [55] People with higher education level are more likely to read and obtain additional materials regarding foot care other than sessions obtained in the clinics. Patients attending Amana and MNH diabetic clinics had higher knowledge compared to those attending Mwananyamala and Temeke. The differences of knowledge score among different clinics could partly be explained by the number, training and experience of clinic staff. The MNH diabetic clinic has more staffs that are better trained with long experience compared to other clinics in the city. Contrary to this explanation, a study that was done in Italy showed no significant difference between patients attended by General practitioners and those attended by Internists or other specialities in terms of patients' education. A significant difference was between General practitioners and diabetologists. [31] Patients who reported to have received foot care advice from doctors had higher mean knowledge score than those obtained from the nurses although it was not statistically significant. Lack of awareness of the importance of foot care may result in neglect of feet especially for those patients who have insensate feet.

In the diabetic outpatient clinics, regular educational classes are provided on a day separate from a clinic day to all patients but stressing on the newly diagnosed patients. Patients may only attend once when they are diagnosed and may not see the need to attend on other days. Moreover, since the patients have to incur the transport cost on a separate day to attend the clinic, they may find it expensive to attend. Those with foot problems especially painful PN may not be able to come frequently and may opt to make just one trip where they will be getting prescriptions for their medications. Because of these reasons, Wadd et al recommended that education programme be flexible to be offered at any time for the maximum convenience of the patients and not limited to the convenience of the providers. [56]

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6.4 FOOT SELF CARE PRACTICES

In this study, foot self care practice was not performed by too many patients even in the subgroups with increased risks for developing foot ulcers. Foot hygiene was not found to be a problem in this community and over 90% reported to be washing feet regularly as part of general cleanliness or prerequisite during prayer sessions, but when it came to drying between toes, the number dropped to almost half. Majority of the patients did not inspect their feet regularly or inspect inside shoes. Among the risky behaviours; cutting toe nail with sharp instruments like razor blade or knife was done by over 80% of the patients and only 29% of patients reported never to walk barefooted. These behaviours can cause minor injuries especially if a patient has PN or retinopathy as part of diabetes complications.

Foot self care was practiced similarly in all risk categories of patients but improved among the group that had received advice on foot care and among patients whose feet have been examined by the doctor at least once. Similar observations were made by Bell et al, in evaluating long term diabetes self management among elderly population in the United States, where patients who had received advice on foot care and those who had been examined by the doctor or shown by the doctor how to examine feet, were more likely to practice foot self care. In contrast to this study's findings, he also found that females were more likely to care for their feet than males. [57]

The role of foot care education has been stressed to be an important aspect in reducing the burden of foot ulcers and amputation especially in underdeveloped countries like Tanzania. A survey done in Tanzania after the initiation of step-by-step project has demonstrated a reduction of rates of amputation after two years of implementation of foot care strategies. [54]

6.5 VALIDITY OF AUTOMATED BP MACHINE IN DETERMINING PVD

The automated (oscillometric) blood pressure machine diagnosed PVD in 13% of patients. When the validity of the test was done using the gold standard (Doppler test), it

was found to have a sensitivity of 83% and specificity of 93%. Use of automated pressure machines have been advocated as it provides an easier means of identifying patients with PVD since Doppler devices are not available in many hospitals. It is even more difficulty to be practical, especially in the setting of public clinics, because they need expertise and consume more time. A study done by Beckman et al, which included patients with and without diabetes showed that automated (oscillometric) measurement of ABPI to be a reliable method for diagnosing PVD. [58] In his study, when compared to gold standard Doppler, automated machine had sensitivity of 88% and specificity of 85% in the left leg and sensitivity of 73% and specificity of 95% in the right leg.

6.6 STUDY LIMITATIONS

Study limitation that needs to be mentioned here is the inability to test for glycosylated haemoglobin in this study because of financial constraints which makes it difficult to relate glycaemic control to the development of foot ulcers of PN a major risk factor in the development of foot ulcers. Also it made it impossible to identify as to how much poor glcycemic control influence DFD.

CHAPTER 7.

CONCLUSION AND RECCOMMENDATIONS

7.1 CONCLUSION

1. The prevalence of diabetic foot ulcers is high among patients attending public diabetic clinics in Dar-es-salaam.
2. PN is the major risk factor for foot ulcer in this population. Avoidance of injuries of an anaesthetic limb and appropriate foot care practice by both patients, and health care providers may reduce foot ulcers.
3. Level of knowledge regarding foot care is low among patients and can still be improved.
4. Proper foot care is not practised adequately by patients and health care providers

7.2 RECCOMMENDATIONS.

1. Improve health education among doctors so as increase knowledge on identifying risk factors for foot ulcers.
2. To put in place foot care programmes that will be able to identify patients with risk factors and those already having foot ulcers.
3. To improve patients' knowledge on risks of developing foot ulcers and on foot self-care.
4. T o encourage patients on foot self care behaviour.

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APPENDECES

Appendix 1. Consent Form (English)

My name is Dr. Faraja Chiwanga. I am currently involved in a research project addressing issues related to diabetes and its foot complications. The project looks at the prevalence, risk factors, for developing foot ulcers as well as knowledge, attitude and practices of foot care among diabetic patients. The study is performed as a partial fulfilment of the requirements for my Master's Degree in Internal Medicine at Muhimbili University College of Health Sciences.

You are invited to participate in this research study. Your participation in this project will provide useful information on the topic. You were selected as a possible subject in this study because you are among diabetic patients who are at risk of developing foot ulcers Your participation in this study is entirely voluntary. Your decision whether or not to participate will not prejudice you or your medical care.

If you choose to participate, I, Dr. Faraja Chiwanga, or my research assistant, will ask you questions about foot care. You will be asked questions and required to answer them to the best of your knowledge without feeling bad by not knowing some of the answers. You will then undergo physical examination which will involve measuring your Blood Pressure in the arm and the leg and examining your feet. Participation for each participant is expected to be approximately 1 hour.

There are no potential risks associated with this study; instead there is a benefit. Apart from the one hour spent on answering questions and being examined, you will have the benefit of physical examinations that are not conducted in routine diabetic clinics, especially for those with potential risk factors for developing foot ulcers.

The information that will be collected will be confidential. The results of this study may be presented at medical meetings however your identity will not be disclosed.

Your participation in this study will no cost you anything, so there will be no payment.

YOUR SIGNATURE INDICATES THAT YOU HAVE READ AND UNDERSTOOD THE ABOVE INFORMATION, AND THAT YOU HAVE DECIDED TO PARTICIPATE BASED ON THE INFORMATION PROVIDED

Signature of Adult Participant /Parent/Guardian Date

_____ _____

Name of Researcher: _____

Adress: MUCHS
PO Box 65001
Dar-es-Salaam.
Phone: 0754-587900

Appendix 2. Consent form (Swahili)
Fomu ya Ridhaa

Ninaitwa Dr. Faraja Chiwanga, kwa sasa ninashughulika na utafiti wa maswala ya vidonda vya mguu, kwa wagonjwa wa kisukari, pamoja na mambo yepi yanayoleteleza kupata vidonda vya mguu mara kwa mara. Utafiti huu pia unaangalia hali ya elimu, uelewa na njia za utunzaji wa vidonda hivi kwa wagonjwa wenyewe wa kisukari. Uchunguzi huu ninafanya kama sehemu ya masomo yangu ya stashahada katika kitengo cha Internal Medicine cha Chuo Kiku cha Muhimbili.

Uchunguzi huu hauna hali ya hatari yo yote. Ingawa utatumia muda wako kujibu maswali, iko faida utakayopata, hasa kwa wale wenye hatari ya kupata shida ya miguu, ni kule kupimwa kwa makini ambako kwa kawaida hakufanyiki unapohudhuria kliniki za kisukari

Unakaribishwa kushiriki katika utafiti. Ushiriki wako katika utafiti huu utasaidia kuleta maelezo sahihi kwa somo hili. Umechaguliwa kama muhusika wa somohili kwa sababu wewe ni mmoja wa wagonjwa wa kisukari unayehudhuria tiba katika hospitali za hapa Dar es Salaam. Ushiriki wako katika zoezi hili ni wa hiari. Uamuzi wa kushiriki ama kutoshiriki hautakuondolea haki yako ya kupata tiba.

Endapo utachagua kushiriki, Mimi, Dr. Faraja Chiwanga, au msaidizi wangu katika utafiti huu tutakuuliza maswali juu ya utunzaji wa mguu. Utakapo ulizwa maswali utatakiwa kuyajibu kwa jinsi unavyoelewa, bila kufikiria kuwa unadhalilishwa ikiwa hujui majibu ya maswali mengine, utapimwa pia kikamilifu kwa kuchukua Blood Pressure (Mzunguko wa Damu) katika mkono na mguu na kupima miguu yako. Uchunguzi na maswali unaweza kuchukua kama saa moja hivi kwa kila mshiriki.

Maelezo yote yatakayochukuliwa yatatunzwa kwa siri. Matokeo ya uchunguzi huu yanaweza yakatolewa katika vikao vya tiba, hata hivyo wewe hutatambulishwa.

Uchunguzi huu hautakugharimu wewe fedha yoyote hivyo hakutakuwa na malipo yoyote.

SAHIHI YAKO INAMANISHA KUWA UMESOMA NA KUELEWA MAELEZO YALIYOPO HAPO JUU, NA UMEAMUA KUSHIRIKI KUFUATANA MAELEZO YALIYOPO.

_____ _____
Sahihi ya Mshiriki/Mzazi/Mlezi Tarehe

Jina la Mchunguzi.....

Anuani: MUCHS
P O Box 65001
Dar es Salaam
Phone: 0754 587900

Appendix 3. Questionnaire (English)

A. Personal information

1. Name .....
2. Identity number .....
3. Age ☐
4. Gender
   1. Female ☐
   2. Male
5. Marital status
   1. Never married
   2. Married
   3. Previously married (divorced/widowed) ☐
   4. Cohabiting
6. What is the level of your education?
   1. Never gone to school
   2. Primary education
   3. Secondary education and vocational training ☐
   4. Advanced diploma/graduate/above
   5. Others (eg. Madrasa)
7. Do you smoke cigarettes?
   1. Current smoker
   2. Past smoker ☐
   3. Never smoked
8. Do you drink alcohol?
   1. Currently drinking ☐
   2. Past drinker
   3. Never drinking
9. Do you own some of the things mentioned below?
   1. House, block and iron roofed
   2. House mud/ or mud roofed etc
   3. Car ☐
   4. Business
   5. Television/video etc/music system
   6. None
10. Do you have a regularly paying job?
    1. Yes ☐
    2. No
11. How much do you earn in month?
    1. <100,000
    2. 100,000 – 199,000 ☐
    3. 200,000-299,000
    4. ≥ 300,000
12. How much do you spend for food in a month in your family?
    [ ]
13. How much do you spend for diabetes care in month?
    1. Buying drugs [ ]
    2. Others [ ]
       i) Glucose measuring
       ii) Admission
       iii) Transportation
       iv) Other treatments like HT, Eyes etc

Total .....

B. Information on diabetes

14. Which clinic do you usually attend?
    1. M.N.H
    2. Mwananyamala ☐

3. Temeke
4. Amana

15. How long since the diagnosis of diabetes?
    1. < 5 years
    2. 5-10 years
    3. > 10 years

16. What method do you use to control your diabetes
    1. Diet/or tablets
    2. Insulin
    3. Insulin and tablets
    4. Others

17. How often do you run out of medication?
    1. None of the time
    2. Few times
    3. Most of the time
    4. Almost every time

18. How often do you forget to take your medications?
    1. None of the time
    2. Few times
    3. Most of the time
    4. Almost every time

19. Do you have your own glucometer at home?
    1. Yes
    2. No

20. Have you ever had a diabetic ulcer (hand or foot)?
    1. Yes
    2. No

21. Have you ever had amputation because of diabetic wound?
    1. Yes
    2. No

C. KAP

22. Is diabetes a big problem in our country? (Yes)
    1. S
    2. P
    3. D

23. What is the cause of diabetes ?(pancreatic problem, obesity, inactivity)
    1. S
    2. P
    3. D

24. What methods are used to control diabetes**?**

	Diet	Insulin	Tablets
S			
P			
D			

25. What are the complications of diabetes?

	↓hypo	ulcer	eyes	sex ↓	stroke	heart
S						
P						
D						

26. What things can predispose a diabetic patient to get ulcers?

	1.minor wounds	2.Tight shoes	3. Burns	4. Others
S				
P				
D				

27. Is it important for diabetic patients to inspect their feet at home? (Yes)
    1. S
    2. P
    3. D

28. Why is it important for diabetic patient to inspect their feet?

	1.pain↓	2.callus	3.corn
S			
P			
D			

29. How often should patients with diabetes inspect their feet (everyday)
    1. S
    2. P
    3. D

30. How often should patients with diabetes wash their feet (everyday)
    1. S
    2. P
    3. D

31. How often should patients with diabetes inspect inside their shoes? (everyday/ every time shoes put on)
    1. S
    2. P
    3. D

32. How hot should the water for washing feet be? (cold/ lukewarm)
    1. S
    2. P
    3. D

33. If you see redness between toes or minor cuts or scratch what do you do first? (see a doctor/nurse)
    1. S
    2. P
    3. D

34. What will happen if diabetic ulcer is left untreated?(gangrene/ amputation)
    1. S
    2. P
    3. D

35. What treatment does a patient with diabetic ulcer receive apart from continuing diabetic drugs? (Antibiotics/wound dressing)
    1. S

2. P
3. D

36. How often do you attend diabetic clinic?
    1. Kila mwezi
    2. Kila baada ya miezi 3
    3. Kila miezi 6
    4. mara moja kila mwaka

37. How many days of the 7 days past have you inspected your feet?

38. How many days of the 7 days past have you inspected inside your shoes?

39. How many days of the past 7 days have you washed your feet?

40. How many days of the past 7 days have you dried in between your toes?

41. How many days of the past 7 days have you soaked your feet?

42. If you soaked your feet what did you use?
    1. Lukewarm water
    2. Cold water
    3. Eusol
    4. Others

43. Do you walk barefooted?
    1. When inside the house
    2. When outside the house
    3. Never walk barefooted

44. What type of shoes do you usually wear?
    1. Covering shoes
    2. Open shoes
    3. High heeled shoes
    4. Sports shoes
    5. Slippers

45. What do you usually use for cutting your nails?
    1. Nail/teeth
    2. Nail cutter
    3. Scissors
    4. Knife
    5. Lazor
    6. Others

46. Have you ever received advice of foot care?
    1. Yes
    2. No

47. What was the form of advice?
    1. Brochures
    2. Verbal
    3. Demonstrations
    4. Video
    5. Others

48. Who gave the advice?
    1. Doctor
    2. Nurse
    3. Relatives/friends/radio

49. Have you ever had a diabetic wound?
    1. Yes
    2. No

50. When last were your feet examined by a doctor/healthcare proffessional?
    1. 6/12 ago
    2. 1 year ago
    3. More than 1 year
    4. I have never been examined
    5. After reporting numbness, ulcer pain etc

51. Once diabetic wound develop the only management is amputation.
    1. Agree
    2. Neutral
    3. Disagree

52. Management of diabetic ulcers include soaking in water or euso at least once a day.

    1. Agree
    2. Neutral
    3. Disagree ☐

53. There are several home remedies that can effectively treat diabetic ulcers
    1. Agree
    2. Neutral
    3. Disagree ☐

D. Physical Examination

1. General examination
1. Weight ……..
2. Height ……
Body mass Index
   1. Normal weight (18 – 24.9)
   2. Underweight (< 18)
   3. Overweight (25 – 29.9)
   4. Obesity (>30) ☐

2. Eye examination
1. Normal
2. Low visual acuity
3. Cataract
4. Retinopathy ☐

3. CVS
1. PR ……..
2. BP …….
3. Precordium……

Conclusion
1. Normal
2. Abnormal ☐

4. RS
1. Rate ……..
2. Chest auscultation
Conclusion
   1. Normal
   2. Abnormal ☐

5. Other medical conditions (if 2 put a code)
1. Normal
2. Abnormal ☐

6. Amputation
1. Yes
2. No ☐

7. Ulcer
1. Yes
2. No ☐

7b. **Fungus**
1. Yes
2. No ☐

8. Foot deformity (flat foot, claw foot, charcoat foot etc)
1. Yes
2. No ☐

9. Ulcer duration
1. ≤14 days
2. 14 days – 8weeks
3. >8weeks ☐

10. Peripheral Neuropathy
10a. Neuropathy symptoms (numbness, tingling, burning sensation)
1. Absent
2. Present ☐

10b Neuropathy Disability Score

	Right foot	Left foot
Sensation Pain Vibration Pressure		
Reflexes Present Reinforced Absent		

Sensation

0-present
1-Absent
Reflexes
0-Present
1-Reinforced
2-Absent

Range of Neuropathy 0-10
1. 0 : No Neuropathy
2. 1-3: Mild neuropathy
3. 4-7: Moderate Neuropathy
4. 7-10: Severe Neuropathy ☐

11. Peripheral vascular disease

Palpable pulses
Dorsalis pedis R L
Post. Tibial R L
1. 4
2. 3
3. 2
4. 1 ☐

ABPI by automated BP machine
1. 0.9 -1.2
2. <0.9
3. <0.3
4. > 1.3

ABPI by Doppler
1. 0.9 -1.2
2. <0.9
3. <0.3
4. >1.3

Symptoms of arterial disease

Intermittent claud	
Rest Pain	
Gangrene	

0-Absent
1-Present

1. Absent
2. Present
3. Arterial calcification ☐

11 b. Fountain class
1. Class 1
2. Class 2
3. Class 3
4. Class 4 ☐

12. FOOT CLASSIFICATION
1. No added risk
2. At risk
3. High risk
4. Diabetic ulcer ☐

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