UNIVERSITY of RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES, SCHOOL OF MEDICINE AND PHARMACY, INTERNAL MEDICINE DEPARTMENT.

CAUSES OF ADMISION OF DIABETES MELLITUS PATIENTS ON THE MEDICAL WARDS AT THE UNIVERSITY TEACHING HOSPITAL IN RWANDA (Kigali University Teaching Hospital ,Rwanda Military Hospital).

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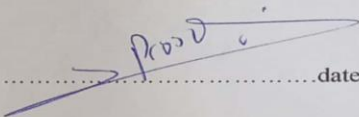CO –SUPERVISOR: Dr. BAZATSINDA Tony, MD, MMED.

A dissertation submitted to College of Medicine and Health Sciences, School of Medicine and Pharmacy in partial fulfillment for the requirement of award of a Masters` degree in Internal Medicine, University of Rwanda.

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DECLARATION

I, Prosper NDAYISABA, to the best of my knowledge, hereby declare that the work presented in this dissertation entitled " **Causes of admission of diabetes mellitus patients at the University Teaching Hospital Medical wards(KUTH,RMH)**" is entirely my own and original work and it has never been presented or submitted in whole or in part to any university. It is submitted to the College of Medicine and Health Sciences in partial fulfillment of the academic requirement for the award of Masters of Medicine in Internal Medicine, University of Rwanda
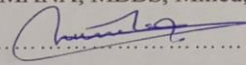
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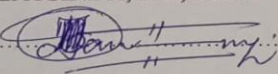
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DEDICATION

To the almighty God

To my dear parents

To my dear brothers and sister

To my supervisors

To my colleagues

To my patients

This work is dedicated with pleasure

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To God almighty, source of life, knowledge and wisdom.

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ABSTRACT

Background

Diabetes Mellitus is associated with acute metabolic and chronic complications. It is known to the outpatient clinics for needing special care pathways as a sensitive disease. However, patients with Diabetes Mellitus are frequently admitted to the hospitals' inpatient wards compared to the general population. There is little information about their reasons for admission and the outcome of care following their admissions in tertiary academic hospitals in Rwanda.

Aim: The aim was to identify reasons for admission to the hospitals' wards among diabetic patients and to identify the outcome of inpatient care following admission.

Patients and Method: This a cross sectional study conducted at the University Teaching Hospitals of Kigali and Rwanda military hospital. It involves 127 participants with Diabetes Mellitus admitted between 1st January 2021 and 31 April 2021. The data were collected from patients' files and were followed up from their admission time to their discharge from the hospital.

Results: Among the 127 participants included in this study, 59.4% were of female gender, 49.6% were of male gender. The majority (85%) were more than 45 years. The mean age was 59.8 years. The type 2 Diabetes Mellitus was more prevalent 92.9% while the patients with type 1 Diabetes Mellitus were 2.4%. The prevalent reasons for admission were classified as acute metabolic complications of diabetes (38.5%), and the commonest specific reason among acute metabolic complications was Diabetic Keto Acidosis; DKA (22.8%) followed by Hyperosmolar Hyperglycemic State; HHS (11.8%) and hypoglycemia (3.9%). The second reason for admission was in the category of infections (37%). Among the bacterial infections noted, the infection affecting the lungs was prevalent followed by the urinary tract infection. COVID-19 pneumonia was identified in 7.09% patients. Other reasons for admission were in the category of chronic complications of Diabetes Mellitus where hypertension was observed as a reason for admission in 22.8%, followed by chronic kidney disease 16.5% and Hypertension as a comorbidity in 59.1%. The mean in hospital stay was 12 days. The overall inpatient mortality rate in this study was 15%. Of all the parameters studied, hyperglycemic hyperosmolar state is outstandingly associated with inpatient mortality (OR=10.49, 95% CI: 3.19-34.49, p<0.001).

Conclusion: The main causes of admission were acute metabolic complications of Diabetes Mellitus followed by the infectious processes. Infections were the most triggers for admission observed in patients with hyperglycemic emergencies. Other significant causes of admission were in the group of chronic complications of Diabetes Mellitus, and on the top of the list we can cite uncontrolled hypertension and chronic kidney disease. A total of 15 % participants died in the hospital. Patients who presented in hyperglycemic hyperosmolar state were 10 times likely to die compared to those who did not present in the same clinical state (P -value <0.001).

Key words: Reasons for admission; diabetic patients; treatment outcomes, Kigali University teaching Hospital; Rwanda military Hospital.

ACRONYMS AND ABBREVIATIONS

ACS: Acute Coronary Syndrome

CMHS: College of Medicine and Health Sciences

DM: Diabetes Mellitus

DM1:   Diabetes Mellitus type 1

DM2:   Diabetes Mellitus type 2

DKA: Diabetic Keto-Acidosis

HONK: Hyperosmolar Non Ketosis state

IDF: International Diabetes Federation

SD: Standard Deviation

SPSS: Statistical Package for Social Sciences

SSTI: Skin and Soft Tissue Infections

UTI: Urinary Tract Infection

OPD: Out Patient Department

KUTH: University Teaching Hospital of Kigali

CHUK: Centre Hospitalier Universitaire de Kigali

RMH :   Rwanda Military Hospital

OR   :   Odd Ratio

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Chapter 1. INTRODUCTION

1.0.Background

Diabetes Mellitus is a chronic metabolic disorder characterized by hyperglycemia due to defects in insulin secretion, action or both. Literally 4 types exist: diabetes type 1, diabetes type 2, gestational diabetes, other specific types.(1)

Sub-Saharan countries have been burdened by the rising of communicable diseases notably, human immunodeficiency virus, tuberculosis, malaria. However, as a result of urbanization, physical inactivity, lifestyle changes and obesity, the trend of non-communicable diseases increases. According to the International Diabetes Federation 4th edition estimates, 21st century has a rising trend of non-communicable diseases in sub-Saharan countries, Diabetes Mellitus being included and this will pose additional burden to sub-Saharan Africa which already has constrained economy and poor health systems plus existing threats to the public health system posed by communicable diseases. It has been apparent that, poor health system, limited economy, limited affordability to health care lead to a late Diabetes Mellitus' diagnosis and with complications in sub-Saharan countries. The micro-vascular complications (retinopathy, nephropathy, neuropathy) are prevalent but acute metabolic complications and infections cause significant mortality.(2)

Globally, type 2 Diabetes Mellitus is very prevalent at 85-95% , Low and Middle –Income Countries have a rise of type 2 Diabetes Mellitus, 2009 International Diabetes Federation estimates were that 285 million people had Diabetes Mellitus (6,4%) and projections were that by 2030 this will increase to 7,7% (438 million people) in the 20-79 age group and the largest group being found in Africa and Asia in 70% of all estimated cases, 90% of Diabetes Mellitus are of type 2 while less 10% are of type1 and other specific types (1)(2).

In Low and Middle –Income Countries, Diabetes Mellitus type 2 affects younger population between 45-64 years, with limited access to health care services, financial constraints this group of population have risks for premature death and hospitalizations related to Diabetes Mellitus that otherwise would have been prevented by public health action and policy makers. (2) (3)

Diabetes Mellitus type 2 is associated with social and economic burden to the patient and society due to its complications and usually premature mortality related to Diabetes Mellitus is

underestimated due to the fact that few diabetic patients die from a cause uniquely attributable to diabetes.(3).

In term of mortality, Diabetes Mellitus is associated with higher mortality compared to the general population. It is a leading cause of renal disease, blindness, stroke and these complications are 2 to 5 times more common (1).

It is estimated that 80% of deaths related to Diabetes Mellitus occur in Low and Middle- Income Countries, half of diabetic patients die prematurely from cardiovascular cause and 10% from renal cause, closer to half of people dying from Diabetes Mellitus are less than 60 years old, fortunately those premature deaths can be prevented through public health action and improved care to diagnosed patients (1)(3)(4).

Social and economic burden on diabetic patients, mortality risks and hospitalizations are related to greater number and severity of complications (5).

In sub-Saharan Africa, Diabetes Mellitus was prevalent at 13.7% in 2016, data about prevalence of Diabetes Mellitus in Rwanda are few, one study done by E. Ndabarora et Al. in 2017 the prevalence of Diabetes Mellitus among people who attended the community work in Nyamasheke District was 8,6% and 72 % were not tested before, meaning that, they were not aware of the diagnosis (6).

Another study done in Rwanda by Amendezo et Al. documented that types 2 Diabetes Mellitus was predominant. The micro-vascular and macro-vascular were common complications of Diabetes Mellitus, among out and inpatients who attended KUTH and diabetic patients with nephropathy were 20% among 294 participants, 22% had cardiovascular complications, 53% peripheral neuropathy and 4% had foot ulcer. A total of 26% vis 16% of the participants reported that had presented with a least one episode of hyperglycemia, hypoglycemic coma respectively (5).

Risks for hospitalization in diabetic patients increase with poor glycemic control, long duration of diabetes mellitus and coexisting morbidities (7).

The Government of Rwanda has put much effort in terms of facilitating access to health care services where more than 80% of population have health insurance; however, accessibility and

affordability of health care are still a big concern due to different reasons including financial, beliefs and geographical access. Therefore, complications related to Diabetes Mellitus, and the late diagnosis of Diabetes Mellitus are likely to occur. All these factors combined predispose Diabetes Mellitus patients to a higher risk of hospitalization.

Unfortunately, no available data about reasons why diabetic patients are being admitted in our settings. We therefore conducted this study to evaluate the different causes of admission among patients with Diabetes Mellitus attending tertiary hospitals in Rwanda.

1.1 Problem statement

As a result of urbanization, unhealthy life style change, lack of physical exercises, the prevalence of Diabetes Mellitus is increasing. Many strategies have been taken to reduce the risks associated with a rapid increase in incidence of Diabetes Mellitus in Rwanda, but few studies have been done so far in order to evaluate how prevalent are diabetic complications in our settings.

 We often receive diabetic patients for scheduled regular follow up in Out Patient Department as it is an outpatient care sensitive disease, however ,this particular group of patients are frequently admitted to the hospitals' inpatient wards compared to the general population due to ; infections, acute metabolic complications of diabetes , chronic complications related to diabetes mellitus . To date, there is little information about their reasons for admission and the outcome of care following their admissions in tertiary academic hospitals in Rwanda.

Therefore this study intended to highlight causes of admission in this particular population; provide current situation to our health care providers; staffs and agencies, policy makers how burden is diabetes mellitus for better plan and management ahead.

1.2 Research question

What are the reasons for hospitalization among patients with Diabetes Mellitus seen at the University Teaching Hospital of Kigali (KUTH) and Rwanda Military Hospital (RMH)?

1.3 Objectives

1.3.1 General objectives

To evaluate the causes of admission among diabetic patients at the University Teaching Hospital of Kigali (KUTH) and Rwanda Military Hospital (RMH).

1.3.2 Specific objectives

1. To assess the most prevalent Diabetes Mellitus related complications responsible for admission among patients with Diabetes Mellitus.
2. To highlights non Diabetes Mellitus related reasons responsible for admission among the patients with Diabetes Mellitus.
3. To assess the in-hospital length of stay.
4. To assess the care outcome following diabetic patients' admission.

1.4 Study significance

Results of this study are informative to our health care providers; staffs and agencies, policy makers and will serve as evidence on the burden caused by Diabetes Mellitus in our population.

Chapter 2. LITERATURE REVIEW

2.1 Empirical review

In 2014, people with diabetes were estimated to be 387 million. The world prevalence was 8.3%, and out of 387 million of diabetic patients 22 million were from Africa. Considering the Projections of International Diabetes Federation (IDF), Diabetes Mellitus patients will rise up to 592 million worldwide in 2035 and 41.5 million will be from Africa (8).

Despite the low prevalence of Diabetes Mellitus in Africa compared to the rest of the world, it has been found that Africa contributes to the highest percentage of deaths worldwide (8).

Diabetes Mellitus is considered as ambulatory care-sensitive condition, and for this reason diabetes related admissions are considered preventable. Unfortunately, people with Diabetes Mellitus are experiencing high rate of hospitalization due to disease related complications. In addition, Diabetes Mellitus is a leading cause of morbidity and mortality. The premature death is due to causes specific to diabetes like Diabetic Keto-Acidosis (DKA), ischemic heart disease, infection etc. (8)(9)(7).

Diabetic patients are commonly hospitalized than those without diabetes. The findings of studies about reasons for admission among hospitalized diabetic patients across different countries, are controversial (8)(9).

Between January 2011 and January 2014 in China, a retrospective study was done to investigate the differences in characteristics, gender and reasons for admission among elderly diabetic patients. Findings were; during the study period (3 years), 817 elderly diabetic patients were recorded to be admitted in Hospital of Wenzhou Medical College, 402 women (49.2 %) and 415 men (50.8 %), among those hospitalized 89.2 % were aged 60-79 years, and 10.8 % were greater than or equal to 80 years. No difference in term of length of stay between men and women.

Of all concerned participants who were diabetic, new diagnosis of diabetes were 65 (8 %) while 752 (92 %) were previously known Diabetes Mellitus. The prevalent reason for admission among admitted elderly diabetic patients was chronic complications of Diabetes Mellitus (42.1 %), second reason for admission was hyperglycemia or poor hyperglycemic control, with or without symptoms, which accounted for 26.4 % and there were no difference in frequencies for males and

females. Infections were the third common reason for admission, respiratory infections with 44.5 %; urinary tract infections 20.3%; gastrointestinal infections 14.8 %; skin and soft tissue infection 10.2 %. Respiratory infections were common in men (61.4 %) than in women (31%; P = 0,001), urinary tract infection was common in women 29.6 % than in men (8.8 %, P = 0.004) (10).

In a cross-sectional study done in Kuwait during a period of two months (from January to February 2008) to determine the prevalence and reasons for admissions among diabetic patients, it was found that among all medical admissions, Diabetes Mellitus was the principal or secondary diagnosis in 40.6%, the majority were type 2 Diabetes Mellitus 97%, and those with a newly diagnosed Diabetes Mellitus were 60 years or above in 63.4 %. Preexisting history of asthma, hypertension, cerebral vascular disease, coronary were prevalent in diabetic patients. Specific reasons for hospitalization in diabetic patients were; Acute Coronary Syndrome (27.2 %), pneumonia (14. 3%), heart failure (11,2%), cerebral vascular accident (10.3%) and chronic obstructive airway disease (3.6%) (11).

Regarding the indication of Diabetes Mellitus patients' admission, a retrospective study was done in Black Lion Hospital (a referral hospital in Ethiopia) from 2010 to 2013 with the aim of determining the reasons of admission of diabetic patients. Of 8048 admissions, 523 patients were diabetic which corresponds to 6.5%. Yearly, the diabetic admissions were 138 (8%) in 2010, 118 (7%) in 2011, 159 (7%) in 2012 and 108 (4%) in 2013. A total of 301 (72%) patients were type 2 Diabetes Mellitus and type 1 DM disease were 104 (28%) , with male gender predominance (62%), elderly patients (median age 60 years) predominantly having type 2 disease. Main admission diagnoses for type 2 disease were diabetic foot ulcer (39%) and cardiovascular disease (21%), stroke (5%) and renal disease (10%); for type 1 disease, it was diabetic ketoacidosis (62%).The median period of hospitalization was 12 days, in hospital mortality among all diabetic patients was high 21%, commonly in Diabetes Mellitus type 2 where those discharged alive were 77% ,mortality reported at 26%, and 4% left secretly .The overall mortality seen was thought to be linked to the existing complications in addition to the indication of admission especially for type 2 Diabetes Mellitus in whom diabetic foot and cardiovascular disease were the main reasons of admission and lead to death (12).

In southwest of Ethiopia at Jimma University specialized hospital, a prospective observational study was carried out seeking for hospitalization pattern and outcome among diabetes mellitus

patients admitted in medical and surgical wards from March to June 2015. They included 89 patients, male participants accounted 59.6% , with the mean age 46.9±15.5 years. Diabetes mellitus Type 2 patients were 74.2%. (33.7%) of patients were diagnosed to have diabetic ketoacidosis. Infections as reason for admission seen in (19.1%) , cardiovascular diseases (18.0%). The most common infections responsible for admission were skin and soft tissue infections (SSTIs), 14 (15.7%) and bacterial meningitis, 4 (4.5%). Median duration of hospital stay was 9 days ranged from 1 to 88 days. Seventy six percent of patients were discharged alive and hospital mortality rate was 11.2% (8).

A retrospective study was carried out at Tripoli Medical center with the aim was to identify reasons of hospitalization of Diabetes Mellitus patients and identifying risks for hospitalizations. It covered patients admitted from January 2015 to December 2015. Out of 1037 diabetic patients recorded, males were 552 males (50.3%) and 515 females (49.7%). Ages were ranging between 16 to 96 years with a mean age of 60.7 year. Increasing frequencies were note to 44.1% when age goes up for patients aged 61-80 years, decreasing frequencies was seen when age goes up, above 80 years. Among 1037 participants in the study, type 2 Diabetes Mellitus were 935 (90.2%), whereas the remaining 9.8% were type 1 diabetes mellitus , the number of days stayed in hospital ranged from 1 day to 51 days ,a calculated mean of stay in the hospital was 6.1±6.03 days.

A longer duration of diabetes was linked with a high rate of admission (56.4%) for those more than 10 years, prevalent causes were infections 23% (chest infections being at the top), followed by lower extremities diseases, cardiovascular diseases 19.3%, neurological diseases 14.4% and renal diseases 11.8%. Metabolic and endocrine accounted 10.7% and Diabetic Keto-Acidosis patients most prevalent (59 of 111 patients), those admitted for hyperglycemia 40 (36.0%),hypoglycemic patients were 10 , finally 2 patients hyperosmolar non-ketotic state (HONK). Either hypertension as a comorbidity or others like ; ischemic heart disease, cerebral vascular diseases was seen in a third of participants, and many did not have other comorbidities. They were older than 60 years, and upon on admission diabetes was not controlled which points to diabetes as a single dominant risk for admission (9).

In Uganda at Mulago Hospital, from 1st August to 15th November 2001, a descriptive cross-sectional study was done with the aim to document causes of admission and outcome among diabetic patients in medical wards. Of 3103 medical admissions, 129 (4.2%) were diabetic patients;

57.5% were of female gender, 42.5 % were of male gender, with a mean age of 49±18 years, the common cause of admission being uncontrolled Diabetes Mellitus (48.3%), infections present in 27.7% (pneumonia was the commonest followed by urinary tract infection). The Diabetic Keto-Acidosis was a cause of admission in 9.3% patients. Among these patients 50.7% had long term complications of diabetes, 53% had hypertension, and the average length of hospital stay was 9.4±5 days. The overall mortality was 10.8% (13 patients died mainly from infections) (13).

CHAPTER 3. METHODOLOGY

3.1 Study type
Cross sectional study among patients with Diabetes Mellitus admitted on the medical wards at KUTH and RMH.

3.2 Study site and period
The study has been conducted in the University Teaching Hospital of Kigali and Rwanda Military Hospital. Both hospitals are located in Kigali city. It has been conducted during the period of four months from January 2021 to April 2021.

The University Teaching Hospital of Kigali (KUTH), was chosen as it is one of tertiary hospitals which receives many patients referred from different district hospitals across the country. In additional, Nyarugenge District where this hospital is located, there was yet no district hospital receiving internal medicine patients, most internal medicine patients are referred from this catchment area at referred to KUTH.

KUTH is among the hospitals where many facilities and staffs for diagnosing different internal diseases are found. RMH has been included as it is among the tertiary hospitals, which receives almost all referred patients from the Eastern province of the country, and facilities for diagnosing many different internal medicine diseases are available.

3.3 Study population
The study has been carried out on Diabetes Mellitus patients who have been admitted in KUTH and RMH medical wards through emergency or internal medicine OPD (Out Patient Department).

3.4 Inclusion criteria

We have included all adult patients with Diabetes Mellitus who have been hospitalized in KUTH and RMH medical wards in a period between January 2021 and April 2021.

3.5 Exclusion criteria

Patient with Diabetes Mellitus treated as Out Patients.

Refusal to participate in the study evidenced by not signing a consent form.

3.6 Sample size

All participants were recruited as received in KUTH and RMH medical wards through emergency or internal medicine OPD between January 2021 and April 2021.

3.7 Description of the study

Our study followed adult diabetic patients admitted in medical wards at Kigali University Teaching Hospital and Rwanda Military Hospital between January 2021 and April 2021.

Follow up has started since their enrollment dates that has been preceded by signing a consent to participate in the study. The patients were enrolled into the research at or shortly after their admission, have been followed during the course of hospitalization to evaluate the reasons for hospitalization, length of stay and the care outcome.

Data regarding social economic and demographic characteristics of participants was recorded from their files .It included age ,district of residence, gender, marital status, level of education, residence(rural/urban),insurance, occupation.

Data regarding indications for admission was recorded from patients' files, the ones considered were those highlighted as immediate reason(s) for admission at discharge by the treating team, unchangeably the team included a consultant Physician. Diabetes mellitus related causes of admission were considered if primarily patient was admitted due to acute metabolic complications (DKA, HHS, hypoglycemia...) or chronic complications of diabetes. Patients could have one or more reasons for admission; if it was the case, all reported diagnosis were recorded. Data regarding existing comorbidities was recorded.

Data regarding hospital stay and outcome was recorded as well. Outcome was considered as being discharged alive or dead.

3.8 Ethical consideration

The validity of the study has been assessed by Faculty of Medicine members. Permission to carry out this study has been obtained from CMHS/IRB (No366/CMHS IRB/2020), KUTH/IRB (Ref.: EC/CHUK/015/2021), RMH/IRB (Ref 115/RMH/COMDT/2021).

The purpose of the study has been explained to the participants before being included in the study using a language that they can easily understand, a consent form was signed by participants before being enrolled and data regarding participants were kept confidential, none was made public unless the participant's identification was removed.

Participants have been free to participate and withdraw from the study at any time during the study period.

3.9 Plan for utilization and dissemination of results

A research report will be submitted to the University of Rwanda as a partial fulfillment of the Master of Medicine in Internal Medicine. This work will also be submitted to the hospital as recognition to have hosted the study. It may also be presented as an oral presentation at research days. In addition, findings of this research will be submitted to international journals for academic and clinical advancements.

3. 10 Data recordings and analysis

Data were collected from participants using a pretested data collection tool and then entered in a personal computer using Epidata 3.1 then exported to SPSS version 25 for analysis. Descriptive data were presented in tables. Categorical data were presented by frequencies and percentages, and continuous data were presented using mean values for normally distributed data and median values with percentiles for skewed data. Chi-square test and binary logistic regression analysis were used to determine the association between risk factors (predictors) and the admission outcome. P-value less than 0.05 was considered to indicate a significant association between variables. Only participants with complete records (completed data collection forms) were included in the final analysis.

CHAPTER 4. RESULTS

4.1 Introduction

In our study we are describing a total of 127 patients with Diabetes Mellitus. All of them did consent for study participation and none of them requested to be removed from the study during the study period.

4.2 Sociodemographic characteristics of study participants

The mean age for our participants is 59.8 years and the majority of participants were from Kigali city at 62%. Most of the participants were more than 45 years old at 85%, relatively younger participants below or equal 35 years old were 8.7% of the total participants.

No significant gender difference among participants. Most of the participants (53.5%) had primary school as level of education, followed by secondary level 32.3% and 10.2% went to university, while 3.9 % had not been to school. Married participants were prevalent at 70.1% and combined single, divorced, widowed participants; were 29.9%. It was noticed that 66.9% of the study participants were from urban areas. Considering health insurance coverage 96.1% of patients were insured.

4.3 Assessment of the prevalence of causes of admission related to acute complications of Diabetes Mellitus

The table below shows different causes of admissions related to acute complications of Diabetes Mellitus and their prevalence. The most prevalent cause of admission being Diabetic Keto-Acidosis at 22.8 % followed by Hyperglycemic hyperosmolar state which was prevalent at 11.8%. A third of participants in our study were admitted in hyperglycemic emergencies.

Table1: Causes of admission related to acute complications of Diabetes Mellitus

Causes of admission	Number	%
Diabetic Keto-Acidosis		
Yes	29	22.8
No	98	77.2
Hyperglycemic hyperosmolar state		
Yes	15	11.8
No	112	88.2
Hypoglycemia		
Yes	5	3.9
No	122	96.1

4.4 Assessment of the prevalent causes of admission related to Diabetes Mellitus' chronic complications

The table below shows different causes of admission related to chronic complications of Diabetes Mellitus. The most prevalent cause was hypertension 22.8%, followed by chronic kidney disease 16.54%, congestive heart failure 7.09%, stroke 6.3%, foot ulcer 6.3% and peripheral artery disease 3.94%. Find more details in table 2 below.

Table 2: Causes of admission related to chronic complications of Diabetes Mellitus and comorbidities

Cause of admission	Number	%
Hypertension	29	22.83
Chronic kidney disease	21	16.54
Congestive heart failure	9	7.09
Stroke	8	6.30
Foot ulcer	8	6.30
Pulmonary edema/ ESRD related	6	4.72
Peripheral artery disease	5	3.94

Table 3: Distribution of the types of infections among admitted diabetic patients

A total of 89 participants with infections were reported in our study, the commonest infections were bacterial chest infections 37.01% and 7.09% were specifically identified as COVID-19 pneumonia. The second commonest infection was urinary tract infection 8.66%. Find more details in table 3 below

Infections	Number	%
Chest infections	47	37.01
Urinary tract infections	11	8.66
COVID 19 (identified among chest infection)	9	7.09
Gastrointestinal tract infections	7	5.51
Hepatitis infection	5	3.94
Cellulitis	3	2.36
Oral candidiasis	2	1.57
Malaria	2	1.57
Abscess	1	0.79
Bacterial meningitis	1	0.79
SSI	1	0.79

4.5 Assessment of the prevalence of comorbidities among participants

We noticed that hypertension was the prevalent comorbidity at 59.1% followed by cardiomyopathies (9.4%), diabetic nephropathy (7.9%), neuropathy (3.1%) and retinopathy (3.1%). For further details see table 4below.

Table 4: Existing comorbidities among participants

Comorbidity	Number	%
Hypertension	75	59.1
Cardiomyopathies	12	9.4
HIV	10	7.9
Diabetic nephropathy	10	7.9
Diabetic neuropathy	4	3.1
Diabetic retinopathy	4	3.1
Stroke	4	3.1
Hepatitis C	3	2.4
Prostatic Cancer/BPH	3	2.4
ESRD	2	1.6
Asthma	2	1.6
Hepatitis B	2	1.6
Diabetic foot	2	1.6
Liver failure	1	0.8
Multiple nodular goiter	1	0.8
Decompensated cirrhosis	1	0.8
Osteoarthritis	1	0.8

Table 5: Laboratory exams at admission, type of Diabetes Mellitus, duration and care outcome

Variable	Number	%
Laboratory exams at admission		
Hemoglobin [Mean (SD)]	**12.58 (2.81) g/dl**	
Severe	8	6.5
Moderate	13	10.6
Mild	27	22.0
Normal	75	61.0
HbA1c [Median (Q1-Q3)]	**9.70 (7.10-12.20)**	
<7%	26	21.1
7-10%	40	32.5
>10%	57	46.3
Serum creatinine [Median (Q1-Q3)]	**1.1 (0.8-2.4) mg/dl**	
<=1.1g/dl	63	50.0
>1.1g/dl	63	50.0
Diabetes Mellitus diagnosis duration		
Newly diagnosed	27	21.3
Less than 1 year	9	7.1
1-5 years	32	25.2
6-10 years	14	11
>10 years	38	29.9
Unknown	7	5.5
Type of Diabetes Mellitus		
Type 1 DM	3	2.4
Type 2 DM	118	92.9
Unclassified/unknown	6	4.7
Admission Outcome		
Discharged alive	108	85
Died in the hospital	19	15
Hospital stay		
Median (Q1-Q3)	12.0 (8.0 -19.0) days	

The above table shows laboratory exams at admission, disease type, duration and care outcome. We notice that 61% of patient had normal hemoglobin at admission, 6.5% had severe anemia. The mean hemoglobin at admission was 12.8 g/dl. Regarding glycated hemoglobin 46.3% had HbA1c greater than 10% and 21% had HbA1c less 7%. We noticed that 50% of patients had high serum creatinine levels greater than 1.1 mg/dl which is the upper limit of normal range. Considering the disease type, duration and care outcome 92.9% were type 2, 2.4% were type 1 and the unknown type were 4.7%. More than a third of patients had Diabetes Mellitus more than 5 years, newly diagnosed were 21.5% and a total of 19 people (15%) died in the hospital. The median days of hospital stay was 12 with a Q1-Q3 range being from 8.0 to 19.0 days.

4.6 Assessment of outcome with regard participants' characteristics and laboratory findings at admission

There was a 1.4 risk of dying for male patients compared to female but no statistically difference

(p=0.435). Patients who were greater than 65years were 1.7 times likely to die compared to those less than 65 years but without statistically significant difference (p=0.3). Considering the association between disease duration and care outcome, patients with unknown duration were 1.8 likely to die compared to patients whose diabetes duration was 5 years or less. Patients with HbA1c greater than 10% were 1.4 times likely to die compared to those who had HbA1c less than 7% but no statistically significant difference (p=0.611). Patients who were admitted with serum creatinine greater than 1.1 mg/dl had 2.4 times risk of dying compared to those who were admitted with normal renal function (p=0.088). Considering being anemic at admission, patients who were anemic had 1.3 times risk of dying compared to patients without anemia but there was no statistically significant difference (p=0.593). Find more details in table 6 below.

Table 6: Association of participants' characteristics, laboratory finding at admission and the care outcome

Predictors	Admission outcome		OR (95% CI)	P value
	Alive	**Died**		
Gender				
Male	52 (82.5%)	11 (17.5%)	1.48 (0.55-3.97)	0.435
Female	56 (87.5%)	8 (12.5%)		
Age				
<65 years	66 (82.5%)	14 (17.5%)	1.78 (0.59-5.31)	0.3
>65 years	42 (89.4%)	5 (10.6%)		
Type of disease				
Type 1	2 (66.7%)	1 (33.3%)		
Type 2	101 (85.6%)	17 (14.4%)	0.34 (0.03-3.92)	0.385
Unclassified	5 (83.3%)	1 (16.7%)	0.40 (0.02-10.02)	0.577
Diabetes duration				
≤5 years	56 (82.4%)	12 (17.6%)		
>5 years	47 (90.4%)	5 (9.6%)	0.49 (0.16-1.51)	0.218
Unknown	5 (71.4%)	2 (28.6%)	1.87 (0.32-10.79)	0.486
Glycated hemoglobin level				
<7%	23 (88.5%)	3 (11.5%)		
7 to 10%	35 (87.5%)	5 (12.5%)	1.09 (0.24-5.03)	0.907
>10%	48 (84.2%)	9 (15.8%)	1.44 (0.35-5.82)	0.611
Creatinine levels at admission				
≤1.1g/dl	57 (90.5%)	6 (9.5%)		
>1.1g/d	50 (79.4%)	13 (20.6%)	2.47 (0.87-6.98)	0.088
Hemoglobin levels				
Anemic	42 (87.5%)	6 (12.5%)	1.33 (0.46-3.83)	0.593
Not anemic	63 (84.0%)	12 (1.0%)		

4.7 Assessment of outcome with regard to participants' causes of admission and hospital stay

Patients who were admitted in hyperglycemic hyperosmolar state were 10 times likely to die compared to those who did not present in hyperglycemic hyperosmolar state (OR=10.49, 95% CI: 3.19-34.49, p<0.001). Patients who were admitted in Diabetic Keto-Acidosis were 1.7 times likely to die compared to patients who did not present in DKA but there was no statistically significant difference (p=0.329). Patients with more than 2 comorbidities were 1.8 times likely to die compared to those who do not have any comorbidity but there was no statistically significant difference (p=0.366). Patients who were admitted with infections were 2.4 times likely to de compared to those who did not have infections but the difference is not statistically significant (p=0.113). Patients who stayed in the hospital for one week and less were 2.7 times likely to die compared to those who were hospitalized for more than one week but the difference was not statistically significant (p=0.058). Find more details in table 7 below.

Table 7: Association of participants' causes of admission, hospital stay and the outcome

Predictors	Admission outcome		OR (95% CI)	P value
	Alive	**Died**		
Diabetic Keto Acidosis				
Yes	23 (79.3%)	6 (20.7%)	1.70 (0.58-4.98)	0.329
No	85 (86.7%)	13 (13.3%)		
Hyperglycemic hyperosmolar state				
Yes	7 (46.7%)	8 (53.3%)	10.49 (3.19-34.49)	**<0.001**
No	101 (90.2%)	11 (9.8%)		
Number of comorbidities				
None	32 (86.5%)	5 (13.5%)		
One comorbidities	55 (87.3%)	8 (12.7%)	0.93 (0.28-3.09)	0.907
≥2 comorbidities	21 (77.8%)	6 (22.2%)	1.83 (0.49-6.76)	0.366
Hypertension				
Yes	64 (85.3%)	11 (14.7%)	0.94 (0.35-2.54)	0.911
No	44 (84.6%)	8 (15.4%)		
Cardiomyopathies				
Yes	10 (83.3%)	2 (16.7%)	1.15 (0.23-5.72)	0.862
No	98 (85.2%)	17 (14.8%)		
Infections				
Yes	58 (80.6%)	14 (19.4%)	2.41 (0.81-7.17)	0.113
No	50 (90.9%)	5 (9.1%)		
Hospital stay				
≤7 days	23 (74.2%)	8 (25.8%)	2.69 (0.97-7.46)	0.058
>7 days	85 (88.5%)	11 (11.5%)		

4.8 Discussion of findings

In our study it has been seen that ;no difference between male and female, 49.6% and 50.4% respectively; this is similar to a study done by Haifa Elhadi et Al. 2015 in Tripoli on reasons for admissions among individuals with Diabetes Mellitus where male to female ratio was 1.1(9).

In other studies, across the African continent either males or females were high probably due to different factors; geographical, cultural belief and lifestyle. We have found that 79 participants (62. 9%) were from urban region notably; Kigali city. Of all participants 66.2 % were from urban regions, these findings support the ones of R. Gatege et Al in 2008-2010 in Rwanda at the University Teaching Hospital of Kigali on the clinical pattern and complications of African diabetic patients where 71% of participants were from urban and semi urban regions (5). The explanations for these findings could be the fact that the targeted participants were from hospitals located in Kigali and probably partially due to the fact that the incidence of Diabetes Mellitus especially type 2 in urban regions increases worldwide in developing country as a result of urbanization which has imperative association with lifestyle change and sedentary life.

Considering age distribution of participants by age, diabetes type; we found that majority of our participants were type 2 Diabetes Mellitus at 92.4%, Diabetes Mellitus type 1 were 2.4% and the unclassified amounted to 4.7%. Of all the participants 75% were more than 40 years old. The similar findings were observed in the study done by Haifa Eldahi et Al in 2015 in Libya where 90.2 % of patients were having type 2 Diabetes Mellitus and the majority of them up to 90% were more than 40 years old.

The almost same findings were seen in a study done in Nigeria by Ojobi JE et Al in 2012-2013 about indications and outcome of admission of diabetic patients where the majority of patients had type 2 Diabetes Mellitus at 95.2% and 4.1% had type 1 Diabetes Mellitus. The majority among admitted patients were more than 40 years old.

Above findings reflect the existing evidence in literature that in the developing world, there is an increasing incidence of Diabetes Mellitus type 2 definitely resulting in increasing prevalence of diabetic complications. The increase in incidence of diabetic patients in developing countries is a result of urbanization, life style change, changed social habits and sedentary life. In addition, type 2 Diabetes Mellitus likely occurs with aging compared to type 1 disease which presents in younger

age. Most of participants were above 40 years. Usually the diagnosis of type 2 Diabetes Mellitus is made many years after its onset risking patients to present when they already have complications related to diabetes especially micro -vascular complications. Hence, combining aging and the existing complications, they are at high risk for hospitalization.

The mean age in our participants was 59.8 years. This is similar to what was found in other multiple studies done across the African continent including the one done by M Gwiza et Al in 2010-2013 in Addis Ababa at Black Lion Hospital. It was about admissions and complications among diabetic patients in Addis Ababa where the median age was 60 years; same results were seen in Tripoli in a study evaluating reasons of admission of individuals with diabetes where the mean age was 60.7 years, and lastly the mean age was 57 years in a study done in Nigeria between 2003 and 2007 about the pattern and outcome of diabetic admission at Federal Medical Center (12)(9)(14).

In some other studies, the mean age of participants was lower or higher compared to our findings probably due to the fact that different countries have different life span and those with higher life span tend to have their population developing Diabetes Mellitus in elderhood.

In our study, it has been noticed that among acute complications (metabolic) related to Diabetes Mellitus, Diabetic Keto-Acidosis was the most prevalent reason for admission with 22.8 % of participants, followed by Hyperglycemic hyperosmolar state (11.8%). Of all acute metabolic complications of Diabetes Mellitus as reasons for admission; 34.6% were due to hyperglycemic emergencies. This results are almost similar to the findings in a study done in Nigeria by Chijioke et Al about mortality patterns among type 2 Diabetes Mellitus patients, where 29.8% of diabetic patients were admitted for hyperglycemic emergencies; considering those with Diabetic Keto-Acidosis were 19.5% whereas in our study were 22.8%. These findings support the similarities, the aspect of difference being that the later was a 10-years retrospective study whereas ours was a 4 months prospective study (15).

Our findings about acute metabolic complications related to Diabetes Mellitus are also similar to the findings seen in a study done in Nigeria by Ojobi et Al in 2011-2013 about the indications and outcome of admission of diabetic patients into medical wards in Nigerian Tertiary Hospital where 36.9% of participants had hyperglycemic emergencies (DKA and HHS), 28.7% and 8.2% respectively (16). Another study done in Ethiopia by Kafale et Al; DKA and HHS admissions were

33.7% and 4.5% respectively, making the overall hyperglycemic emergencies related admission 38.2% (8).

Above findings are different from a study done in Libya on reasons for admission of individual with Diabetes Mellitus to Tripoli Medical Center by Haifa et Al in 2015,where they noticed that from all patients with Diabetes Mellitus admitted during the studied period only one tenth of participants (10.7%) had acute metabolic complications related to Diabetes Mellitus as a reason for admission notably; DKA 5.9%, HHS 0.9%, Hyperglycemia 3.8% and Hypoglycemia 0.1% (9). Lastly, a study done in a country of high income economy; Kuwait by Afaf et Al found that acute metabolic complications were third among common reasons of admissions in diabetic patients 6.3% (11).

The findings from these last 2 studies are lower compared to our findings and other studies from Nigeria and Ethiopia mentioned above, many other studies either report higher or lower percentages of acute complications as causes of admission in diabetic patients. The factors responsible for different findings are multifactorial; including poor glycemic control in some population that may cause patients to present with acute complications, differences in duration of Diabetes Mellitus governing onset of chronic complications of Diabetes Mellitus, age differences and diabetes onset where newly diagnosed patients likely present with hyperglycemic emergencies, cultural beliefs where some people have some specific habits predisposing them to some additional comorbidities on top of Diabetes Mellitus.

The prevalence of hypoglycemia in our study was 3.5% which is almost the same as the one found in Ethiopia 2.25% (8). These findings were lower than those reported in a study titled "Morbidity and Mortality among diabetic patients admitted to Mulago in Uganda" by Bateganya et Al. where 14.2% presented with hypoglycemia. The probable explanation of this high percentage of hypoglycemia in Ugandan participants at Mulago Hospital, might have been observed due to the high percentage of participants who were on insulin therapy (47.5%)(13) .

We observed that of all the patients who presented in hyperglycemic emergencies (DKA and HHS) in 60.4% of them the triggering reasons were infections. Among patients who presented with DKA, 55.5% had infections as a trigger. These findings look similar to those observed in a study done in Tanzania in 2021 by Shabani Iddi et Al. about the clinical presentation and precipitating factors of

Diabetic Keto-Acidosis among patients admitted to the intensive care unit at a tertiary hospital in Mwanza where 51.7% of DKA had infection as its trigger (17). The same findings were seen in a study done in Nigeria by Andrew about the clinical profile and outcomes of patients with hyperglycemic emergencies where more than 50% of patients who presented in hyperglycemic emergency had infection as a trigger (18).

Another study done in Ethiopia by Mohamed, the findings documented that infections and poor compliance were the most contributive triggers for hyperglycemic emergency (19). The similar information was seen in a paper published by Pasquel FJ et Al. about a historic review of the clinical presentation, diagnosis, treatment of hyperosmolar state where they reported that 40 - 60% of patients who present in hyperglycemic state have infections as trigger (20).

In our study we noticed that about 67.6% of participants had a reason for admission which had association with chronic complications of Diabetes Mellitus. Almost the similar observation were seen in a study titled "Reasons for admission of individual with diabetes to the Tripoli Medical Center" in 2015 by Haifa et Al where participants admitted with renal diseases, neurological affection, cardiovascular and lower extremities diseases accounted for 67.9% (9).

Of all the participants in our study, infections as cause of admission were highlighted at 70.02%, but only 47 participants (37%) were having infection as the only specific reason for admission. The most common reported infections were chest infection in forty-seven patients (37.01%), followed by urinary tract infection in 11 patients (8.6%), specified chest infection included COVID-19 pneumonia in 9 patients (7.09%). These findings are almost similar to those reported in a study titled "Morbidity and mortality among diabetic patients admitted to Mulago Hospital in Uganda done by Bateganya et Al (13) where 27.7% had infections, the commonest being chest infection in 15%, followed by urinary tract infection in 11.8% (13); these findings are a little bit different from the ones reported in a study titled "Hospitalization pattern and treatment outcome among diabetic patients admitted to a teaching hospital in Ethiopia" done by Kefale et Al where infections were reported in 17 patients (19.1%) with skin and soft tissues infection being the commonest affecting 14 patients (15.7%) out of the total (21). Lastly, a study titled "Reason for admission of individuals with diabetes to Tripoli Medical Center" done in Libya by Haifa et Al, reported infections predominantly as the main cause of admission (23%) and chest infections were

commonest.

These observed differences may be explained by differences in number of type 1 diabetic patients reported in the later study done in Ethiopia where this group of population use insulin injection for diabetes,therefore that may predispose them to high prevalence of skin infections. We can't also neglect age differences and diabetes duration difference where those with advanced age and longer diabetes duration have high risk of lower extremities infections as a result of increased risk of peripheral artery diseases.

In our study we observed patients with confirmed COVID-19 pneumonia reflecting that, this pandemic era might have partially contributed to the findings we observed.

According to the findings in our study; the main specific reasons for admission were acute metabolic complications of diabetes 38.5% (DKA: 22.8%, HHS 11.8%, Hypoglycemia 3.9%) followed by infections 37%. Other significant reasons for admission were chronic complications of diabetes; the commonest being hypertension (22.8%) followed by chronic kidney disease (16.5%).

In this category of chronic complications of Diabetes Mellitus as reason for admission, we noticed that patients were frequently reported to have more than one reason for admission probably due to existence of complications related to diabetes that were requiring acute management.

Knowing that chronic hyperglycemic state in diabetes mellitus patients predispose them to immunosuppression, neuropathy and other factors like autonomic nerves affection predisposing them to frequent urinary tract infection, pneumonia and other various infections, we notice that; by excluding infections as non -diabetes related causes of admissions, the rest of non -diabetes related causes of admission were not significant and were reported in 0.8% among reasons for admission.

Regarding comorbidities among participants, we have found that 70.8% had comorbidities of which 49.6% had one comorbidity and 21.2.1% had two or more than two comorbidities. Most of these comorbidities were reflecting chronic complications of diabetes though some were not necessarily causative reasons of admission. Hypertension was the commonest comorbidity we

observed at 59.1% followed by cardiomyopathies at 9.4%, nephropathy at 7.9%. Almost same findings were reported in a study done by Bateganya et Al. in Uganda at Mulago Hospital where hypertension was the commonest comorbidity found in 59.2% (13). The same findings were reported in a study done in Ethiopia by M.Gizaw where 85% of people had existing complications notably hypertension, neuropathy, nephropathy and foot ulcer (12).

The same reports were seen in a study done in Libya about reasons for admission of individual with diabetes to the Tripoli Medical Center by Haifa et Al. in 2015 where the frequent comorbidities was hypertension in 26.7% of participants, multiple comorbidities were seen in 24.6% and a total of 40.5% had no comorbidities (9).

These findings are explained by the known significant association between Diabetes Mellitus and hypertension, especially in type 2 Diabetes Mellitus and the duration of diabetes since people with long duration of diabetes have micro-vascular complications. Partially, some variations in prevalence of some comorbidities seen in many studies done in different countries may be from different social habits and cultural beliefs across the world as the later may predispose people to other comorbidities on top of existing Diabetes Mellitus.

In our study 92.9% had type 2 Diabetes Mellitus and 40% of participants had Diabetes Mellitus more than 5 years, which explains the significant high prevalence of long term complications of Diabetes Mellitus that was observed.

It has been noticed in our study that 108 participants (85%) were discharged alive and 19 participants (15%) died in the hospital. Of the 15% participants who died 73.6% had infections. The similar findings have been seen in Uganda in a study done by Bateganya et Al. about morbidity and mortality among diabetic patients admitted to Mulago where mortality was 10.8% and 61.8% of death occurred in participants with infections.

The similar findings were observed in a study done in Ethiopia by Kefale et Al.2015 where the mortality rate was found to be 11.2%. Among participants who died 40 % had infections (21).

Lastly, almost similar findings about mortality among diabetes mellitus patients were seen in Nigeria from a study done by Ojobi et Al. where the mortality was found to be 8.2%. Of the people

who died, 31% occurred in those who presented with metabolic decompensation complicated by sepsis (16).

According to the results, diabetes related complications (acute and chronic) are major causes of admission and are associated with morbidity and mortality; the major causes of decompensation in acute metabolic complications being infections. Non -diabetes related causes of admission were not significant in our study.

In our study participants who presented in hyperosmolar state had 10 times risk of dying compared to those who did not present in hyperosmolar state (OR=10.49,95% CI:3.19-34.49, P<0.001).

We have noticed that, the mean hospital stay for our participants was 12 days. Though not statistically significant (p<0,058), patients who stayed less than 7 days were 2.7 likely to die compared to those who stayed more than a week. We thought probably those who died presented too sick then deteriorated quickly.

IV.2 Study limitations

Our study took into consideration of the reported multiple reasons for admission and each was counted separately.

Study period was short, we might have missed some other causes of admission.

CHAPTER 5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study revealed that the commonest specific indications for admission were acute metabolic complications of diabetes 38.5%; of which DKA accounted 22.8%, followed by Hyperosmolar hyperglycemic state 11.8%. Infections were the second commonest primary reasons of admission 37% and commonest triggers of hyperglycemic emergencies in 60.4%. Lastly other significant reasons for admission were chronic complications related to diabetes. Though majority of participant were discharged with improvement 85%, in hospital mortality among participants was 15% and patients admitted in hyperosmolar state were 10 times likely to die compared to those who did not present in hyperosmolar state.

5.2 Recommendations

While Diabetes Mellitus is an outpatient care-sensitive disease, in our study we have noticed that the commonest reason for admission among Diabetes Mellitus patients were complications related to diabetes itself (acute and chronic). Therefore, we recommend establishing an easy protocol for effective primary health care delivered to those particular patients.

Furthermore, we have noticed 21.3% of participants were newly diagnosed with Diabetes Mellitus and this finding reflects that probably there are many undiagnosed diabetes patients in our Rwandan population; hence we recommend regular scheduled National-wide screening for Diabetes Mellitus. Continuous health care providers' education to update knowledge about Diabetes Mellitus is imperative. Finally, we noticed that there is a significant mortality in patients admitted in hyperglycemic emergencies, but our study did not assess more about it. We recommend that further studies to assess predictors of treatment outcome among hyperglycemic state patients should be conducted.

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APPENDICES

Appendix 1: Informed consent form

Dear Respondents,

Informed consent form

My name is Dr Prosper NDAYISABA, I am a student of University of Rwanda (UR) pursuing Masters in Medicine (MMed) In Internal Medicine. I am conducting a research entitled:

Causes of admission of diabetes mellitus patients on the medical wards at Kigali the University Teaching hospitals in Rwanda.

Diabetes mellitus is a complex chronic disease associated with complications. In developing countries, there is an increase incidence of diabetes mellitus due to urbanization. In Rwanda due to life style change associated with urbanization sedentary life we observe growing numbers of new diabetes mellitus patients, their admission is not uncommon, yet little information   about reasons for admission in those particular patient is known. Hence we want to conduct a study to know the commonest reasons for admission among diabetic patients admitted in teaching hospitals.

Participation in this study is voluntary and you have the right to withdraw from the study anytime. However, we hope you will participate in this study since it will help us to know the commonest reasons for admission among diabetic patient which will help health care providers to get updated information about the burden related to diabetes, then it will increase their awareness so that they may help those particular patients accordingly. Lastly policy makers may base on available information for planning and advocacy whenever needed to improve quality of life for those patients.

Whatever information you provide will be kept confidential and no reference to your names or other family members will made anywhere. We do not anticipate that there would be any harmful event that would occur with the study. But for any concern , your refer to the research committee (researchcenter@ac.ur.rw Tel +250 788563311).

Thank you.

I ……………………………………………understand the explanation by ………………………

about the risks and benefits of this research on causes of admission of diabetes mellitus patients on the medical wards at the university teaching hospital in Rwanda . I accept willingly to participate in the research.

Participant's signature   Researcher's signature

Date:………../……/2021

APPENDIX 2: Data Collection tool
PART 1: Social, Economic, Demographic Information

Initials: Hospital id: District: Tel number:

Age (years):

Gender (circle): male   female

Marital status (circle): single   married   divorced   widow

Level of education (circle): primary   secondary   university   none

Residence (circle): rural   urban

Insurance status (circle):   MMI   Mutuelle de Santé   RSSB
                    Others   no insurance

Occupation (circle):   Government employee   Military   Farmer
                    Business owner   Retired   Jobless

PART 2: CAUSES OF ADMISSIONS (REASONS).

  A) Acute complications of diabetes mellitus

(Circle)   1. diabete ketoacidosis(DKA)   2. Hyperglycemic hyperosmolar status

        3.hypoglycemia   4. other,…………………………

B) Related to chronic complications of diabetes mellitus

(Circle) 1. Foot ulcer   2. Peripheral artery diseases   3.congestive heart failure

(Circle) 4. Coronary artery disease 5. Hypertension   6.Arrhythmia

(Circle) 7. Pulmonary oedema ESRD related

8) acute kidney injury   9. Chronic kidney disease(CKD)

(Circle) 10. Stroke

 c) **Infections**   in : a) Chest (bacterial Pneumonia)

b) Other chest infection ……….

b) Gastro- intestinal infections

C) Abcess

Other infection(s)……………………………………….

d) Others   1) hematological : ………   . 2)thrombo emboli: a) deep vein thrombosis

b) pulmonary embolism

. E) other reasons…………………..

PART THREE EXISTING COMMOBIRDITIES

(Circle) 1. Hypertension   2. Cardiomyopathies   3.previous myocardial infarct

4. Stroke   5. Diabetic foot infection   6. Diabetic nephropathy

7. Diabetic neuropathy   8.diabetic retinopathy   9. Other ……,

10. None

IV . Diabetes mellitus   duration

(Circle)   a) Less 1 year   b) 1 year   – 5 years   c) 6 – 10 years

    d) >10 years   e) not known   F) newly diagnosed

V. OUTCOME

1. Discharged alive ………………
2. Died in the hospital…………….

3. **VI .IN HOSPITAL STAY**: ………….DAYS

VII. When diagnosed diabetes Mellitus

  (Circle) a) Childhood or when was less 20 years old.

    b) Adulthood age.   C) No information.

VIII . Laboratory data

    A) HbA1c percentage at admission   ………%.

    B) HbA1C percentage recent one in the past if previous diabetic …………% not available………..

    C)   Serum Creatinine level on admission …………   in mg /dl   or

          …………   In micromole/l

    D) Recent Serum Creatinine level in the past if any recorded ……………mg/dl

…………micromole/l

E) Hb on admission for all patients …… G/DL