

AFRICA UNIVERSITY
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PREVALENCE OF DIABETIC NEPHROPATHY AMONG DIABETES MELLITUS TYPE
2 PATIENTS ATTENDING SALLY MUGABE DIABETIC CLINIC: JANUARY 2024-
DECEMBER 2024

BY

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A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF BACHELOR OF MEDICAL LABORATORY
SCIENCES IN THE COLLEGE OF HEALTH AGRICULTURE AND NATURAL SCIENCES

2025

Abstract

Diabetic Nephropathy (DN) is a critical complication of Type 2 Diabetes Mellitus (T2DM) that significantly contributes to the increasing prevalence of chronic kidney disease (CKD) and associated with morbidity and mortality. The Sally Mugabe biochemistry department reported a significant number of urine and electrolytes (U&E) tests from the hospital wards, with many samples originating from the renal ward, highlighting a concerning rise in the incidence of DN despite advancements in diabetes management, particularly in developing regions where access to healthcare and early detection mechanisms are limited. The aim of this study was to investigate the prevalence of diabetic nephropathy among T2DM patients attending Sally Mugabe Diabetic Clinic from January to December 2024, by using medical laboratory data of 385 patients to achieve this objective. A retrospective cross-sectional design was employed, focusing on laboratory records from adult patients diagnosed with T2DM. The researcher used the random sampling technique during the research based on the exclusion and inclusion criteria. The research examined key risk factors, including socio-demographic variables and renal function test results. The study population consisted of patients aged 18 years and older who had been confirmed to have T2DM. Exclusion criteria included individuals with Type 1 diabetes, pregnant women and those with missing relevant data. Findings indicate that there is a high prevalence of DN among the study prevalence, with significant associations noted between socio-demographic factors such as age, gender, and socio-economic status, and the incidence of DN. Laboratory assessments, including Urine-Albumin-Creatinine Ratio (UACR) and estimated Glomerular Filtration Rate (eGFR), revealed alarming trends indicative of declining renal function, necessitating early detection and intervention strategies. A prevalence of diabetic nephropathy of 35.1% was found among T2DM patients attending the Sally Mugabe Diabetic Clinic. A higher prevalence was noted among males (38%), compared to females (31.9%). Most cases of diabetic nephropathy were found in those aged 50 years and above. The study suggests that inadequate healthcare access may increase the risk of DN in developing regions like Zimbabwe. The research findings highlight the urgent need for systematic screening and management protocols in diabetic clinics to address the rising burden of diabetic nephropathy and its consequential impact on public health. The findings contribute valuable insights into the epidemiology of diabetic nephropathy among type 2 diabetes patients, emphasizing the role of comprehensive healthcare strategies in mitigating its prevalence and progression.

Keywords: Diabetic Nephropathy, estimated Glomerular Filtration Rate, Type 2 Diabetes Mellitus, Urine Albumin Creatinine Ratio

Declaration

I, Tanyaradzwa Blessing Mugoniwa student number 210351 do hereby declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a Bachelor of Science degree.

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Acknowledgements

I would love to express my deepest gratitude to my parents and my little brother for believing in me as well as providing any necessary funds throughout the course of this research. Their unwavering love and encouragement kept me motivated. I owe my heartfelt appreciation to Mr G. Malunga, my supervisor for his invaluable guidance, encouragement and expertise. Sally Mugabe Central Hospital management is also appreciated for permitting me to collect data for my research project. His insights have been instrumental in shaping my research. I would also like to thank the Lord Almighty.

Dedication

I dedicate this dissertation to my parents and my little brother for their unwavering support and prayers throughout the course of my studies.

Acronyms and Abbreviations

CKD	Chronic Kidney Disease
UACR	Urine Albumin Creatinine Ratio
DM	Diabetes Mellitus
DN	Diabetic Nephropathy
eGFR	estimated Glomerular Filtration Rate
T2DM	Type 2 Diabetes Mellitus
UACR	Urine Albumin Creatinine Ratio
U&E	Urine and Electrolytes

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Definition of key terms

Type 2 Diabetes mellitus - A chronic condition that affects the way the human body metabolizes sugar (glucose).

Diabetic Nephropathy - A serious kidney-related complication of diabetes, particularly Type 1 and Type 2 diabetes.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Diabetic nephropathy is a common and serious complication of type II diabetes mellitus, leading to chronic kidney disease and increased mortality worldwide. Laboratory parameters such as serum creatinine and glomerular filtration rate are important for diagnosing and monitoring the disease (Kurtis et al, 2012). The prevalence of diabetic nephropathy is increasing due to the growing burden of type II diabetes mellitus, and it is projected to become a major public health concern in the coming years (Laube et al., 2019).

However, the prevalence of diabetic nephropathy and chronic kidney disease is often underestimated in type 2 diabetes mellitus patients (Laube et al., 2019). Early detection and management of diabetic nephropathy are critical to prevent or delay its progression to an end-stage renal disease (Kim et al., 2018). Therefore, it is vital to conduct studies to evaluate the relationship between laboratory parameters and the prevalence of diabetic nephropathy, as well as to evaluate the frequency of chronic kidney disease and micro-albuminuria in these patients.

1.2 Background of the Study

1.2.1 Worldwide burden of diabetic nephropathy

Type II diabetes mellitus is a common disorder that affects millions of individuals and is associated with various long term health complications, including renal health complications. It is characterized by high blood sugar levels due to the body's inability to effectively use or produce insulin. Kidney disease is an increasing global problem that disproportionately affects poor, vulnerable and marginalized populations, and is associated with high individual, health care and societal costs (Vaidya & Aeddula, 2024). Approximately 700 million people are estimated to have (Chronic Kidney Disease) CKD worldwide, with the prevalence estimated to be around 10-14% in the general population (Vaidya & Aeddula, 2024). Diabetic nephropathy is said to affect approximately one-third of all individuals with diabetes thus is a

leading cause of end-stage renal disease. As such early and effective identification and monitoring of renal risk factors in patients is essential for the prevention and management of the health complications.

Diabetic nephropathy, also identified as diabetic kidney disease is a fast rising global health concern (Deng et al., 2021). Recent estimates show that there were approximately 2.62 million new cases, 134.58 million patients, 405,990 deaths and 13.09 million disability-adjusted life-years (DALYs) related to diabetic nephropathy worldwide in 2019 (Deng et al., 2021). The main age group that is affected by diabetic nephropathy is said to vary by region, with 55-64 years being the primary age group in Asia and Africa (Bikbov et al., 2018).

Renal disease, specifically diabetic nephropathy, is a major cause of morbidity and mortality in diabetes patients. It is characterized by increased urine albumin excretion and declining renal function. The severity of albuminuria is a well-established predictor of renal disease progression in diabetic patients, indicating the vitality of early identification and intervention.

1.2.2 Pathophysiology of diabetic nephropathy

A combination of peripheral insulin resistance and inadequate insulin secretion by pancreatic beta cells is a character of type 2 diabetes. Insulin resistance, which has been attributed to elevated levels of free fatty acids and pro-inflammatory cytokines in plasma, leads to decreased glucose transport into muscle cells, elevated hepatic glucose production, and increased breakdown of fat (American Diabetes Association, 2022; DeFronzo & Ferrannini, 2015).

Extensive studies into the relationship between hyperglycemia and hypertension, have revealed a complex interplay between the two conditions (Hall et al., 2014; Cheung et al., 2017). Hyperglycemia, or elevated blood glucose levels can lead to vascular dysfunction, inflammation, and oxidative stress, all of which contribute to development of hypertension (Sowers et al., 2016).

Hypertension results in proteinuria and reduced renal function. Albumin excretion in the urine

has been linked to hydrostatic pressure alterations in the afferent glomerulus, increased leakage of the glomerular basal membrane, and poor tubular function in hypertensive patients. The prolonged exposure to high blood sugar levels can lead to microvascular damage, inflammation, and fibrosis in the kidneys, ultimately resulting in diabetic nephropathy (Tsugawa H. et al., 2019).

Recent studies have concluded that dyslipidaemia characterized by for example high levels of blood total cholesterol and low density lipoprotein is associated with diabetic nephropathy progression. Since albuminuria is related substantially to high total cholesterol levels, the presence of dyslipidaemia can be used as an assessment tool for micro-albuminuria among patients with type II diabetes mellitus (National Institute for Healthcare Excellence, 2021).

1.2.3 Laboratory diagnosis of diabetic nephropathy

DN is a significant complication of diabetes mellitus, characterized by the presence of albumin in the urine and decline in kidney function. Early diagnosis is crucial for effective management and to slow progression of the disease. The laboratory diagnosis of diabetic nephropathy primarily involves the assessment of urinary albumin levels and the assessment of kidney function.

The urinary albumin test is crucial for the detection of albuminuria, a hallmark of DN. It measures the amount of albumin (a type of protein) excreted in urine. Nephropathy can be detected by the presence of micro-albuminuria which refers to excretion of albumin in amounts too small to be detected by routine dip stick testing. An albumin secretion rate of 30mg/day or more indicates the presence of DN (National Kidney Foundation, 2014).

The gold standard for diagnosing is said to be 24-Hour urine collection for protein and albumin. DN provides a comprehensive assessment of proteinuria despite being less commonly used. This test provides an estimate of albumin secretion over a 24 hour period by measuring the concentration of albumin relative to creatinine (a waste product). The albumin-to- creatinine (ACR) is frequently used as a method to assess albuminuria.

The Glomerular Filtration Rate (eGFR) is another critical measure of kidney function which can be used to assess kidney function. The test is used to estimate how well the kidneys are filtering blood thus being a key marker in early kidney damage detection. Basing on serum creatinine levels, sex, age and race the eGFR provides an estimate of kidney function. A normal eGFR is typically above 60 mL /min / 1.73 m², while values below this threshold indicate varying stages of chronic kidney disease (Narva & Bilous, 2015). Despite not always detecting early kidney damage, a decline in eGFR indicates worsening kidney function and is associated with progression of DN (National Kidney Foundation, 2014).

Proteins, glucose and other substances can also be detected in urine by urinalysis. The presence of both protein (proteinuria) and glucose (glucosuria) can be used as indicators of kidney damage. A protein considered to be a more sensitive marker for kidney function than creatinine, Cystatin C is also measured in blood. It may provide additional information about kidney function in patients with diabetes (Batuman, 2024). Collection of a small sample of kidney tissue is done in kidney biopsy to confirm the diagnosis and assess the extent of kidney damage in the laboratory (National Kidney Foundation, 2014). According to, (Persson & Rossing, 2018), some studies are exploring the use of various urinary and serum biomarkers that may provide insights into kidney damage and disease progression.

1.3 Statement of the Problem

Diabetic nephropathy poses a substantial burden on healthcare systems and significantly impacts patients' quality of life as it is a leading cause of end stage renal disease. The Sally Mugabe biochemistry department reported a significant number of urine and electrolytes (U&E) from the hospital wards. It became a topic of interest because quite a number of those samples came in from the renal ward of the hospital hence further sparking interest and promising to be a significant cause of concern. This showed that despite advancements in diabetes management, there is a rise in incidence of DN, particularly in developing regions where access to healthcare and early detection mechanisms are limited, Zimbabwe included. Additionally, there is a limited

understanding of the social determinants affecting the emergence of DN, especially in marginalized populations (Zhang et al., 2020). Due to its association with other chronic conditions and multifactorial nature there was crucial need for comprehensive research that explores the risk factors and epidemiology for DN.

1.4 Research Objectives

1.4.1 Broad Objective

This research aimed to evaluate the prevalence of diabetic nephropathy among type 2 diabetes patients attending Sally Mugabe Diabetic Clinic in 2024, based on medical laboratory data.

1.4.2 Specific Objectives

1. To determine the prevalence of diabetic nephropathy among diabetes type 2 patients attending Sally Mugabe Diabetic Clinic in 2024.
2. To analyse the renal function tests laboratory results of T2DM patients attending Sally Mugabe Diabetic Clinic in 2024.
3. To identify socio-demographic factors associated with diabetic nephropathy among T2DM patients attending Sally Mugabe Diabetic Clinic in 2024.

1.5 Research Questions

1. What is the prevalence of diabetic nephropathy among T2DM attending Sally Mugabe Diabetic Clinic in 2024?
2. What was the trend of renal function tests laboratory results of T2DM patients attending Sally Mugabe Diabetic Clinic in 2024?
3. What are the socio-demographic factors which are associated with diabetic nephropathy among T2DM patients attending Sally Mugabe Diabetic Clinic in 2024?

1.6 Study Justification

According to, Zhang et al. (2020), the prevalence of diabetic nephropathy is significantly high among diabetes type 2 patients, necessitating a thorough evaluation of its frequency and

risk factors. The management of diabetic nephropathy is crucial to prevent or delay its progression to chronic disease or mortality. Diabetic nephropathy has a significant impact on public health, in terms of economic costs and burden on healthcare systems. There is limited data on the prevalence and risk factors of diabetic nephropathy among type 2 diabetes patients attending a diabetic clinic in our context.

1.7 Study Limitations

This research relied on hospital diagnostic coding of hospitalized patients hence the outcome excluded diabetic type II mellitus patients who were never admitted to the hospital. This research only took place at Sally Mugabe Central Hospital Diabetic Clinic therefore data collected from diabetic patients from other provinces was irrelevant. Due to policies of hospitals, clinics and medical laboratories the researcher found it difficult to obtain information as it was private and confidential. Due to time and financial constrictions the researcher failed to travel frequently for data collection.

1.8 Study Delimitations

This research was carried out at Sally Mugabe Central Hospital Diabetic Clinic. This research looked at the clinical data that is medical laboratory test results and hospital records that were carried out on type II diabetes patients. The study exclusively included patients diagnosed with type 2 diabetes mellitus, excluding those with type 1 diabetes or other forms of diabetes. This research used specific criteria for diagnosing Diabetic nephropathy (e.g., albuminuria levels), potentially excluding cases diagnosed by different criteria.

1.9 Chapter Summary

This chapter served to assess the prevalence of diabetic nephropathy in diabetes type 2 mellitus patients. The chapter also looked into the background information on the various laboratory parameters which may be used as markers of diabetic nephropathy.

CHAPTER 2 REVIEW OF RELATED LITERATURE

2.1 Introduction

The literature in this chapter strived to explore current knowledge and fundamental information in relation to diabetic nephropathy. It aimed to explore three key areas related to diabetic nephropathy in T2DM patients thus suggesting that understanding diabetes mellitus type 2 is crucial for effective management and prevention of DN. The literature that was reviewed was obtained from articles that have been published on the internet.

2.2 Conceptual Framework for diabetic nephropathy

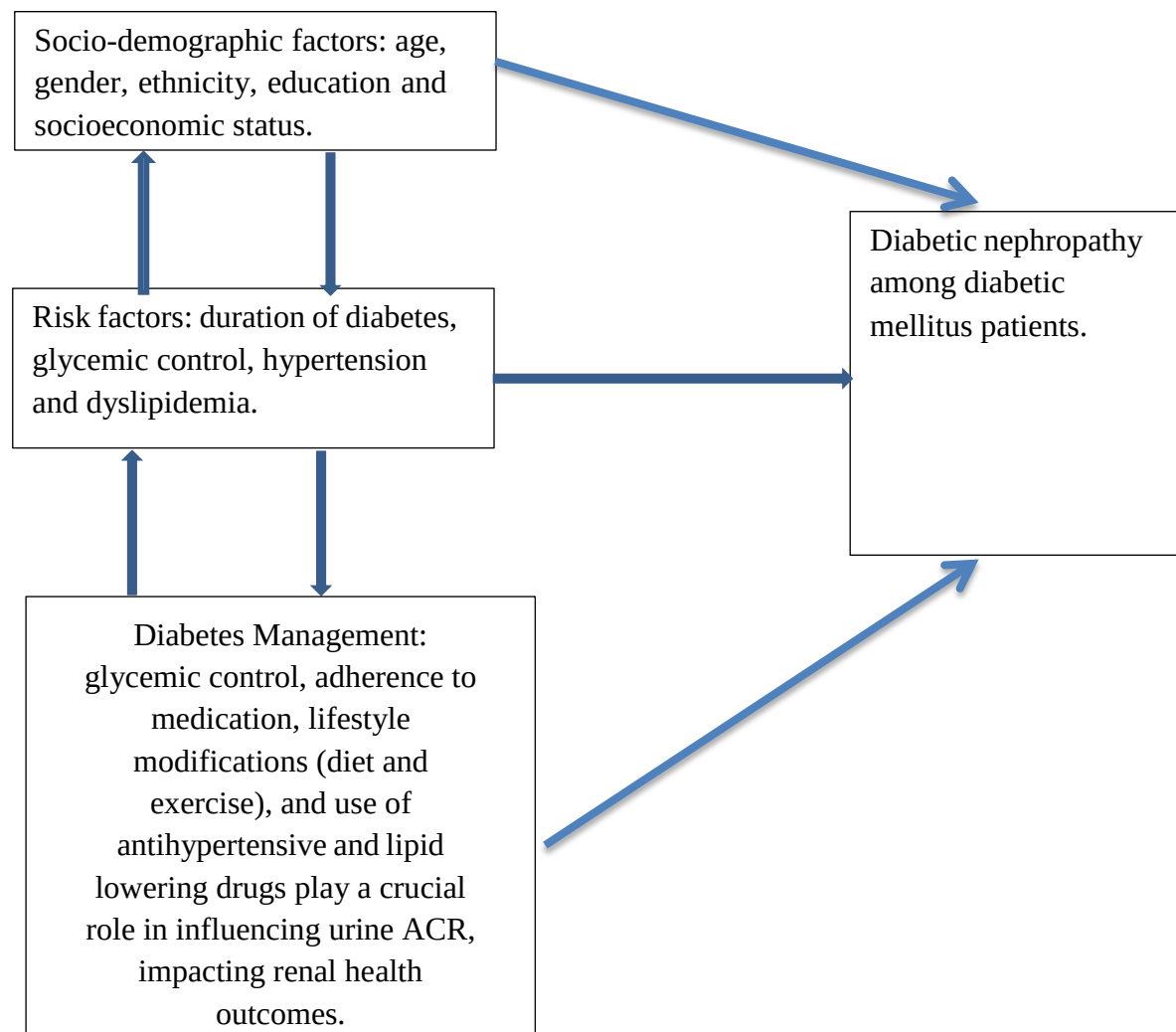


Figure 1: Conceptual framework for diabetic nephropathy

The above conceptual framework illustrates some of the contributing factors of as well as the management of DN. The framework was designed to explore the relationship between socio-

demographic factors, risk factors and diabetes management in relation to DN in T2DM patients. It highlighted how the interaction of the risk factors and socio-demographic factors can contribute to the development and progression of DN thus leading to the rising need of disease management. The framework served as a guide to understand how these elements interacted and contributed to the development and progression of diabetic nephropathy. Socio-demographic factors encompass a range of characteristics, including age, sex, ethnicity, socioeconomic status, and education level. Studies have shown that male sex and older age are associated with a higher prevalence of DN among T2DM, thus these factors can significantly increase the risk of developing DN. It was thus vital to understand these socio- demographic influences so as to be able to identify the at risk populations and be able to tailor interventions. Risk factors for DN can be categorized into non-modifiable (genetic predisposition and age) as well as modifiable (hypertension, poor glycemic control, dyslipidemia and life choices) factors. Identifying and addressing, these risk factors which can lead to the development of micro-albuminuria, a precursor to DN, and ultimately progress to more severe kidney damage is essential for preventing the onset and progression of DN. Effective diabetes management is vital in preventing complications such as DN. Management includes regular monitoring of blood glucose levels and adherence to prescribed medications among other measures. Managing comorbid conditions, such as hypertension and dyslipidemia reduces the risk of kidney damage. Patient support systems and education, play a very significant role in empowering individuals to manage their diabetes effectively and adhere to treatment regimens.

2.3 Literature Review in relation to study objectives

2.3.1 Prevalence of diabetic nephropathy among diabetes type 2 patients.

Diabetes, a chronic disease associated with kidney damage is fast becoming one of the major causes of death in diabetes type 2 mellitus patients. Quite a number of studies have reported varying prevalence rates of DN among type 2 DM patients, due to geographic, demographic, and methodological factors.

In specific populations, such as those in developing countries, the prevalence can be even higher due to factors like delayed diagnosis and inadequate healthcare resources (Tekalign et al., 2023). For example, a study conducted in Ethiopia reported a prevalence rate of 15.3% among diabetic patients, highlighting the urgent need for effective screening and management strategies to address this public health issue (Tekalign et al., 2023). The increasing incidence of diabetic nephropathy underscores the importance of understanding the associated risk factors and implementing preventive measures.

A systematic review that was done of 22 studies reported a pooled global prevalence of diabetic nephropathy among diabetes type 2 mellitus as 37.4% (Li et al., 2020), with regional prevalence rates found to be Asia (36.2%), Europe (42.1%), North America (40.5%), and Africa (44.9%). In a case-control study that investigated the prevalence of diabetic nephropathy among 305 newly diagnosed patients in Hebei province, results showed a 44% prevalence with males being more susceptible (Ren et al., 2023).

Moreover, another review by (Afkarian et al., 2014) indicated that approximately 30% of patients with T2DM develop DN, thus highlighting the condition's significance as a public health issue. Alike, a study conducted in India found a prevalence rate of 38.8%, hinting a higher burden in specific populations (Kumar et al., 2016). The prevalence of diabetic nephropathy among T2DM patients is alarmingly high, with estimates suggesting that between 20% to 50% of individuals with diabetes may develop this complication during their lifetime (Vaidya & Aeddula, 2024).

2.3.2 Renal function tests laboratory results of T2DM patients.

Diabetic nephropathy is a serious complication of type 2 diabetes, and laboratory parameters such as serum creatinine and glomerular filtration rate are important for diagnosing and monitoring the disease (American Diabetes Association, 2020). Elevated levels of serum creatinine and reduced eGFR are indicative of declining kidney function and are often used to diagnose diabetic nephropathy (Tekalign et al., 2023). Studies have shown that a significant

proportion of T2DM patients exhibit abnormal renal function test results, with many progressing to more severe stages of kidney disease if not adequately managed (Vaidya & Aeddula, 2024).

A study conducted in India found a significant relationship between serum creatinine and the prevalence of diabetic nephropathy in type 2 diabetes patients (Kumar et al., 2020). Another study conducted in South Africa found a significant relationship between glomerular filtration rate and the prevalence of diabetic nephropathy in type 2 diabetes patients (Mthembu et al., 2018).

Serum creatinine is an important parameter for diagnosing diabetic nephropathy, as it reflects renal function (Kurtis et al, 2012). A study conducted in Brazil found that serum creatinine was a significant risk factor for diabetic nephropathy in type 2 diabetes patients (Silva et al., 2019).

Glomerular filtration rate is another important parameter for diagnosing diabetic nephropathy, as it reflects renal function (Laube et al., 2019). A study conducted in Germany found that glomerular filtration rate was a significant risk factor for diabetic nephropathy in type 2 diabetes patients (Wanner et al., 2017). Regular monitoring of these laboratory results is essential for early detection and intervention, which can significantly alter the disease trajectory.

2.3.3 Socio-demographic factors associated with diabetic nephropathy among T2DM patients.

It is crucial to identify socio-demographic factors associated with DN among type 2 diabetes mellitus patients for the sake of early detection as well as intervention. Various factors have been found to be associated with diabetic nephropathy and these include age, gender, ethnicity, education and socio-economic status. For instance, older age has been identified as a positive predictor of diabetic nephropathy, with studies showing that each additional year increases the risk of developing kidney complications (Vaidya & Aeddula, 2024).

Additionally, being illiterate has been associated with a higher hazard of nephropathy, suggesting that education may influence health outcomes through better management of diabetes (Tekalign et al., 2023). Furthermore, socioeconomic factors, such as income and access to healthcare, can exacerbate the risk of developing diabetic nephropathy, particularly in marginalized populations (Vaidya & Aeddula, 2024).

A systematic review conducted in 2020 of 15 studies found that patients with diabetic nephropathy were significantly older than those without diabetic nephropathy (mean age: 65.4 vs. 59.7 years) (Li et al., 2020). Alike, a 2019 retrospective cohort study of 1 431 type 2 diabetes mellitus patients revealed that age greater or equal to sixty-five years was independently associated with diabetic nephropathy (OR:2.17, 95% CI:1.53-3.08) (Koye et al., 2019).

Another analysis of 10 studies conducted in 2020 revealed that males were at a higher risk of DN than females (RR: 1.28, 95% CI: 1.12-1.46) (Wang et al., 2020). However, another cross sectional study of 500 diabetes mellitus that had been done in 2019 found no significant difference in the prevalence between males and females ($p=0.31$) (Al-Rubeaan et al., 2019).

Non- Hispanic Whites were found to be at a lower risk of diabetic nephropathy in comparison to African Americans and Hispanics (RR: 1.39, 95% CI: 1.19-1.63) (Hall et al., 2020). A separate 2020 cross-sectional study of 1 200 type 2 diabetes mellitus revealed that those with higher education levels had lower odds of diabetic nephropathy (OR:0.78, 95% CI:0.61-0.99) (Shah et al., 2020). According to a prospective cohort study of 2 344 type 2 diabetes mellitus patients found that those with lower socioeconomic status had higher odds of developing diabetic nephropathy (OR:1.43, 95% CI: 1.02-2.01) (Mainous et al., 2019).

2.4 Chapter Summary

This chapter served to outline some of the research work that has been carried out and the gaps which have been left out. This chapter included revisiting the literature that was published on diabetes patients and their susceptibility to Diabetic nephropathy as well as

UACR levels.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter showed how the research was carried out on the prevalence of diabetic nephropathy among diabetes mellitus type 2 patients attending Sally Mugabe Diabetic Clinic. It summarized the research methodology, data sources as well as the data collection tools. All the methods used in this research aligned with the ethical code of ethics so as to not violate any patient rights. The researcher utilized laboratory records from the outpatient department, focusing on those patients who had attended the diabetic clinic.

3.2 Research Design

For this research a retrospective cross sectional design was used. The design allowed possible solutions that will assist in the early diagnosis, management of diabetic nephropathy and prevention of its progression to chronic disease and mortality even in places where more advanced testing tools are unavailable.

3.3 Study Population

The study population for this study was the 385 diabetes mellitus type II patients who attended the Sally Mugabe Central Hospital Diabetic Clinic from January to December 2024.

3.4 Inclusion Criteria

Laboratory records of patients diagnosed with type II diabetes mellitus, aged 18 years or older, and without any other known renal diseases. The study specifically included patients diagnosed with Type II diabetes mellitus. This diagnosis was confirmed through medical records from the Sally Mugabe Central Hospital Diabetic Clinic. Only patients aged 18 years or older were included, ensuring that the study focused on adult diabetic patients.

3.5 Exclusion Criteria

The proposal outlined exclusion criteria that helped filter out non-diabetic patients, such as excluding those with Type I diabetes, those with missing data, pregnant women, and individuals on medications that would have interfered with the study outcomes. Patients under the age of 18 years were not included in this research.

3.6 Sample Size

The participants for the study were selected based on the inclusion and exclusion criteria set for the study. The target sample size was determined by using the following formula:

For example a sample of 385 patients would be calculated assuming a 95% confidence interval, 0.5 expected CKD prevalence (the maximum variability) and a margin of +/- 5%.

N= sample size

Z=the statistic corresponding to the level of confidence

d=margin of error

p=expected CKD prevalence

$$N_0 = Z_{1-\alpha}^2 / z^2 * p * (1-p) / d^2$$

$$= 3.8416 * 0.5 * 0.5 / 0.0025$$

$$= 384.16$$

$$= 385 \text{ patients}$$

3.7 Sampling Procedure

The researcher used the random sampling technique during the research based on the exclusion and inclusion criteria. The researcher statistically analysed patients' laboratory records to evaluate the prevalence of diabetic nephropathy and associated risk factors. The researcher created a data abstraction form with the following for data collection: age, sex, race, serum creatinine level and UACR.

3.8 Pilot Study

In this study a small sample size (5% of the sample size) was drawn from the hospital records at Parirenyatwa Group of Hospitals laboratory. A simple convenient random sampling method was used and the data was analysed to check if the study is feasible enough to carry out. The aim of the pre-test study was to check validity and reliability of the data collection tool.

3.9 Study Setting

The research was conducted at Sally Mugabe Central Hospital Laboratory in Harare Province. Laboratory records for the period 2nd January to 30th December 2024 were used for this research. The hospital is a referral hospital for patients from the Northern half of Zimbabwe thus being ideal due to the diverse population that visits the hospital for treatment. This will then mean the data collected was of a truly diverse population thus a fair representative. The research study was carried out on diabetes type II mellitus patients who had come to the Diabetic Clinic. The researcher travelled to the hospital in order to collect information.

3.10 Analysis and Organization of Data

The data was then arranged in tables and charts for easy analysis and interpretation. Information was also obtained from the internet on similar cases. The data collected was presented in charts, bar graphs and tables. The data and information required was presented as percentages and other vital numerical information such as the prevalence, mean and median was also calculated to give a clear picture of the obtained results using Excel.

3.11 Ethical Considerations

Prior ethical approval from the relevant institutional review boards (Sally Mugabe Central Hospital Ethics Review Board and AUREC) was obtained before initiating the study. After collection of laboratory data, result confidentiality was maintained, with no names of the patients being required, misused or taken down during the course of this research.

3.12 Chapter Summary

This chapter served to outline the methods that were employed by the researcher to carry out their research. The researcher looked at the population which participated in the research and the suitable designs to follow when carrying out the research. The researcher also looked at the suitable instrument that will be of perfect use while conducting the research.

CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presented the data collected from the hospital laboratory records of 385 type 2 diabetes mellitus (T2DM) patients attending Sally Mugabe Diabetic Clinic from January to December 2024. The analysis aimed to evaluate the prevalence of diabetic nephropathy (DN) and the association of socio-demographic and clinical factors. The data was presented in the form of tables, pie charts as well as graphs.

4.2 Prevalence of Diabetic Nephropathy among study participants

Table 1: Prevalence of diabetic nephropathy among study participants

Gender	Prevalence (%)
Male	38
Female	31.9

Table 1 is showing the prevalence of diabetic nephropathy among study participants. In this study all individuals with an eGFR < 60 mL/min/1.73 m² were already included in the combined prevalence of micro-albuminuria and macro-albuminuria, hence the total prevalence was simply the total of micro-albuminuria and macro-albuminuria (35.1%) as it suffices to represent the condition considering the overlap. In 2024, from the sample size of 385 patients used in this study, 135 of the patients were found to be suffering from diabetic nephropathy (UACR>30mg/g). Seventy-six (38%) of them were male and 59(31.9%) were female. The prevalence of diabetic nephropathy was 35.1%, calculated by the following formula:

Prevalence= (Number of cases of the condition/ Total population at risk) ×100

4.3 Glycemic control of study participants

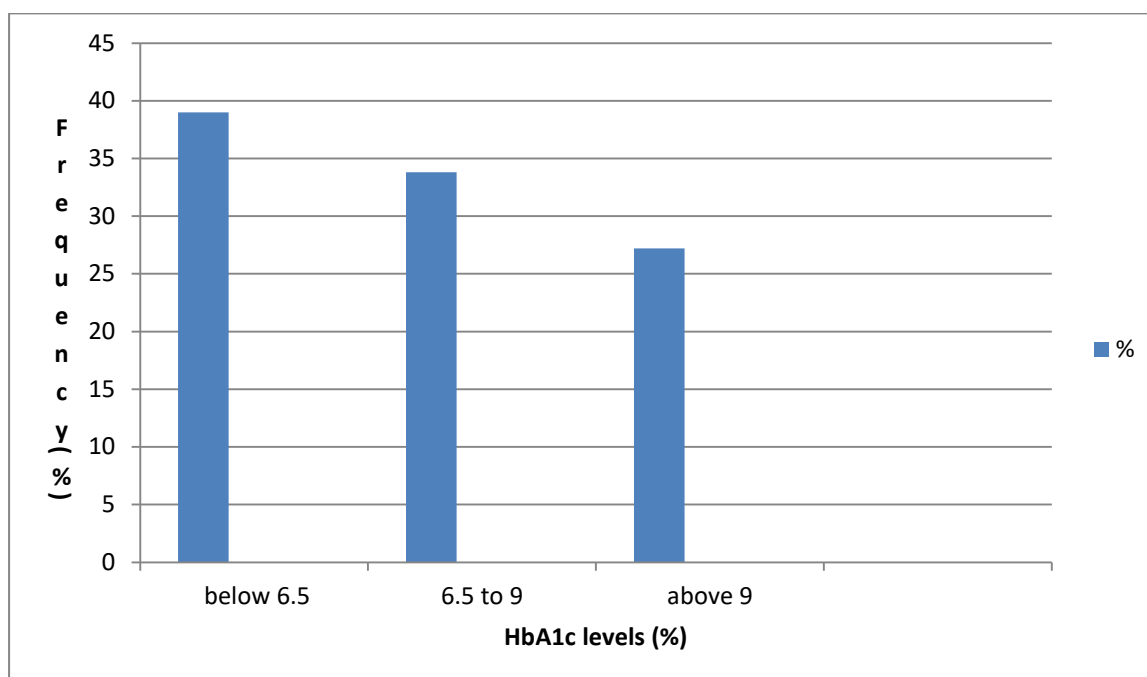


Figure 2: Glycemic control of study participants

Figure 2 above is showing glycemic control of study participants. HBA1c levels for the study participants were observed under three groups (<6.5%), (6.5-9%) as well as (>9%). (39%) of the patients had HBA1c levels <6.5% thus showing good glycemic control for diabetes while 130 (33.8%) of the patients had HBA1c levels within the range of 6.5-9% thus exhibiting moderately poor glycemic control in diabetes. The remaining 105 (27.2%) patients had HBA1c levels >9% showing very poor glycemic control in diabetes. Poor glycemic control could have indicative of none adherence to medication as well as ignorance to the advice of clinicians.

4.4 Renal function test results of study participants

4.4.1 UACR results of study participants

Table 2: UACR results of study participants

UACR (mg/g) levels	Male /N (%)	Female /N (%)
Normal (<30)	124 (62.0)	126 (68.1)
Micro-albuminuria (30-300)	49 (24.5)	36 (19.5)
Macro-albuminuria (>300)	27 (13.5)	23 (12.4)

Table 2 above shows the UACR level results. The UACR (mg/g) level measurement was grouped into three groups; Normal (<30), Micro-albuminuria (30-300) and Macro-albuminuria (>300). Micro-albuminuria is an early indicator of kidney damage especially in individuals with diabetes while macro-albuminuria often signifies more advanced kidney damage and can be associated with overt DN. The UACR values were taken from computed results calculated by the following formula: (UACR= Urine Albumin/Urine Creatinine). The majority (64.9%) patients were found to have normal level of UACR (<30). Sixty-two percent of the total male population was in this group while (68.1%) of the total female population was in this group. A total of 85 (22.1%) patients were seen to have micro-albuminuria. In this group 24.5% were male and 19.5% were female. The remaining 50 patients were observed to have shown macro-albuminuria making up 13%. There were 13.5% males and 12.4% females.

4.4.2 eGFR results of study participants

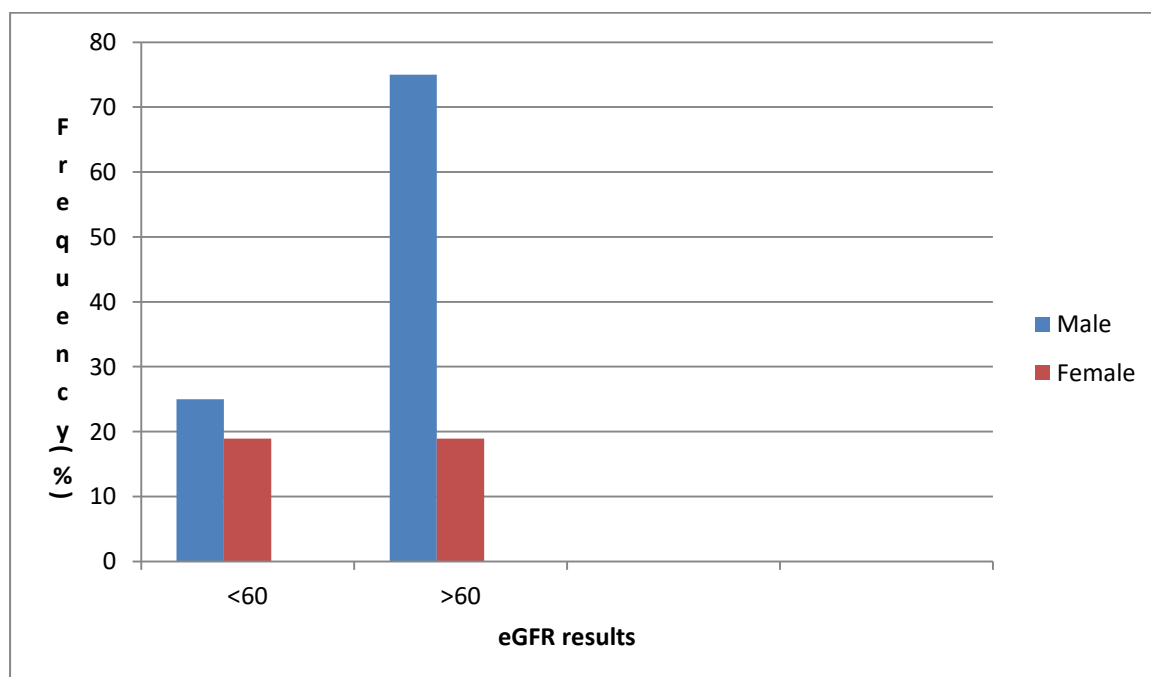


Figure 3: eGFR results of study participants

Figure 3 is indicating the eGFR results of study participants. eGFR is a key laboratory measurement used to assess kidney function by estimating the rate at which kidneys filter blood, specifically measuring how well the kidneys are able to remove waste products from the blood. It

is calculated based on serum creatinine levels, age, gender and sometimes race. The eGFR (mL/min/1.73m²) for the 385 patients was calculated and grouped into two; normal (>60) and abnormal (<60). The eGFR values were taken from computed results calculated by the following formula:

$$\text{eGFR (mL/min/1.73 m}^2\text{)} = 186 \times (\text{Serum Creatinine (mg/dL)})^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if Black}).$$

The majority (77.9%) of the patients were found to have eGFR levels >60. In this group 150 (75%) were males while 150 (81.1%) were female. A total of 85 patients had a calculated eGFR ranging between <60. There were 25% males and 18.9% female.

4.5 Socio-demographic characteristics of study participants

4.5.1 Gender of study participants

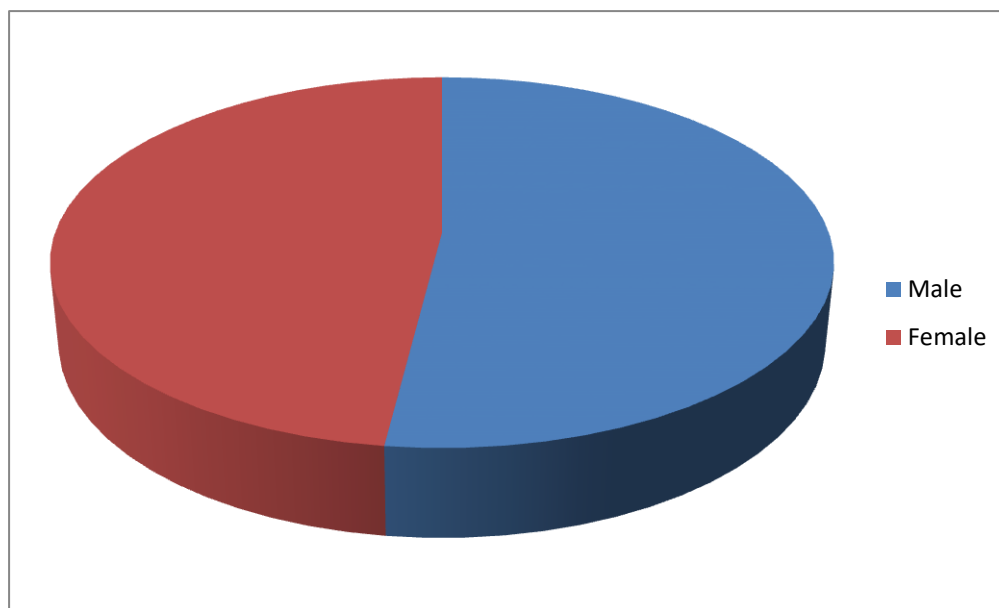


Figure 4: Gender of study participants

Figure 4 represents the distribution of the total number of patients used in the study according to gender. Despite there being an almost equal representation of gender among the study participants, there were slightly more males. There were 200 (52%) males in the study and 185 (48%) women in the study.

4.5.2 Distribution of age of study participants

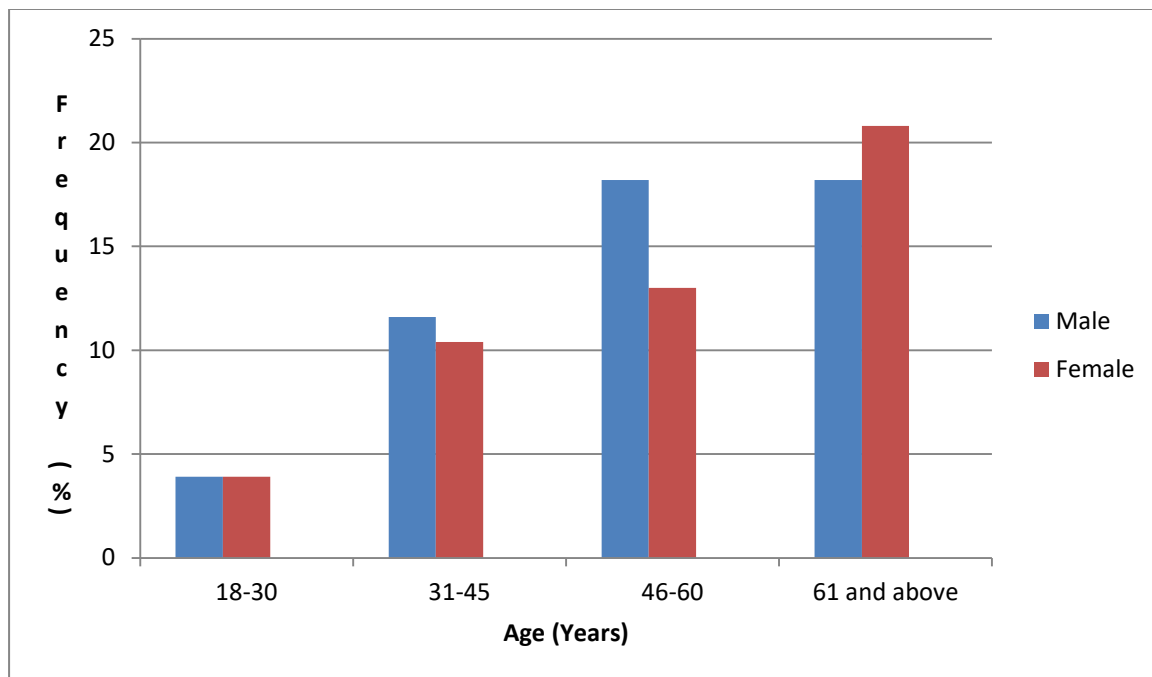


Figure 5: Age distribution of study participants

Figure 5 is showing the age distribution of study participants. The age group most represented in the study was the (61 and above) with a total number of 150 patients and a percentage of 39%. Seventy (18.2%) were males while 80 (20.8%) were females in this group. The least represented age group was the (18-30 years) taking up 7.8% of the population. Each gender was represented by 15 (3.9%) patients each. Most of the male population was in age groups of (46-60 years) and (61 and above). The majority of the female population was in the age group (61 and above years).

4.5.3 Distribution of place of residency of study participants

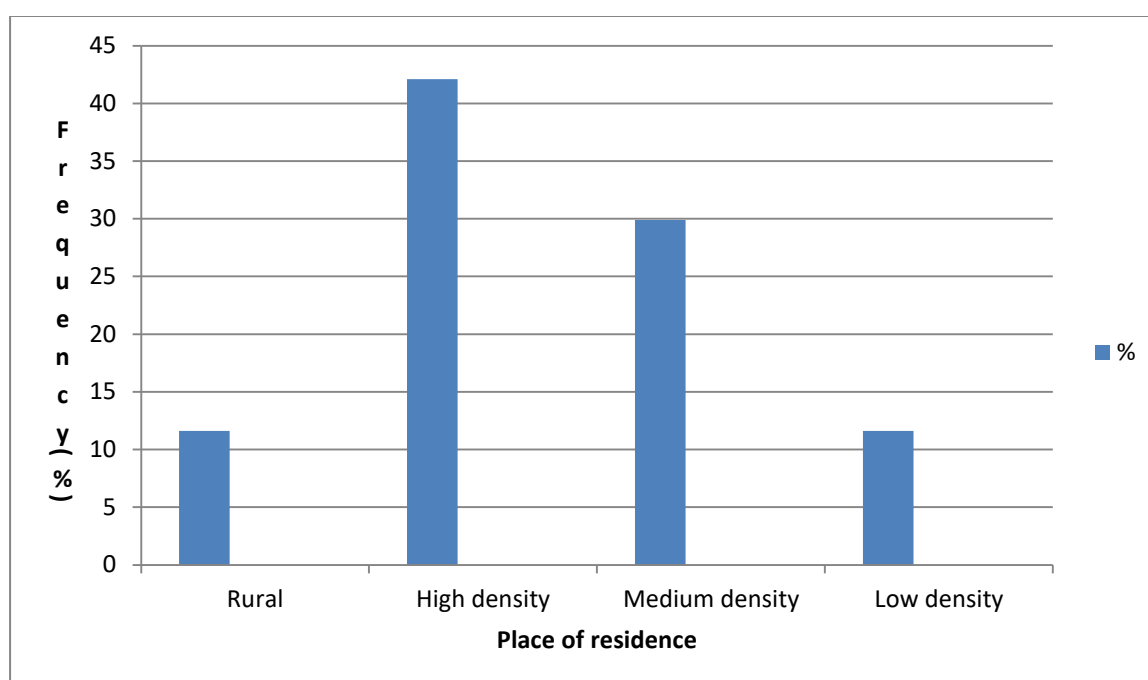


Figure 6: Distribution of place of residency of study participants

Figure 6 is indicating the distribution of place of residency of study participants. The majority of the patients (42.1%) were from high density residential areas. The least number of patients (11.6%) of the study participants were from rural areas. This representation of a diverse population is due to the fact that Sally Mugabe is a countrywide referral hospital. All these patients were suitable for the study's inclusion criteria.

4.6 Chapter Summary

This chapter analysed the data on diabetic nephropathy among Type 2 Diabetes Mellitus (T2DM) patients at the Sally Mugabe Diabetic Clinic in 2024. It reveals a prevalence of 35.1%, predominantly in males (38%) and those aged 50 and above. Glycemic control and renal function tests indicate declining kidney health, highlighting the urgent need for regular screening and effective management strategies to address this public health concern.

CHAPTER 5 DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter is a summary of the results obtained in Chapter 4. The study employed a retrospective cross-sectional design, analysing laboratory records from the Diabetic clinic to assess the relationship between eGFR and other laboratory parameters, focusing on their role in early identification of diabetic nephropathy. The delimitations of this study will be highlighted along with the recommendations as well as a conclusion.

5.2 Discussion

5.2.1 Prevalence of diabetic nephropathy among T2DM attending Sally Mugabe Diabetic Clinic in 2024

UACR was used as the primary marker for prevalence, thus showing its critical role in identifying nephropathy in its early stages. This is in support of on-going recommendations for routine screening of UACR levels among T2DM patients to facilitate early intervention (Zhang et al., 2021).

A prevalence of diabetic nephropathy of 35.1% was found among T2DM patients attending the Sally Mugabe Diabetic Clinic. According to a study by Ma et al. (2022), diabetic nephropathy affects approximately 30% to 50% of individuals with diabetes throughout their lifetime, depending on demographical and geographic factors, thus the findings of the study are consistent with global trends. Recent systemic reviews have reported varying prevalence rates, with studies indicating rates as high as 44.9% in African populations (Vaidya & Aeddula, 2024).

Several factors including inadequate glycemic control and late diagnosis of diabetes-related complications can be attributed to the observed high prevalence. Sower et al. (2016), states that, the presence of risk factors such as hypertension and dyslipidemia, which are common in T2DM patients, further exacerbates the risk of nephropathy. Moreover, this is correlating with a recent study by Tekalign et al. (2013) emphasized lack of healthcare resources in developing countries contributes to a higher incidence of DN.

5.2.2 Trend of renal function tests laboratory results of T2DM patients attending Sally Mugabe Diabetic Clinic in 2024

An alarming trend was revealed by the analysis of renal function tests among T2DM patients at the Sally Mugabe Diabetic Clinic. The study assessed eGFR and UACR results, revealing that few participants had abnormal results, with notable elevations in UACR and reductions in eGFR. These results which are indicative of a decline in kidney function are consistent with findings from recent studies that emphasize the vitality of regular monitoring of renal function in diabetic patients (Kumar et al., 2020; Mthembu et al., 2018).

HbA1c levels were analysed in this study and revealed that a significant number of patients had suboptimal control of their blood glucose levels (values consistently above the recommended target of <6.5%. Elevated HbA1c levels were closely associated with both severity of nephropathy and the likelihood of micro-albuminuria. These results are also correlating with a study by Rohlfing et al. (2020), elevated HbA1c levels correlate with increased progression to kidney damage, affirming studies that indicate a direct relationship between chronic hyperglycemia and renal complications.

The analysis of UACR results showed that 85 (22.1%) patients demonstrated micro-albuminuria thus indicating the onset of diabetic nephropathy. This analysis highlighted the significance of UACR in the early detection of diabetic nephropathy. This aligns with current guidelines that recommend regular assessment of UACR for early identification of kidney damage in diabetes (American Diabetes Association, 2022). Thirteen percent of the patients demonstrated macro-albuminuria thus highlighting a considerable risk of progression to more advanced stages of diabetic nephropathy among patients with elevated UACR. A study by Huang et al. (2021) shows that early detection via UACR and effective glycemic control can lead to timely interventions, crucial for preventing the advancement of kidney disease.

Furthermore, 22.1% of patients had estimated Glomerular Filtration Rate (eGFR) values below 60 mL/min/1.73 m². A significant proportion of patients are shown to be at risk for diabetic

nephropathy by this trend. These findings are supported by a study by Laube et al. (2019), indicating that abnormal renal function tests are prevalent among T2DM patients, thus highlighting the necessity for timely interventions to prevent the progression to end-stage renal disease. These findings are significant, as GFR is a standard measure of kidney function, and reductions indicate compromised renal health (Gonzalez et al., 2022).

5.2.3 Socio-demographic factors which are associated with diabetic nephropathy among T2DM patients attending Sally Mugabe Diabetic Clinic in 2024

The research findings identified socio-demographic characteristics that are associated with diabetic nephropathy among T2DM patients at Sally Mugabe Diabetic Clinic. The analysis revealed that older individuals, (≥ 50 years) had a higher prevalence of DN, thus accounting for 81.5% of the total DN cases in this study. Literature by Deng et al., (2021) states that, aging increases the likelihood of diabetic complications due to prolonged exposure to hyperglycemic conditions. This emphasizes the need for targeted screening and preventative measures.

This study showed a slightly higher representation of males (52%) among the participants. The finding suggested that male (38%) patients were more susceptible to diabetic nephropathy than the female (31.9%) patients. The literature, however, presents mixed findings with regards to gender differences in DN prevalence. A study by, Adeleye and Ogunmekan (2018) in Nigeria, demonstrated that, while both male and female patients were affected by diabetic nephropathy, there were no significant differences in the prevalence rates between genders. Another study by Wang et al. (2020) however, reported that males are at a higher risk of developing DN in comparison to females.

The results are correlating with a study by Mainous et al. (2019) which showed that, the socio-economic status of patients may also impact health outcomes, as individuals from lower socio-economic backgrounds have limited access to healthcare and diabetes management resources. This study found that patients from lower socioeconomic backgrounds (based on place of residency) had a higher prevalence of diabetic nephropathy. According to the study, those who

resided in high density as well as rural areas were found to have higher rates of nephropathy in comparison to those who resided in medium and low density residential areas. This was also linked to educational levels whereby areas of residence were taken as a representative of educational levels. Patients with lower educational levels were more susceptible to diabetic nephropathy. A study by Kumar et al., (2020) indicates that health literacy significantly impacts diabetes management; individuals with limited understanding of their condition are more likely to miss critical management strategies.

5.3 Study Implications

These study findings have significant implications for clinical practice and public health policy requiring urgent enhanced screening practices and preventative strategies. For informed targeted interventions and screening programs, particularly for older adults and high risk populations, it is important for there to be understanding of the socio-demographic factors associated with DN. Priority of regular monitoring of renal function in T2DM patients, especially those with elevated risk factors. Early interventions can mitigate complications and foster better outcomes, addressing critical public health challenges (Mohammed et al., 2023)

Furthermore, the high prevalence of DN highlights the need for improved diabetes management strategies, which include education on glycemic control and lifestyle modifications. The focus of public health initiatives should be on raising awareness about the importance of early detection and management of diabetic complications.

5.4 Study Limitations

The data collected was from a single clinic, thus limiting the generalizability of the findings to other populations. The cross-sectional design restricts the ability to establish causality between socio-demographic factors and diabetic nephropathy. Time constraints hindered the researcher from conducting extensive data collection. Budget limitations affected the time duration as well as the scope of the study. Lastly, the reliance on laboratory record alone may exclude diabetes type II patients who were never admitted to the hospital and may lead to incomplete data on some

patients, with regards particularly to lifestyle factors such as physical activity and diet, which are vital in diabetes management.

5.5 Conclusion

The findings of the study highlight the importance of addressing socio-demographic factors in managing diabetic nephropathy among T2DM patients. The need for comprehensive screening programs and targeted interventions to improve patient outcomes is underscored by the observed trends in renal function tests as well as the high prevalence of DN. The management of diabetes and its complications in the population served by the Sally Mugabe Diabetic Clinic can be significantly enhanced if these factors are addressed.

5.6 Recommendations

Healthcare providers can work towards reducing the burden of diabetic nephropathy and overallly improving patient outcomes in the population served by the Sally Mugabe Diabetic Clinic by implementing the following recommendations:

1. **Patient Education:** Educational programs should be specifically tailored to address the specific needs of diverse patient populations. The importance of glycemic control, renal functioning monitoring, and lifestyle modifications should be highlighted in the patient education.
2. **Screening Programs:** Regular screening for diabetic nephropathy should be implemented in T2DM patients, particularly those aged 50 years and older. Routine UACR and eGFR testing could be included as part of standard diabetes care.
3. **Healthcare Policy:** It is important to foster collaboration with community organizations in order to improve outreach and education efforts. Policies that facilitate access to diabetes management resources and kidney health screening should be advocated for, especially in underserved areas.

5.7 Further Research

There is need to carry out longitudinal studies to monitor the progression of diabetic nephropathy

and evaluate the effectiveness of implemented intervention strategies. Future research should explore the psychosocial factors influencing diabetes management and health outcomes.

5.8 Dissemination of Study Findings

My results will be shared with the Sally Mugabe Central Hospital management for cascading of information to the Ministry of Health for implementation.

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Appendices

Appendix 1: Data abstraction form

Patient Number	Patient Age	Patient Sex	Patient Race	Patient Serum Creatinine Level	UACR

Appendix 2: Gantt Chart

Activity	October 2024	November	December	January 2025	February	March	April
Recognition and approval of research proposal							
Proposal writing							
Submission and approval of the research							
Data collection							
Data entry							
Data analysis							

Appendix 3: Research study budget

Activity	Amount (USD)
ACCOMMODATION	40
TRANSPORT FEE	40
STATIONERY	10
INTERNET BUNDLES	20
COMMUNICATION FEE	30
FOOD	10
TOTAL COST	150

Appendix 4: Site approval letter

Telephone: 621100-19
Fax: 621157

Reference: SMCHEC100225/32

SALLY CENTRAL MUGABE HOSPITAL
P. O. BOX ST 14
SOUTHERTON
HARARE
ZIMBABWE



ZIMBABWE

24 February 2025

Mugoniwa Tanyaradzwa B

REF: PREVALENCE OF DIABETIC NEPHOPATHY AMONG DIABETES MELLITUS TYPE 2 PATIENTS ATTENDING SALLY MUGABE DIABETIC CLINIC: JANUARY 2024- DECEMBER 2024

I am glad to advise you that your application to conduct a study entitled: **PREVALENCE OF DIABETIC NEPHOPATHY AMONG DIABETES MELLITUS TYPE 2 PATIENTS ATTENDING SALLY MUGABE DIABETIC CLINIC: JANUARY 2024- DECEMBER 2024** (Ref: SMCHEC100225/32), has been approved by the Sally Mugabe Central Hospital Ethics Committee.

This approval is premised on the submitted protocol. Should you decide to vary your protocol in any material way please submit these for further approval.

You are advised to avail the results of your study whether positive or negative to the hospital through the committee for our information.

Yours sincerely,



DR. H Chifamba
Chairperson Sally Mugabe Central Ethics Committee

HARARE CENTRAL HOSPITAL
DEPARTMENT OF MEDICINE
04 MAR 2025
TCN

Board Members, Chairman Dr E Chagonda, Deputy Chairperson Ms A Mashamba, Members:- Mr J Makoya, Mrs P Sibanda, Mr. S. Hlatywayo, Dr C. Pasi (Chief Medical Officer)

Appendix 5: AUREC approval letter



"Investing in Africa's future"

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3706/25

12 March, 2025

TANYARADZWA BLESSING MUGONIWA

C/O Africa

University Box 1320

MUTARE

RE: PREVALENCE OF DIABETIC NEPHROPATHY AMONG DIABETES MELLITUS TYPE 2 PATIENTS ATTENDING SALLY MUGABE DIABETIC CLINIC: JANUARY 2024- DECEMBER 2024

Thank you for the above-titled proposal you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

- **APPROVAL NUMBER** AUREC 3706/25
This number should be used on all correspondences, consent forms, and appropriate document
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 12, 2025
- **EXPIRATION DATE** March 12, 2026
- **TYPE OF MEETING:** Expedited
After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be

submitted to AUREC.



Yours Faithfully MARY CHINZOU

FOR CHAIRPERSON

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE

Mary Chinzou