

**ASSESSMENT OF DRUG COSTS FOR MANAGEMENT OF DIABETES
AND ITS COMPLICATIONS AT MUHIMBILI NATIONAL HOSPITAL
OUTPATIENT PHARMACY**

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**ASSESSMENT OF DRUG COSTS FOR MANAGEMENT OF DIABETES AND ITS
COMPLICATIONS AT MUHIMBILI NATIONAL HOSPITAL OUTPATIENT
PHARMACY**

By

Anna Pius

**A Dissertation submitted in (Partial) fulfillment of the requirements for the Degree
of Master of Science in Pharmaceutical Management of
Muhimbili University of Health and Allied Science.**

**Muhimbili University of Health and Allied Sciences
November, 2013**

CERTIFICATION

The undersigned certify that she/he has read and hereby recommend for acceptance by a Muhimbili University of Health and Allied Sciences a dissertation entitled "**Assessment of drug costs for management of diabetes and its complications at Muhimbili national hospital outpatient pharmacy**" in fulfillment of the requirements for the degree of Master of Science in pharmaceutical management of the Muhimbili University of Health and Allied Sciences.

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Date

DECLARATION

AND

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I, Anna Pius, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for similar or any other degree award.

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DEDICATION

This work is dedicated to my Husband, Sallingu W.M and my two children Glory-Nchambi and Ian-Lwikey, they have been missing my attention during the busy time of my course work but they had been tolerant and very supportive.

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ABBREVIATIONS

ADA	American Diabetes Association
AIDS	Acquired Immune Deficiency Syndrome
ACE	Angiotensin Converting Enzymes
ANOVA	Analysis of Variance
BNF	British National Formulary
CDC	Centers for Diseases Control
D	Prescriptions cost for patients with diabetes medicines only
DC	Prescriptions cost for patients prescribed diabetes and cardiovascular medicines
DL	Prescriptions cost for patients prescribed diabetes and lipids lowering medicines
DLC	Prescriptions cost for patients prescribed diabetes, lipids lowering and cardiovascular medicines
DM	Diabetes Mellitus
FDA	Food and Drug Administration
GDM	Gestational diabetes mellitus
HIV	Human Immunodeficiency virus
IDDM	Insulin Dependent Diabetes Mellitus

IDF	International Diabetes Federation
MNH	Muhimbili National Hospital
MOHSW	Ministry of Health and Social Welfare
MODY	Mature Onset Diabetes of the Young
MSD	Medical Stores Department
MSH	Managing Sciences for Health
MUHAS	Muhimbili University of Health and Allied Sciences
NIDDM	Non Insulin Dependent Diabetes Mellitus
PPY	Per Person Year
TDA	Tanzania Diabetes Association
TSHS	Tanzanian Shillings
USD	United States Dollars
WHO	World Health Organization

ABSTRACT

Introduction

The estimated numbers of diabetes mellitus patients in Tanzania are most probably going to increase as a result of longer expected life expectancy, urbanization associated with a high prevalence of obesity and sedentary lifestyle. Drugs cost for the management of diabetes and its complications as a key factor for the determination of patients' affordability should be looked with critical eye for the better function of the health care system.

Study objective

The objective of the study was to assess drug costs for management of diabetes and its complications at Muhimbili National Hospital (MNH) outpatient pharmacy.

Methodology

This was cross sectional retrospective study. Data was collected through Retrieval and review of electronic data of all diabetes outpatients registered from 1st January 2012 to 31st December 2012 available in the MNH JEEVA Database. The drug cost – prices was obtained from the Public distributor of drugs (Medical Stores Department), price of the Hospital buying consortium and the retail price at the intramural practice pharmacy at MNH.

Results

The most commonly prescribed medicines for diabetes, cardiovascular and elevated cholesterol were metformin, losartan and atorvastatin respectively. One third of Diabetes out patients at MNH had cardiovascular and elevated cholesterol complications. The mean cost per prescription for patients prescribed diabetes medicines only was Tshs. 17,191.3/=. Patients prescribed diabetes and cardiovascular medicines had a significantly higher mean prescriptions cost of 51.8 %,(P-value <0.01) as compared to patients prescribed diabetes medicines alone. Similarly diabetes patients prescribed both diabetes medicines and lipid lowering medicines drugs also had a significantly higher mean prescriptions cost of 121.9 %,(P value <0.01) as compared to patients prescribed diabetes medicines alone. However the

most striking and significant mean prescription cost of 207.4 % (P value <0.01) was seen in patients prescribed Diabetic, Lipid lowering and cardiovascular medicines as compared to patients prescribed diabetes medicines alone.

Conclusion and recommendation

About one third of Diabetes mellitus out patients attended at MNH for the study period were also suffering from cardiovascular or elevated cholesterol complications. The cost of treating these complications is significantly higher compared to the cost of treating patients with diabetes alone. The Government should improve efforts for timely diagnosis of diabetes by mandating community pharmacies to screen for diabetes and elevated cholesterol so as to reduce diabetes complications and reduce the cost of treating diabetes complications.

CHAPTER ONE

1.1.0 INTRODUCTION AND LITERATURE REVIEW

In 2012 the International Diabetes Federation (IDF) estimated that the number of diabetes patients was more than 371 million, with 4 out 5 of these persons coming from low and middle income countries (IDF, 2012). This scourge not only results in unnecessary loss of life but imposes a large economic burden on the individuals, national healthcare systems and the economy, due to loss of productivity and the cost associated with treating complicated diabetes (Mbanya, 2010). With the incidence of diabetes increasing in Africa, strategies need to be put in place to effectively prevent and control all forms of diabetes in Africa to ensure that the merger economics gains that Tanzania has achieved are not eroded by health care expenditure on diabetes.

1.1.1 Types of diabetes mellitus

In Tanzania and globally diabetes mellitus presents in three major forms namely; type 1, type 2 and gestational diabetes.

Type 1 diabetes mellitus (previously known as insulin dependent or childhood onset diabetes) is characterized by lack of insulin production. It is the least common of the two main diabetes types, its incidence in Tanzania is estimated to be 1.5/100,000 (Majaliwa et al 2008). A common indicator of the presence of type 1 diabetes is a condition called ketoacidosis, Diabetes Ketoacidosis (DKA) has been found in the range of 7-80% (4-8) in newly diagnosed patients and 25-90% in children who have already been diagnosed with diabetes (Majaliwa et al 2008). If left untreated ketoacidosis can result in extremely serious complications and even prove fatal (Kitabchi et al, 2009).

Diabetes mellitus type 2 (formerly known as noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes) is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin. The classic symptoms of this condition are excess thirst, frequent urination, and constant hunger. This type of diabetes is far more common than type 1 diabetes and accounts for 85-95% of all people with diabetes (WHO, 2006). Obesity is thought to be the primary cause of type 2 diabetes in individuals genetically predisposed to the disease. This form of diabetes also referred to as adult onset diabetes or Mature Onset Diabetes of the Young (MODY), is generally more common in adults rather than children. However with increased urbanization resulting in sedentary lifestyles resulting in obesity more and more children are now being diagnosed with the condition (WHO, 2006).

Gestational diabetes mellitus (GDM) is a type of diabetes that develops in around 2 to 5% of all pregnancies. It occurs because the body has less ability to produce enough insulin to meet the extra needs of the pregnancy. This type of diabetes occurs more frequently in women with a history of diabetes, over the age of 25, part of minority race and women that are overweight or obese. Despite disappearing once pregnancy is over, GDM leaves women with a higher risk of later developing type 2 diabetes mellitus (WHO, 2006).

1.1.2 Management of uncomplicated and complicated diabetes mellitus.

The goal in caring for patients with diabetes mellitus is to eliminate symptoms and to prevent or to slow, the development of complications. Micro vascular (i.e. eye and kidney diseases) risk reduction is accomplished through control of glycaemia and blood pressure; Macro vascular (i.e. coronary cerebrovascular, peripheral vascular) risk reduction, through control of lipids and hypertension, smoking cessation, and aspirin therapy.

Management of diabetes mellitus generally includes the following: Dietary and exercise modifications, medications, self-monitoring of blood glucose, regular monitoring of

complications and laboratory assessment. Commonly oral anti-diabetic drugs are used for the treatment of type 2 diabetes mellitus. However these drugs should only be prescribed if the patient fails to respond adequately after at least 3 months restriction of energy and carbohydrate intake and an increase in physical activity. These drugs should only be used to augment the effect of the diet and exercise, and not to replace them. For patients not adequately controlled by diet and oral hypoglycemic drugs (type 1 diabetes mellitus) insulin should be provided (BNF, 2011).

The commonly prescribed antidiabetics drugs in England from 2003 to 2008 were metformin followed by the sulphonylureas (Srinivasan et al, 2008). Similarly, in Mexico, metformin was the most commonly prescribed followed by Glipizide extended release (Messer, 2004).

The use of statins (atorvastatin, fluvastatin, pravastatin, rosuvastatin and simvastatin) has increased sharply in recent years, and they are now among the most widely prescribed medicines in the world. In addition, the most recent data from the National Health Nutrition Examination Survey (2012), 22 percent of Americans 45 years and older take statin drugs. Statins are the group of medicines that are commonly used to reduce the level of cholesterol in the blood. They work by blocking the action of certain enzyme (chemical) which is needed to make cholesterol.

The cardiovascular drugs encompass a large number of prescription medications that are used to control heart diseases. These are Angiotensin Converting Enzymes Inhibitors (ACE I), Angiotensin II Receptor Blockers, Antiarrhythmics, Antiplatelets, Beta blockers, Calcium Channel Blockers, Clot Buster, Digoxin Diuretics, Nitrates, Warfarins and other blood thinners(Consumer report,2012).

1.1.3 Drug cost for the management of diabetes and its complications

Diabetes mellitus in Tanzania is an emerging major health problem that not only cause morbidity and mortality but also levels a large financial burden on health care systems. Economic loss due to chronic ill health is associated not merely with the cost of care but takes a heavy toll in terms of loss in productivity.

A study by Lee et al (2013) in Australia, found that annual direct per person costs was 1,898 Australian dollars(A\$) for those with known diabetes. While the cost for people with diabetes mellitus and both micro- and macro vascular complications was 4390A\$. Similarly a study done in Hong Kong found that the annual total cost of Type 2 DM in a patient was US\$ 1,725 +/- 2,044with direct costs accounting for more than 87.9%. %(Chan et al, 2007).

Kanavos et al (2012) in UK revealed that, an estimated £14 billion pounds was spent a year on treating diabetes mellitus and its complications, with the cost of treating complications representing the much bigger cost. Likewise, a 2012 report from the London School of Economics, estimates that the cost of prescribing medications for complications of diabetes mellitus is around 3 to 4 times the cost of prescribing diabetes mellitus medication. Medication for cardiovascular constitute the largest proportion of prescriptions cost for people with diabetes mellitus.

In Germany, the annual total prescription costs per diabetic patient were £559. Average costs for antidiabetic medication were £172. The major antidiabetic cost factor was insulin and analog, which accounted for 22% of the total drug costs in diabetic patients. All oral antidiabetic drugs together accounted for 8% of total costs. New drugs (glitazone, glinides and insulins) accounted for 15% of total cost (40% of antidiabetic drugs). A 40% increase (£387) in all non diabetes related drugs was due mainly to cardiovascular and lipid lowering drugs (Rathman et al, 2004)

Even though several drug clinical trials have demonstrated that tighter glycemic control can prevent diabetes mellitus complications in individuals (Shina et al, 2010). These studies have also unfortunately found that tighter glycemic control has no added advantage in terms of preventing cardiovascular complications in these patients (Gerstein et al, 2008; Patel et al, 2008). Consequently the search for better anti hyperglycemic agents and newer prevention strategies for diabetes are required.

Recently, the U.S. Food and Drug Administration (FDA) approved nine new products for glycemic control (Nathan, 2007). Some are new forms or combinations of existing classes, whereas others belong to new therapeutic classes such as amylin analogs, glucagon-like peptide-1 receptor agonists, incretins, and dipeptidyl peptidase-IV inhibitors. Although these agents increase the management options available, they come at an increased cost and may not be appropriate for all populations (Ramachandran et al, 2007; Rathmann et al, 2007; Alexander et al, 2008; Schwarz et al, 2008 and Liao, 2012). Particularly for developing countries such as Tanzania, with a mean monthly household expenditure budget of 20,122 Tanzanian shillings (Tsh) per capita (Tanzania National Household Budget Survey, 2007).

1.1.4 Pharmaceutical management and diabetes

Pharmaceutical management is the set of practices aimed at ensuring the timely availability, affordability, and appropriate use of pharmaceuticals in health-care settings. Pharmaceutical management has four components that form a cycle, namely selection of the product, procurement; distribution and its use to the patients (MSH, 1997).

To date the majority of pharmaceutical management studies conducted in Tanzania have concentrated on affordability and availability of anti-diabetes drugs (Piette et al, 2004; Norman et al, 2007; Matowe et al, 2008; Temu et al, 2009) with limited studies on how to prioritize DM medication in hospital formularies.

Although it is generally accepted that availability and affordability of pharmaceuticals has been one of the most visible symbols of quality of care of any health care system (**World Bank**, 1994). It can be however be argued, that it is not just the stocking of medications but stocking the right and most affordable medications to be among the correct indicators of quality pharmaceutical health care.

With ongoing global economic crisis, health care budgets have suffered severe cuts particularly in resource strapped countries like Tanzania. As a result countries like **these**, often

experience stocks outs of even essential medicines (Francis, M. K. 2011). For resource strapped health systems or institutions to implement quality pharmaceutical health care, they must not only ensure that key medications are rarely out stock, but they must also determine what they are , assess trends in drug use, as well as find the most cost effective mechanisms for prioritization of drugs for their hospital formulary. This will ensure that for their specific populations, they have drugs they really need with the most affordable option prioritized.

To date however, there have been limited studies to find alternative conceptual frameworks for cost efficient way to assess use and prioritize drugs in resource strapped countries a key function of effective pharmaceutical management. One approach could be to utilize electronic prescription data for a specific disease such diabetes for this framework. We thus intend to embark on a determining study of electronic prescription costs records for diabetes out-patient to assess the feasibility of this approach. We anticipate that this exercise will not only facilitate the determination of prescription trends, shed light on stocking and budgeting need, it may also be the basis to determine patients' ability to pay for their prescriptions in the future. Furthermore we anticipate that it will inform hospital planners and policy makers how to prioritize and budget for diabetes medicines. In addition to this it may provide much need data on drug use trends in specific population groups that could be used to make inference for use in diabetes control and prevention programs. Nonetheless all above said it may in the long run facilitate that health institutions rarely run out of stocks and thus prevent the costly complications of diabetes as results of non-adherence.

1.2 PROBLEM STATEMENT

The prevalence of DM in Tanzania and health care costs are increasing inversely to available health resources. This situation has been made worse by the fact that cost for new DM medications have been dramatically rising, posing major challenges to hospital budgets. As a result, health care planners and providers have been forced to cut resources worldwide including Tanzania. These cutbacks may have resulted in diabetes patients developing unnecessary complications as due unavailability of free or subsisted DM medications in government health care institutions.

For national diabetes control programs to be effective, health care institutions have to be able to plan and allocate their meager resources through best evidence based approaches. In order for them to do this appropriately they need to be provided with adequate background data that is current. Amongst the data that has to be collected, is information of the currently prescribed DM medications plus estimates of the current of cost and use of drugs for DM within various groups of patients. Although there have been studies relevant to decision making in hospitals regarding drugs, none have described how electronic prescription data can assist in priority setting and budgeting for drugs in hospitals. The findings from this study my provide evidence how electronic prescription data can used to track drug use trends, improve hospital's drug priority setting and budgeting practices, with the aim, of assuring accessibility of key essential medicines for specific conditions even under budget constraints.

1.3 RATIONALE

Diabetes mellitus poses a significant social and economic burden to many countries. The costs of diabetes mellitus are manifested in both direct and indirect costs. Direct costs include medical costs for long-term care and complications; indirect costs account for losses in productivity and costs in quality of life.

Currently, the Tanzanian diabetes mellitus patients are getting their medications free of charge. However with the current global economic recessions, Tanzanian patients may in the near future be required to pay for their own medication. This being the case it is thus imperative that the average prescription cost for diabetes out-patient be determined as bases for future interventions and studies to determine the financial implications of diabetes treatment and care to the average Tanzanian household.

Information about the outpatient prescription costs and trends in diabetes medicines prescribing may provide useful information for budgeting and drug price control strategies. This may lead to the formulation of new or modifications of existing national drug policies, so as to ensure that diabetes drugs are available, affordable and accessible to the average Tanzanians.

1.4. RESEARCH QUESTIONS

1. What are the most commonly prescribed ant-diabetic, lipid modifying and cardiovascular medicines to diabetes mellitus patients at MNH?
2. What is the mean prescriptions cost for the patients with diabetes mellitus alone, diabetes mellitus with elevated cholesterol, diabetes mellitus with cardiovascular complications and diabetes mellitus with cardiovascular and elevated cholesterol complications?
3. Do the diabetes mellitus complications significantly increase the diabetic outpatients' prescription cost?

1.5. OBJECTIVES

1.5.1 Broad Objective

Determination of drugs cost for the management of diabetes and its complications at Muhimbili National Hospital outpatient pharmacy.

1.5.2 Specific Objectives

1. To determine the types of diabetes medicines prescribed to patients suffering from diabetes mellitus at MNH
2. To determine the mean prescription cost for drugs to control diabetes mellitus
3. To determine the types and cost of cardiovascular drugs prescribed to patients suffering from diabetes mellitus.
4. To determine the types and cost of lipid modifying drugs prescribed to patients suffering from diabetes mellitus.

CHAPTER TWO

2.0. METHODOLOGY

2.1 Study design

A retrospective cross sectional study was conducted, where by electronic patient file pharmacy records corresponding to patients attending the diabetic clinics was retrieved for the period 1st January 2012 to 31st December 2012.

2.2 Area of the study.

The study was conducted at Muhimbili National Hospitals in outpatient pharmacy in Dar es Salaam region.

2.3 Study population

Study included all diabetic out patients registered at the MNH diabetic clinic for a period of 1st January 2012 to 31st December 2012

2.4. Data collection methods

The information was obtained from electronic prescriptions, and then recorded on a data collection form (Appendix I). For each patient, personal particulars (age, weight, sex, residence), education level, marital status, diagnosis and treatment details, particularly drugs, out-patient drug use, co-morbidities and diabetic complication if any. Data with unknown or incomplete information or inaccuracies was retrieved from patients' paper records. The drug cost – prices was obtained from the public distributor of medicines (Medical Stores Department), price of the Hospital buying consortium and the retail price at the intramural practice pharmacy at MNH. One United State Dollar (USD) was set to be equivalent to 1,620 Tshs.

2.5. Inclusion criteria

All complete prescriptions for the study period

2.6. Exclusion criteria

All incomplete Prescriptions for the study period

2.7 Data analysis

The electronic collected data was retrieved and saved in the form of Microsoft Excel. The data was then be coded, checked and cleaned. Frequency distribution was used to determine the proportion of diabetes patients who were afflicted with diabetes alone and those afflicted with diabetes and complications of diabetes. They were also used to determine the most frequently prescribed diabetes, lipid lowering and cardiovascular drugs in diabetes patients. The data was then exported and analyzed by R statistical package version 2.15. The outpatient pharmacy (prescription) costs was analyzed per group (diabetes patients alone [D]using different diabetes drugs) (this formed the categories of patients of diabetes alone), the prescription cost of different diabetes patients using different lipid lowering drugs [DL], the prescription cost of different diabetes patients using different cardiovascular drugs [DC] and the prescription cost of diabetes patients using cardiovascular and lipid lowering drugs [DLC]. The different group prescriptions mean cost was compared by analysis of variance (ANOVA). To determine the relative prescription drug cost of having diabetes alone versus diabetes and other complications of diabetes, prescription cost expenditure ratios was constructed by using the total cost expenditure per person years of follow up or per prescription of those with diabetes alone compared to those with diabetes and other complications.

Prescriptions cost per patient per year

The mean prescription cost per patient per year was calculated based on the drug cost per visit using a cost analysis formula adopted from 3rd Edition of methods for economic evaluation of health care programmes by Drummond M et al.

Drug cost per person years=

$$\frac{\sum_{first\ visit}^{last\ visit} (Total\ price\ for\ every\ drug\ at\ every\ visit\ for\ every\ study\ patient\ visits)}{\sum_{patient\ 1}^{patient\ 991} Duration\ since\ first\ visit\ to\ date\ of\ data\ collection(days)/365}$$

2.8 Ethical consideration

Ethical approval to conduct the study was sought from the Muhimbili University of Health and Allied Sciences (MUHAS). Permission to use data from the, pharmacy, at MNH was sought from the hospital authority. All the information from computer database was kept under strict confidentiality. No names were recorded.

CHAPTER THREE

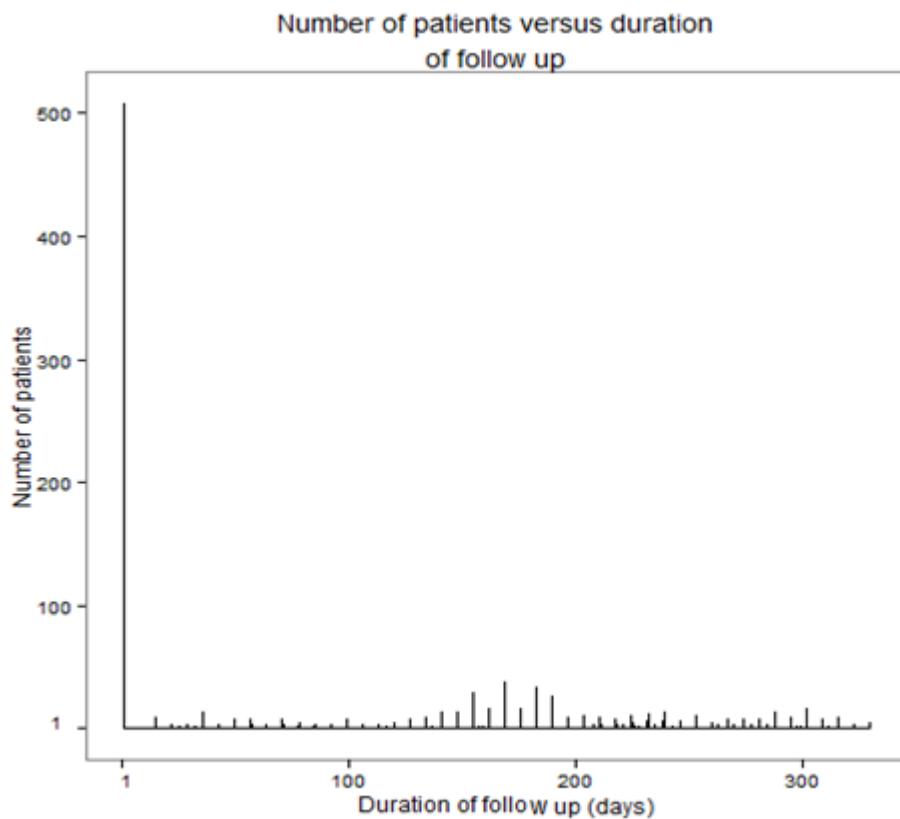
3.0 RESULTS

A total of 1072 adults and children diabetic patients were registered on the MNH Jeeva database for the study period 1st January 2012 to 31st December 2012. Out of these 991 (92.4%) patients were found to be prescribed drugs for diabetes equivalent to 2361 prescriptions.

3.1 Patients follow up

The median duration of patients follow up for the study period was 64 days as shown in the figure 1.

Figure 1: Number of patients at specific follow up days



3.2 STUDY POPULATION CHARACTERISTICS

Among the studied patients, 55.3% were female whereas 44.6% were aged between 45 and 64 years.

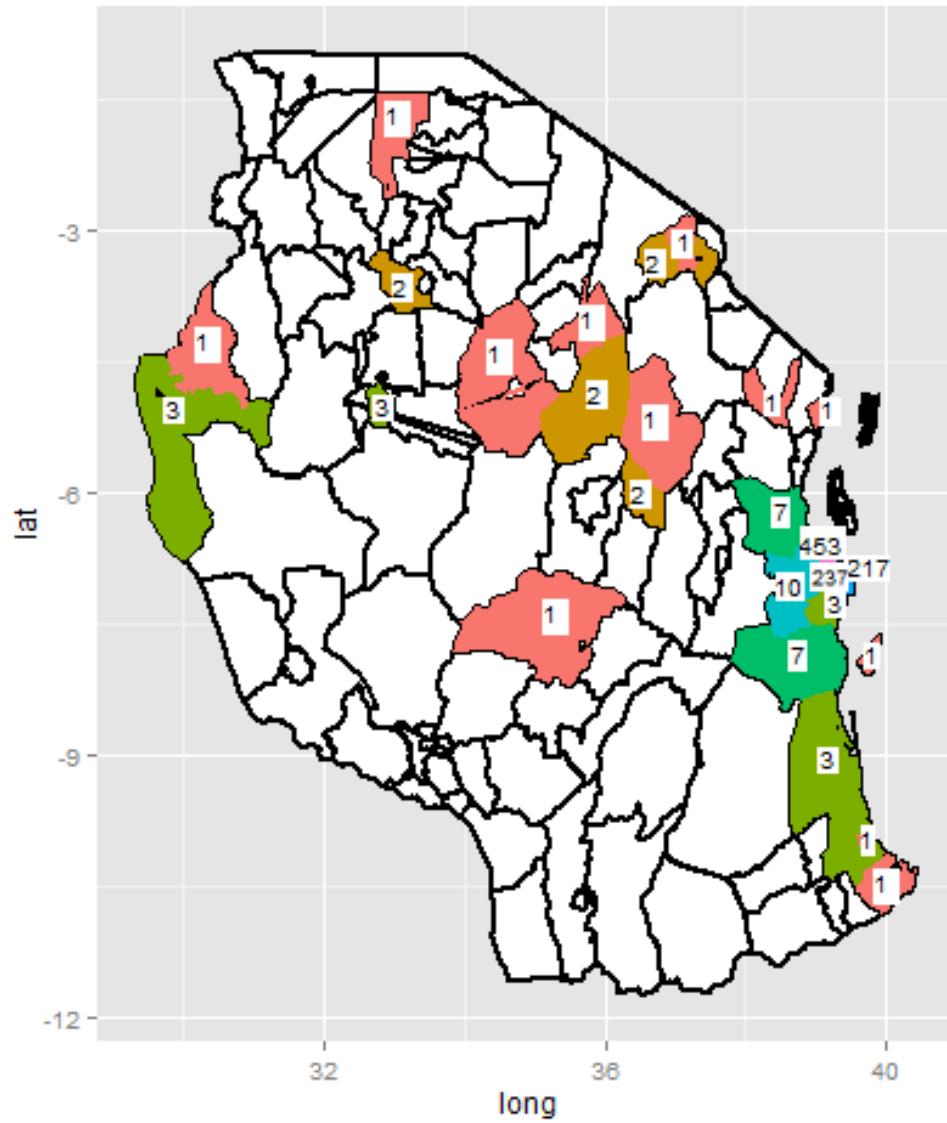
Table 1: Socio demographic data of the studied patients (n=991)

Characteristics	Number	Percentage (%)
SEX		
Male	443	44.7
Female	548	55.3
AGE		
0-14	62	6.3
15-24	102	10.3
25-44	242	24.4
45-64	442	44.6
Above 65	143	14.4

3.2.2 Residency of study population

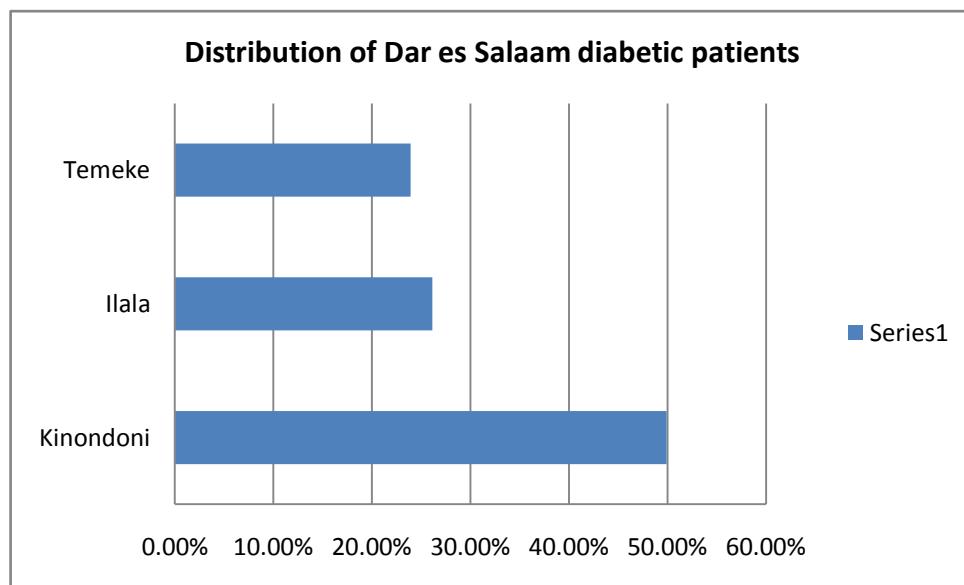
The majority of the diabetic patients, 91.5% attending at the MNH diabetic clinics, came from Dar es Salaam. For those who came from Dar es Salaam 453(49.9%) were from Kinondoni District as shown in the figure 2 and 3.

Figure 2: Map of Tanzania showing residency of the study population



NOTE: Numbers on the map shows the numbers of diabetic patients from the respective Regions / Districts.

Figure 3: Distribution of Dar es Salaam diabetic patients attended MNH Clinic for the study period



3.2.3 Grouping of Diabetic patients based on drugs prescribed

About 32.4% of patients were prescribed drugs for diabetes with either cardiovascular or lipid lowering medicines as seen in table 2

Table 2: Diabetic patients divided on groups based on drugs prescribed.

S/no	Category	Number	Percentage (%)
1	Diabetic patients prescribed only diabetes medicines	668	67.4
2.	Diabetic patients prescribed diabetes and cardiovascular medicines	309	31.2
3.	Diabetic patients prescribed diabetes, cardiovascular and lipid lowering medicines	9	0.9
4.	Diabetic patients prescribed diabetes and lipid lowering medicines.	5	0.5
	TOTAL	991	100

3.3.1 DRUGS PRESCRIBED TO CONTROL DIABETES

Out of 2361 diabetic prescriptions studied, 72.7% prescriptions were found to have diabetes medicines. The rest contained medicines for other conditions.

The most commonly prescribed diabetes medicines were the injectables these included insulin human isophane which comprised 85.8% of the diabetic prescriptions, followed by insulin human soluble (83.3%). The most commonly prescribed oral diabetes drug was metformin 500mg which accounted for 45.0% of the diabetic prescriptions followed by Glibenclamide 5mg (33.31%) as seen in the table 3.

Table 3: Diabetes medicines prescribed to diabetes mellitus patients for the study period

S/no	Diabetes medicines	Prescriptions	Percentage (%)
1.	Insulin human isophane 100iu/ml	1474	85.84
2.	Insulin human soluble 100iu/ml	1430	83.28
3.	Metformin 500mg	773	45.02
4.	Glibenclamide 5mg	572	33.31
5.	Chlopropamide 250mg	69	4.02
6.	Pioglitazone 15mg tabs	12	0.70
7.	Pioglitazone 30mg tabs	12	0.70
8.	Glucored forte® (metformin 500mg + glibenclamide 5mg) tabs	5	0.29
9.	Glucored® (metformin 500mg + glibenclamide 2.5mg) tabs	2	0.12
10.	Metformin 400mg + glibenclamide 2.5mg tabs	2	0.12
11.	Glimepiride 1mg tabs	2	0.12
12.	Glipizide 2mg	1	0.06
13.	Gemer 2®(Glimepiride 2mg + metformin 500mg) tabs	1	0.06

3.3.2 CARDIOVASCULAR MEDICINES PRESCRIBED TO DIABETIC PATIENTS

Out of 2361 prescriptions, 19.19% were found to contain cardiovascular drugs. The most commonly prescribed drugs were Losartan (24.5%) followed by Captopril (24.06%), as can be seen in the table 4 below;

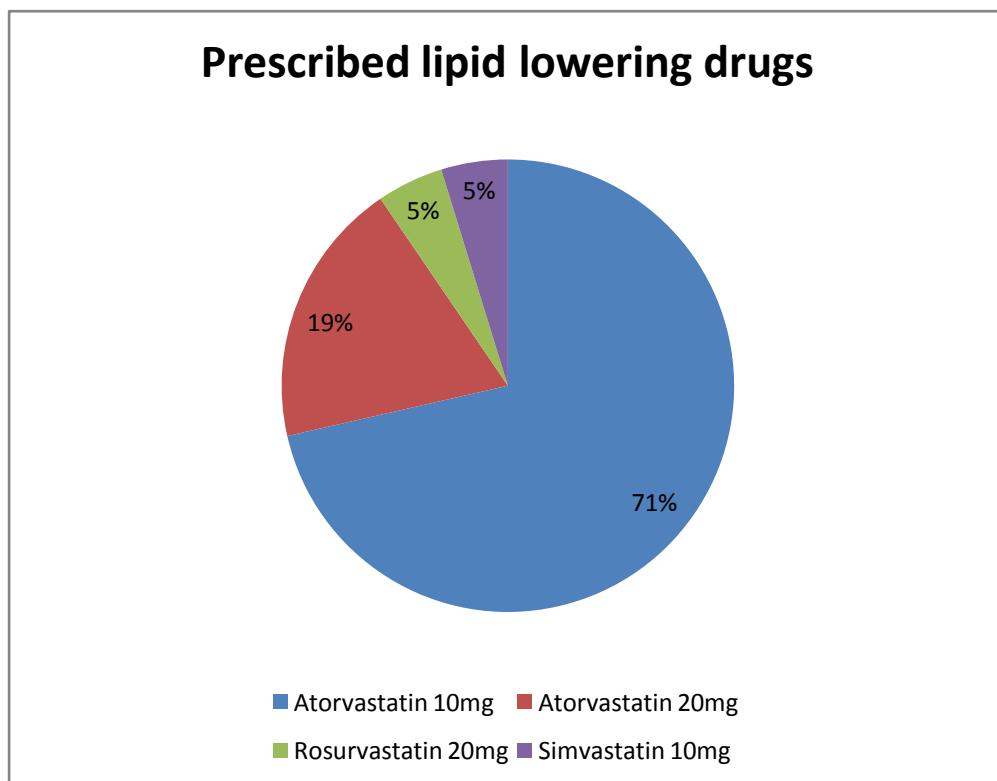
Table 4: Cardiovascular medicines prescribed to diabetes mellitus patients for the study period.

S/no	Cardiovascular medicines	Prescriptions	Percentage (%)
1.	Losartan 50 or 25mg tablets	111	24.5
2.	Captopril 25mg tablets	109	24.06
3.	Nifedipine 20mg tablets	100	22.08
4.	Atenolol 50mg tablets	96	21.19
5.	Bendroflumethiazide 5mg tablets	74	16.34
6.	Acetylsalicylic acid 75mg(soluble) tablets	46	10.15
7.	Amlodipine 10 or 5mg tablets	33	7.28
8.	Repace H® (Losartan potassium 50mg + hydrochlorothiazide 12.5mg) tablets	31	6.84
9.	Enalapril 10 or 5mg tablets	25	5.52
10.	Furosemide 40mg tablets	12	2.65
11.	Furosemide injection	1	0.22
12.	Lisinopril 5 or 10mg tablets	11	2.43
13.	Propanolol 40mg tablets	11	2.43
14.	Digoxin 0.25mg tablets	7	1.55
15.	Isosorbide mononitrate tablets	7	1.55
16.	Carvedilol 12.5 or 6.25mg tablets	6	1.32
17.	Spironolactone 25mg tablets	6	1.32
18.	Methyldopa 250mg tablets	5	1.10
19.	Metoprolol 50mg tablets	3	0.66
20.	Hydralazine 25mg tablets	2	0.44
21.	Isosorbide dinitrate 10mg tablets	1	0.22
22.	Clopidrogrel 75mg tablets	1	0.22
23.	Losartan potassium 100mg or hydrochlorothiazide 12.5mg) tabs	6	1.32

3.3.3 LIPID LOWERING MEDICINES PRESCRIBED TO DIABETIC PATIENTS

This study found that, 0.89% of the studied prescriptions contained lipid lowering medicines. The most commonly prescribed medicine was atorvastatin 10mg tablets which 71.43% of the prescriptions followed by atorvastatin 20mg (19.05%) as can be seen in the figure 4 bellow.

Figure 4: Commonly prescribed lipid lowering medicines to diabetes mellitus patients for the study period.



3.3.4 OTHER MEDICINES PRESCRIBED TO DIABETES PATIENTS

Fifty percent of all prescriptions were found to contain insulin disposable syringes, anti-pain and anti-inflammatory medicine accounted for 4.2% with Paracetamol tablets being the most commonly prescribed at 1.6%. Other commonly prescribed medicines to diabetic patients were the central nervous system medications such as neurobion® tablets, neurovit® tablets, vitacap® capsules, vitamin B complex tablets, ginsomin®, multivitamin tablets and Gabapentin tablets. Also drugs for mental illness such as Amitriptyline and carbamazepine tablets and antifungals such as fluconazole tablets were prescribed as can be seen in the table 5 below.

Table 5: Other medicines/supplies commonly prescribed to diabetes patients

S/no	Medicines/supplies	Number of prescriptions(percentage from the total prescriptions)
1.	Ant-neuropathies <ul style="list-style-type: none"> • Neurobions, neurovit, neuroton, B complex, vitacap, ginsomin and multivitamin tablets. • Gabapentin tablets 	123(5.2%) 38(1.6%)
2.	Drugs for mental illness <ul style="list-style-type: none"> • Amitriptyline • Carbamazepine 	35(1.5%) 30(1.3%)
3.	Antifungal <ul style="list-style-type: none"> • Fluconazole 	27(1.1%)
4.	Ant-allergy/ant-inflammatory <ul style="list-style-type: none"> • Cetirizine 	34(1.4%)
5.	Insulin disposable syringes	1184(50.1%)
6.	Ant-pain / ant-inflammatory <ul style="list-style-type: none"> • Paracetamol tablets • Diclofenac analogs • Meloxicam(muvera®) tablets • Tramadol capsules • Ibuprofen tablets • Mefenamic acid • Piroxicam capsules 	38(1.6%) 25(1.15%) 22(1.1%) 11(0.5%) 1(0.04%) 1(0.04%) 1(0.04%)

3.4.1 COST OF THE PRESCRIBED DIABETES MEDICINES

The total cost for all medications prescribed for the study period was Tshs48, 953,042/=, out of these diabetic medicines accounted for Tshs. 36,133,675/= of which Insulin injections accounted for the majority of the expenditure at a cost of Tshs 25,594,275 equivalent to 70.8% of the total cost for diabetes medicines. Metformin tablets which was the most commonly prescribed oral anti-diabetes drug cost 5, 877,820/= (16.27% of the total cost of the ant diabetic medicines). Among the oral formulations, combined therapy tablets Gemer 2® at a price of Tsh 775/= followed by glucored® at a price of Tshs 450/= were the most expensive as seen in the table 6.

Table 6: Cost of the prescribed diabetes medicines to the study population

S/no	Medicines	Total number of the prescribed drugs(unit)	Average Price per unit (Tshs)	Total cost of the prescribed medicine (Tshs)	Percentage of the total cost (%)
1.	Insulin human isophane 100iu/ml	1494	8792	13,134,675	36.35
2.	Insulin human soluble 100iu/ml	1432	8700	12,459,600	34.48
3.	Metformin 500mg	64,413	91	5,877,820	16.27
4.	Glibenclamide 5mg	42,197	83	3,481,776	9.64
5.	Chlopropamide 250mg	3546	135	480,450	1.33
6.	Pioglitazone 15mg tabs	390	300	119,760	0.33
7.	Pioglitazone 30mg tabs	360	450	162,000	0.45
8.	Glucored® (metformin 500mg + glibenclamide 2.5mg) tabs	60	450	27,000	0.07
9.	Glucored forte®(metformin 500mg + glibenclamide 5mg) tabs	480	450	215,844	0.60
10.	Glimepiride 1mg tabs	300	231	69,300	0.19
11.	Gemer2® (Glimepiride 2mg + metformin 500mg) tabs	90	775	69,750	0.19
12.	Metformin 400mg + Glibenclamide 2.5mg	44	450	19800	0.05
13.	Glipizide 2.5mg	30	330	9,900	0.03
TOTAL				36,133,675	100

3.4.2 COST FOR THE PRESCRIBED CARDIOVASCULAR MEDICINES

The total cost of the prescribed cardiovascular medicines for the study period was 5,846,251.93/= . This was 11.9% of the total cost for all medicines prescribed to diabetic patients for the study period. The largest expenditure with regard to cardiovascular medicines was for Losartan 50mg tablets which accounted for 27.66%) of the total cost of the cardiovascular medicines followed by Captopril 25mg tablets at 20.56%. Among the cardiovascular medicines Lisinopril 10mg (Zestril®) tablets was the most expensive medicine followed by Clopidrogrel tablet as can be seen table 7 below.

Table 7: Cost of the prescribed cardiovascular medicines for the study period

S/no	Medicines	Total number of the prescribed drugs(units)	Average Price per units (Tshs)	Total cost of the prescribed medicine(Tshs)	Percentage of the total cost (%)
1.	Losartan 50mg tablets	2788	580	1,617,040	27.66
2.	Losartan 25mg tablets	540	460	248,400	4.25
3.	Captopril 25mg tablets	5795	207.3	1,202,190	20.56
4.	Nifedipine 20mg tablets	5215	87.5	456,225	7.80
5.	Atenolol 50mg tablets	3945	93.5	369,150	6.31
6.	Bendroflumethazide 5mg tablets	2205	26.9	59,398.65	1.02
7.	Acetylsalicilic acid 75mg(soluble) tablets	1365	214.9	293,355.08	5.02
8.	Amlodipine 5mg tablets	1260	133.1	167,700	2.87
9.	Amlodipine 10mg tablets	360	250	90,000	1.54
10.	Repace H® (Losartan potassium 50mg + hydrochlorothiazide 12.5mg) tablets	810	648.1	525,000	8.98
11.	Enalapril 5mg tablets	300	222	66,660	1.14
12.	Enalapril 10mg tablets	370	529.2	195,810	3.35
13.	Furosemide 40mg tablets	375	31.1	11,676	0.20
14.	Furosemide injection	8	420	3360	0.06
15.	Lisinopril 5 mg(cipril®) tablets	300	213.3	63,999.9	1.09
16.	Lisinopril 10mg(cipril®) tablets	90	430	38,700	0.66

17.	Lisinopril 10mg(Zestril®) tablets	28	1,700	47,600	0.81
18.	Propanolol 40mg tablets	351	68.9	24,204	0.41
19.	Digoxin 0.25mg tablets	210	35.3	7410	0.13
20.	Isosorbide mononitrate 10mg tablets	386	157.7	60,880.3	1.04
21.	Isosorbide mononitrate 20mg tablets	60	256	15,360	0.26
22.	Isosorbide dinitrate 10mg tablets	30	198	5940	0.10
23.	Carvedilol 6.25mg tablets	105	320.9	33,700	0.58
24.	Carvedilol 12.5mg tablets	90	500	45000	0.77
25.	Spironolactone 25mg tablets	170	262.2	44,580	0.76
26	Methyldopa 250mg tablets	510	132	67,320	1.15
27.	Hydralazine 25mg tablets	81	153	12,393	0.21
28.	Clopidrogrel 75mg tablets	30	1030	30,900	0.52
29.	Metoprol 50mg	90	350	31500	0.54
30.	Warfarin	60	180	10800	0.18
GRAND TOTAL				5,846,251.93	100

3.4.3 COST FOR THE LIPID LOWERING MEDICINES

The total cost of the lipid lowering medicines for the study period was 843,552/=with expenditure for Atorvastatin 10mg amounting to 72.61% of the total expenditure of the drugs prescribed in this category. The most expensive medicine in this category was rosurvastatin 20mg (crestor[®]) tablets at a cost price of Tsh 1608.43/= as seen in table 8 below.

Table 8: Cost of the prescribed lipid lowering medicines for the study period

S/no	Medicines	Total number of the prescribed drugs(units)	Average Price per unit (Tshs)	Total cost of the prescribed medicine (Tshs)	Percentage of the total cost (%)
1.	Atorvastatin 10mg tabs	960	638	612,480	72.61
2.	Atovastatin 20mg tabs	120	1000	120,000	14.23
3	Rosurvastatin 20mg tabs	56	1608.43	90,072	10.68
4.	Simvastatin 20mg	30	700	21,000	2.49
TOTAL				843,552	100

3.4.4 COST OF OTHER PRESCRIBED MEDICINES TO DIABETIC PATIENTS

The total cost of other prescribed medicines for a study period was 6,129,563.07/= which was equivalent to 12.5% of the total cost of all medicines prescribed to the studied patients. This cost was largely contributed by ant neuropathies (41.4%), medicines for mental illness (5.8%), antifungal (5.7%) and disposable insulin syringes (5.2%).

Figure 5: Cost of other commonly prescribed medicines/supplies to the diabetes patients for the study period

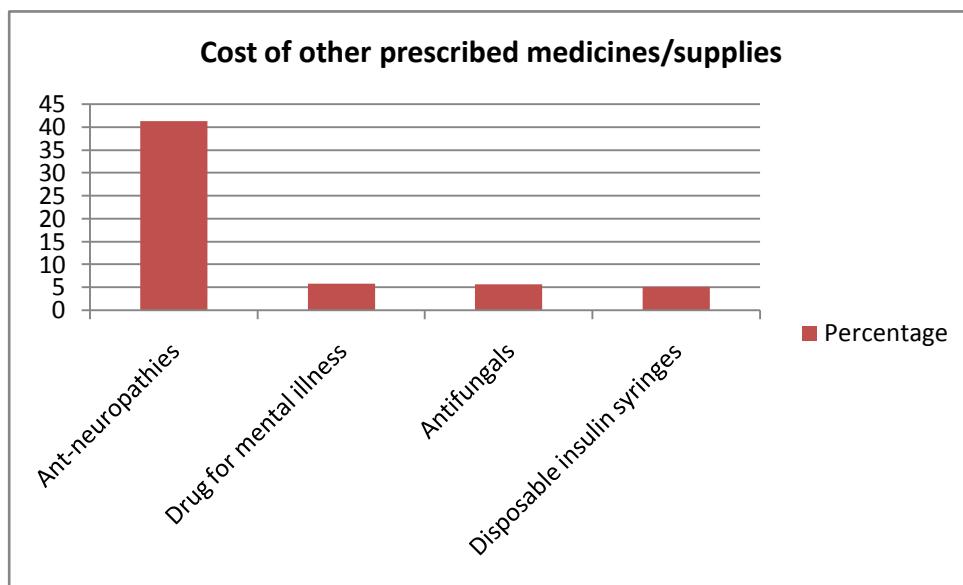


Table 9: Cost of diabetes, cardiovascular, lipid lowering and other medicines prescribed to diabetes patients for the study period.

S/NO	MEDICINES	COST (Tshs)	PERCENTAGE (%)
1.	Diabetes mellitus	36,133,675	73.8
2.	Others	6,129,563.07	12.5
3.	Cardiovascular	5,846,251.93	11.9
4.	Lipid lowering	843,552	1.7
TOTAL		48,953,042	100

3.4.5 PRESCRIPTION COSTS FOR COMPLICATED AND NON COMPLICATED DIABETES

3.4.5.1 Prescriptions cost per patient per year

The cost per patient year for a patient with diabetes without cardiovascular and elevated cholesterol complications was found to be Tsh141, 519/= as compared to Tshs 168,486/= for a patient with diabetes and cardiovascular complications. The study found that, there was an increase of cost by 19% when treating diabetic outpatients with cardiovascular complications. Cost rose by 82% when managing diabetic outpatients with elevated cholesterol. For the diabetic outpatients with both cardiovascular and elevated cholesterol, the medicines cost rose by 111% as seen in the table 10.

Table 10: Diabetic prescriptions costs per person years

S/no	Prescriptions category	Total duration of follow up person years(ppy)	Total cost of treatment (Tshs)	Cost per patient per year (Tshs)
1.	Diabetes patients prescribed diabetes medicines only.	198.402	28,077,767	141,519
2.	Diabetes patients prescribed diabetes and cardiovascular medicines.	76.66575	12,917,131	168,486
3.	Diabetes patients prescribed diabetes and lipid lowering medicines.	3.04383	784,341	257,682
4.	Diabetes patients prescribed diabetes, lipid lowering and cardiovascular medicines.	3.287671	982,746	298,918
5.	Prescription cost for all medicines prescribed to diabetes patients for the entire study period (ant diabetic, lipid lowering, cardiovascular and other medicines.)	284.567	48,953,042	172,026

3.4.5.2 Mean prescription cost per visit

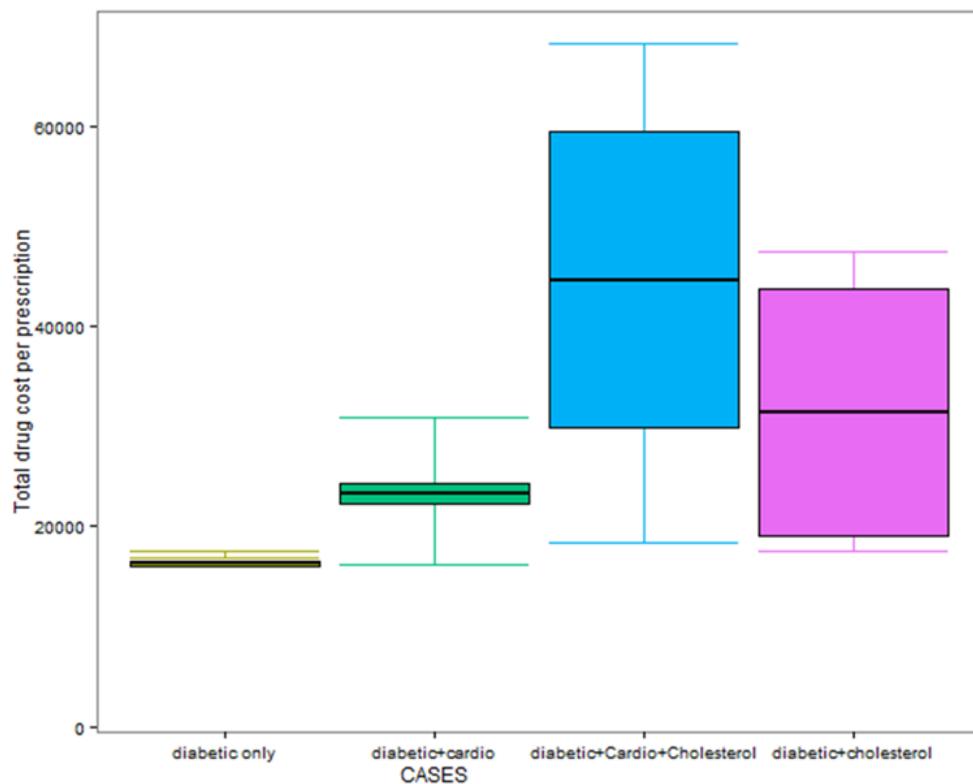
Mean prescription cost per visit for the patients prescribed diabetes medicines only differ highly significantly with those prescribed diabetes with either cardiovascular or lipid lowering or cardiovascular and lipid lowering medicines(P value<0.01)as seen in table 11.

The mean prescription cost per visit for patients prescribed diabetes and cardiovascular medicines was significantly high by 51.8% compared to the cost per prescription for those prescribed diabetes medicines only (P value <0.01). Likewise, the mean cost per prescription for patients prescribed diabetes and lipid lowering medicines was significantly high by 121.9% compared to the cost per prescription for patients prescribed diabetes medicines only (P value <0.01). Moreover, the mean cost per prescription for patients prescribed both diabetes, cardiovascular and lipid lowering medicines was significantly high by 207.4% compared to the mean cost per prescription for those prescribed diabetes medicines alone (P value <0.01) as seen in table 11 and figure 6

Table 11: Comparison between Mean prescription costs per visit for complicated and non complicated diabetes mellitus

S/no	Compared prescription categories	Mean differences (Tshs)	95% confidence intervals		P-values
			Lower boundaries (Tshs)	Upper boundaries (Tshs)	
1.	Diabetes + cardiovascular drugs VS diabetes drugs only	8911.5(51.8%)	8161.6(47.5%)	9661.5(56.2%)	<0.01
2.	Diabetes + lipid lowering drugs VS diabetes drugs only	20959.5(121.9%)	17713.2(103.0%)	24205.9(140.8%)	<0.01
3.	Diabetes + cardiovascular+ lipid lowering drugs VS diabetes drugs only	35656.7(207.4%)	32773.2(190.6%)	38540.1(224.2%)	<0.01

Figure 6: Medicines mean cost per prescription for diabetic patients grouped according to prescribed medicines during the whole period of follow up.



CHAPTER FOUR

4. DISCUSSION

4.1 Study population characteristics

The study found that, the greater number of the diabetic patients was at the age between 45 and 64 years (44.6%). This data matches with the global statistics, 2012 documented in the International Diabetic Federation Atlas which found that ‘The greater numbers of people with diabetes are aged between 40 to 50 years’ ((IDF, 2012). In this study children between 1 and 14 years occupied 6.3% of the studied population. This figure is much higher than the figures quoted by IDF at 0.012% (IDF, 2010). This may be a warning sign that the national effort to prevent diabetes in children should be increased for this not in future to result in a national diabetes epidemic.

The higher numbers of the diabetic patients were female (55.3%). These results concurred with the results from other studies, including a study conducted among Zuni Indians aged 5 years and above. Among the Zuni Indians, the prevalence was 57% higher among female than male members of the population (Scavin et al, 2003). Moreover another study conducted in 1984 north-western Tanzania found higher proportion of women (68%) with diabetes than males (Ahren et al, 1984). Globally, the ratio of prevalence of diabetes in men versus women varied markedly between populations with little discernable trend (King et al, 2013). However this higher figure may be explained by the fact that women have higher health seeking behavior than men (Nyamuhanga, 2011)

Among the studied patients, 31.2% had cardiovascular complications. The percentage of diabetic patients with cardiovascular complications was less compared to the percentage found in a study conducted in 2005 to 2008 in UK where by 67% of adult aged 20 years or older with diabetes were found to have cardiovascular complications (CDC,2011). Despite this moderate figure still there is need to make some efforts to cut this rate even further down as treating these patients has severe cost implications and that these complications are associated with high mortality in diabetes patients (Kengne et al, 2005).

4.2 Commonly prescribed ant-diabetic medicines

The commonly prescribed anti-diabetic medicines were the insulin injections (66.69%). Insulin injections occupied the largest percentage of prescriptions. This may be due to the fact that, Diabetes patients under insulin regimen had several hospital visits as compared to patients under oral hypoglycaemic drugs as they usually got one vial of insulin per visit which is not enough for a month. They had an average of two visits per month as opposed to patients under oral drugs which had an average of one visit. In addition to this, Insulin injections are very expensive and unaffordable to many patients; therefore they must go to the hospital in order to get them.

Metformin and Glibenclamide were the two most commonly prescribed as oral diabetes medicines. This could be explained by the fact that, these two drugs are first line drugs for the treatment of type 2 diabetes mellitus in Tanzania, indicating that prescribers routinely follow the standard treatment guidelines(STG) of 2007 and are using similar drugs as prescribed in the United kingdom (Fillion et al, 2009). Nevertheless there were a number of incidences (23%) where prescribers prescribed drugs like glimepiride and pioglitazone tablets that are not stipulated in the Standard treatment guideline indicating that a review of the STG should be done or more training should be conducted to ensure that prescribers prescribe rationally.

4.3 Commonly prescribed cardiovascular medicines

The most commonly prescribed cardiovascular medicines were the angiotensin converting enzyme, losartan 50 and 25mg tablets (15.9%) followed by angiotensin receptor blocker, captopril 25mg (15.62%). A similar study conducted in Nova Scotia, New Brunswick and Prince Edward Island showed some correlation with this study where by angiotensin converting enzyme and angiotensin receptor blocker were also the commonly prescribed cardiovascular medicine to diabetes patients (Putnam et al, 2009). This could be explained by the fact that, ACE inhibitors have been shown to not only help lower blood pressure but also delay the onset and progression of nephropathy in people with diabetes. In fact this ability to

protect the kidneys from damage seems to be their most important quality, more so than their ability to actually control blood pressure. However the above drugs are not prescribed by the current Tanzania STG of 2007. These findings therefore suggest that the current STG needs to be reviewed in order to be up to date with the current trends of cardiovascular treatment.

4.4 Commonly prescribed lipid lowering medicines

The commonly prescribed medicine was atorvastatin tablets which occupied 90.48% of the prescriptions. Atorvastatin was somehow cheaper compared to other lipid lowering drugs and this could explain its prescribing trends but also atorvastatin is the first drug of choice for elevated cholesterol treatment as stipulated in Tanzania 2007 STG.

4.5 Other medicines commonly prescribed to diabetes patients

Gabapentin and vitamin medicines were found to be also prescribed to diabetes patients in study (6.8% prescriptions). This could be as result that these medicines are very much useful for the treatment of the peripheral neuropathy caused by nervous system damage. It is known that about 60 to 70 percent of people with diabetes have mild to severe form of nerve damage (CDC, 2011). The results of such damage include impaired sensation or pain in the feet or hands, slowed digestion of food in stomach, carpal tunnel syndrome, erectile dysfunction, or other nerve problem.

Though there are few studies that are well designed and examine the prevalence or incidence of peripheral neuropathy in Africa, there is little doubt that neuropathy is a common feature of diabetes patients as found in studies done Ethiopia, South Africa , Zambia and Tanzania (Teshfaye S et al,2011).

Diabetic patients were also found to be commonly prescribed drugs for mental illness, particularly amitriptyline and carbamazepine. This could be explained by the fact that, people with diabetes are twice as likely to have depression, which can complicate diabetes management, than people without diabetes. In addition, depression is associated with 60% increased risk of developing type 2 diabetes (CDC, 2011).

4.6 Prescription cost for managing diabetes and its complications

The mean prescription cost of treating one diabetic patient per year with neither cardiovascular disease nor elevated cholesterol was Tshs 141,519/=. Moreover, the mean cost per prescription per visit for patients prescribed diabetes medicines only was Tshs.17,191.33/=. This is extremely high cost as compared to Tanzanians economy with mean monthly household expenditure budget of 20,122 Tanzanian shillings per capita (Tanzania National Household Budget Survey, 2007). These situations suggest that a large proportion of the Tanzanian population could be left without medication if they would have to pay for treatment as it is documented that approximately 80% of the Tanzanian population consume less than 38,600/= per month which is equivalent to 1,380/= per day(Analysis of household income and expenditure,2009).

The cost of treating diabetes patient per year with cardiovascular diseases and elevated cholesterol complications was Tshs.298, 918/=. The study indicated an increase of cost by 111% for patients with cardiovascular diseases and elevated cholesterol complications as compared to patients with diabetes only. A Similar study which was conducted in Dar-es-Salaam, Tanzania in 2003, found that, the cost for treating diabetic complications per person per year was USD 138(Beran et al, 2006). When this cost per person per year compared to the figure (298,918/=) found in this study, it is suggested that there is 33.7% increase in the cost of treatment of the complications per person from 2003 to 2012. This could be explained by the fact that a number of new and expensive drugs are being prescribed to manage complicated diabetes e.g pioglitazone, rosuvastatin, gemer® 1 and 2. In addition this increase could be due to the fact that the majority (66.7%) of the prescriptions contained insulin which is an expensive drug for diabetes treatment.

Although Tanzania presents an example of successful National diabetes program in sub-Saharan Africa (Beran et al, 2006), where collaboration between Tanzania diabetes Association and ministry of health has established a network of diabetes clinics throughout the country, along with health worker training, guidelines and education patient materials, however more emphasis should also be put to educate the community on how to prevent

diabetes and its complications as the cost of treating diabetes has significant economic and social impact on Tanzania and its health resources.

CHAPTER FIVE

5.1.CONCLUSION

About one third of Diabetes mellitus out patients attended at MNH for the study period were also suffering from cardiovascular or elevated cholesterol complications. The cost of treating these complications is significantly higher compared to the cost of treating patients with diabetes alone. Losartan and Atorvastatin were commonly prescribed to diabetes mellitus patients for the management of cardiovascular and elevated cholesterol complications. Insulin injections being the mostly commonly prescribed and expensive diabetes medicine accounted for more than half of the total cost of all medicines prescribed for the whole study period.

Electronic prescription data can be used as tool by pharmaceutical managers to determine diabetes drug use trends, cost and to prioritize diabetes drugs for hospital budgeting committees.

RECOMMENDATIONS

Based on the study findings, it is recommended that

- i. Hospital pharmacies to utilize electronic prescription data to monitor drug use, trend and cost for budgeting purposes.
- ii. The Government should improve efforts for timely diagnosis of diabetes by mandating community pharmacies to screen for diabetes and elevated cholesterol so as to reduce diabetes complications and reduce the cost of treating diabetes complications.
- iii. The Government should make efforts to reduce the prevalence of diabetes and complications both in adults and children by establishing and promoting physical fitness centers and nutritional programs at work places and schools.

- iv. The Government should appropriately budget for diabetes medicines so that they are available and affordable to patients. This will ensure patient adherence reducing the incidence of diabetes complications which in turn will reduce the cost burden of treating complicated diabetes
- v. More studies on affordability and stocking of diabetes medicine should be conducted. This will help us to determine the true cost for treatment and care of diabetes outpatients.

5.3 STUDY LIMITATIONS

The data collected was routine in nature, not purposely designed for research. Thus the quality of data may have been compromised by data recording errors and missing values. In addition to this, being a retrospective study there was a limited opportunity to find missing data from patients who shifted from MNH clinic to other clinics

Moreover the MNH electronic pharmacy data base only records issued drugs and not the drugs that were out of stock; hence it was not possible to ascertain the extent of drug stock out at MNH for the study period. In addition to this, the data base does not record patients' diagnosis. This would have been useful in determining what was the drug being used to manage what conditions.

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APPENDIXES

Appendix I: Questionnaire – English Version

Data retrieval from Muhimbili National Hospital diabetes Clinic

Social – Demographic Information

1. File Number_____
2. Region_____
3. District_____
4. Workplace_____
5. Occupation_____
6. Age (use numbers)_____
7. Sex (Male/Female)_____
8. Marital Status
 - a. Single
 - b. Married / cohabiting
 - c. Divorced
 - d. Widow
9. Education
 - a. None
 - b. Primary
 - c. Secondary
 - d. Post-secondary
10. Head of Household (Yes/No)_____
11. Patient's Diagnosis_____
 - a. Diabetes type I without cardiovascular complications
 - b. Diabetes type 2 without cardiovascular complications
 - c. Type 1 Diabetes with cardiovascular complications
 - d. Type 2 Diabetes with cardiovascular complications

- e. Type 1 Diabetes with Non-alcoholic fatty liver disease (NAFLD)
 - f. Type 2 Diabetes with Non-alcoholic fatty liver disease (NAFLD)

Treatment Details, Types of Drugs, Out Patient

Diabetes Drugs

Drugs for Other Diseases