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Prevalence of Chronic Kidney Disease in Diabetes Mellitus Patients attended at Diagnostics Laboratory Services (DLS), Bulawayo, Zimbabwe January to October 2023

By

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELORS IN MEDICAL LABORATORY SCIENCES IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

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Abstract

Diabetes Mellitus (DM) and Chronic Kidney Disease (CKD) are prevalent disorders. However, there is little study that has been done on the prevalence of Chronic Kidney Disease among individuals having Diabetes Mellitus as an underlying condition, most particularly in developing countries such like Zimbabwe. The shared correlation between Diabetes Mellitus and Chronic Kidney Disease has to further be investigated on in order to effectively address the study gap and create strategized interventions that can change and or improve clinical outcomes for patients. The broad aim of the study is to; accurately assess the prevalence of Chronic Kidney Disease in Diabetes Mellitus patients attended at Diagnostics Laboratory Service (DLS) laboratory in Bulawayo, Zimbabwe. This study was a cross-sectional retrospective study. Data from January to October of 2023 was collected from the Diagnostics Laboratory Services laboratory, a Private laboratory in Bulawayo, Zimbabwe. Census sampling is the type of sampling approach employed in the study, as information was from the Laboratory's (DLS) database in the process, from which 109 laboratory reports pertaining to patients who met the inclusion and exclusion criteria were collected. Information about the patient's age, ethnicity, gender, and residency, as well as a screening for whether patient was diagnosed with Diabetes Mellitus, was extracted from the obtained laboratory reports. The data from the DLS Laboratories database, was exported to an Excel spread-sheet, and then tabulated and presented in both tabular, graph and pie chart form in accordance with the study objectives and Questions. There were 109 participants in the study, 42% of whom were men and 58% of whom were women. Of the 109 participants in the study, 29% had typically normal eGFR readings and 71% had abnormal eGFR readings indicating different degrees of renal impairment. In the study 10% of the participants were aged >80 years old, 25% between 50 and 61 years old, 32% between 60 and 71 years old, 16% between 70 and 81 years old, and 7% between 17 and 41 years old. The study revealed that 28% of the participants were ethnically white and 72% of the participants were ethnically black. Of the 109 participants, 24% resided in rural areas and the other 76% in urban areas. Stage-by-stage differences were observed in the severity of Chronic Kidney Disease (CKD), with 21% in stage 3a, 14% in stage 4, 11% in stage 3b, and 5% in stage 5. Males and ethnically white participants had more severe Chronic Kidney Disease CKD than female and ethnically black participants. eGFR declined gradually with increasing age in both females and males. Compared to men, who had a prevalence of 30.26%, kidney failure affected women more frequently (40.35%). Those who ethnically black experienced renal failure at a higher rate (49.52%) than did those who ethnically white (21.11%). Undiagnosed Chronic Kidney Disease has frequently shown to be a major cause of concern in Diabetes Mellitus patients. The following characteristics of people with Diabetes Mellitus showed a substantial correlation with Chronic Kidney Disease: gender, age, race (black or white), and place of residence. With the use of eGFR readings with the aim to screen Chronic Kidney Disease, patients can be diagnosed at an earlier stage of the disease's progression and can get effective treatment to better manage the disease's severity.

Keywords. Estimated Glomerular Filtration rate, Diabetes Mellitus, Diabetic Kidney Disease, Chronic Kidney Disease, and Prevalence.

Declaration

I declare that this research project 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 degree.

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List of Acronyms and Abbreviations

AUREC	-	Africa University Research Ethics Committee
CKD	-	Chronic kidney disease
DKD	-	Diabetic Kidney Disease
DM	-	Diabetes mellitus
UnE	-	Urea and Electrolytes
WHO	-	World health Organisation
eGFR	-	Estimated Glomerular Filtrate Rate

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CHAPTER 1: INTRODUCTION

1.1.Introduction

The study's objective is to provide a precise estimate on the prevalence of Chronic Kidney Disease in Diabetes Mellitus patients attended at Diagnostics Laboratory Services (DLS) laboratory Bulawayo, in Zimbabwe. Millions of people worldwide suffer from Diabetes Mellitus (DM), is a chronic condition marked by hyperglycaemia brought on by the body's incapacity to produce enough insulin hormone or to use the insulin that is produced in an efficient manner within the human body. Chronic kidney disease (CKD) is identified by Cockcroft Gault equations as an indicator of the disease, with an e-GFR of less than 60 mL/min/1.73m included in the patient's medical laboratory report or chart.

“The prevalence of chronic kidney disease (CKD) is highly variable in different parts of the world due to various environmental, ethnic, socioeconomic, and rural-urban differences”(Fenta et al., 2023). Diabetic kidney disease (DKD), which is a kind of Chronic Kidney Disease, is one of the most common consequences of Diabetes Mellitus. “CKD is estimated to affect 50% patients with T2DM globally, and its presence and severity markedly influences disease prognosis.”(Fenta et al., 2023). A study done in Zimbabwe by Pasipanodya et al., (2017) confirmed an equally high prevalence of nephropathy in both type 1 and type 2 Diabetes Mellitus patients more than previously done studies in the same setting. The chapter elaborates more on the rationale for doing the study, the study objectives, study questions, the study's significance and delimitation to public health.

1.2.Background of the Study

"The term diabetes describes a group of metabolic disorders characterized and identified by the presence of hyperglycaemia in the absence of treatment" (World health Organisation: Classification of diabetes mellitus, 2019). The heterogeneous aetiology includes abnormalities in insulin secretion, action, or in both appear in both circumstances, as well as problems in the carbohydrate, lipid, and protein metabolism. "The chronic hyperglycaemia of diabetes mellitus (DM) is associated with end organ damage, dysfunction, and failure in organs and tissues including the retina, kidney, nerves, heart, and blood vessels."(Alam et al., 2014). The association of Diabetes Mellitus and Chronic Kidney Disease was concluded in the study done by Farah et al., (2021) "Diabetic kidney disease (DKD) is a major long-term complication of DM type 2 and is the leading cause of chronic kidney disease (CKD) and end-stage kidney disease (ESKD) worldwide". Diabetes Mellitus has been associated with the eventual loss of kidney function; this is observed in a study done by Pasipanodya et al., (2017) where complications of diabetes mellitus that include diabetic nephropathy were more prevalent in African patients such like in Zimbabwe as to patients in developed countries where circumstantial early stage treatment is inaccessible, bust glycemic control among patients with diabetes mellitus, late presentation of condition and little to no screening and diagnostic facilities.

A study done in Zimbabwe by Pasipanodya et al., (2017) point out that " Overall, just over a third (35.8%) of patients had moderately increased albuminuria and 9.0% had severely increased albuminuria giving an overall prevalence of nephropathy of 44.8%.". In relation to Chronic Kidney disease in Diabetes Mellitus patients, a study in Zimbabwe by Nyasha et al (2013) point out that "In our study, the number of hypertensives was followed by those with diabetes". In another study on the investigation of the prevalence of dialysis in Zimbabwe by

Rumbidzai et al.,(2022), concluded on a 76% representing Zimbabwe's prevalence dialysis population, thus raising concern on the prevalence of Chronic Kidney Disease and more over in Diabetes Mellitus patients.

1.3.Statement of the Problem

The evaluation of estimated GFR in diabetes mellitus (DM) patients is crucial for monitoring disease progression and optimizing treatment strategies. "In the low- and lower-middle-income countries of sub-Saharan Africa, such as Zimbabwe, the burden of CKD is poorly understood, with little data on even the most severe form, kidney failure."(Rumbidzai et al., 2022). However, there is a need to clearly address the problem of limited research and understanding regarding the comprehensive evaluation of prevalence of Chronic Kidney Disease in Diabetes Mellitus patients. This gap and lack of knowledge of CKD and DM hinders the development of personalized and effective management approaches. Furthermore, the specific problem of limited studies evaluating the association between Chronic Kidney Disease (CKD) and Diabetes Mellitus (DM) patients' needs to be addressed. This problem statement highlights the need for further research to explore the significance of evaluating DM patients and their correlation with CKD, leading to improved clinical outcomes and tailored interventions.

1.4. Justification of the Study

By assessing the prevalence of CKD in Diabetes Mellitus patients attended at the DLS laboratory in Bulawayo, this study adds on to current knowledge, fill gaps and contribute to the scientific literature in relation to the topic. The purpose of this study is to look into stages of Chronic Kidney Disease, which indicate the severity of renal failure in Diabetes Mellitus patients in order to better understand the relationship between Diabetes Mellitus and kidney function in an overall individual's health. The results of this study guides the development and improvement of personalized treatment plans and better patient outcomes in the curative and or palliative advancement to counter Chronic Kidney Disease in Diabetes Mellitus patients.

1.5. Research Objectives

1.5.1 Main Objective:

- To investigate the prevalence of chronic kidney disease (CKD) in patients attended at DLS, Bulawayo who are known to have diabetes mellitus (DM) for the January to October 2023 period.

1.5.2 Specific Objectives:

- To determine the socio-demographic characteristics of CKD patient with DM attended at DLS, Bulawayo.
- To assess the prevalence of Chronic Kidney Disease (CKD) in Diabetes Mellitus patients attended at DLS, Bulawayo.

1.6.Research Questions

- What is the prevalence of chronic kidney disease (CKD) in patients diagnosed with diabetes mellitus (DM)?
- How does the prevalence of CKD in patients with diabetes mellitus vary across different demographic factors such as age, gender, and ethnicity?
- What are the potential socio-demographic risk factors associated with the development and progression of CKD in patients with diabetes mellitus?

1.7.Significance of the Study

The evaluation patients with diabetes mellitus (DM) leading to chronic kidney disease (CKD) is of great significance. It emphasises the need for early detection, diagnosis for better personalized treatment, and enrich the goal to improve clinical outcomes. Public health implications may be necessary so as to include interventions of informative policies and strategies to reduce the burden of Chronic Kidney Disease in the Diabetes Mellitus population. Better assessment methods and communicated awareness can better the monitoring of the Chronic Kidney Disease progression and optimized treatment strategies. Additionally, the study itself definitely contributes to the existing knowledge of Chronic Kidney Disease in Diabetes Mellitus patients, thus uncovering new possible associations and needed therapeutic targets. By understanding healthcare utilization patterns and the resource implications, aid in the resource allocation and cost-effective interventions, strategies to better healthcare assistance can be improved. In summary, evaluating the prevalence in DM patients with progressive CKD has far-reaching implications for medical clinical practices, public health system and patient care.

1.8.Limitations of the Study

The research study on the prevalence of Chronic Kidney Disease in Diabetes Mellitus patients faced several limitations. Firstly the sample size and representativeness of selected units were limited, thus this having an impact on the generalizing of the findings at a large scale, in Zimbabwe. Working with a small number of participants and let alone a small specific population subgroup, making the findings not so much applicable to the broader population. Additionally, there's the complexity and the known heterogeneity of Diabetes Mellitus results in variability renal function parameters thus necessitating careful consideration and control of confounding variables. Moreover it is recognised how different techniques used and laboratory assays used pose a risk in introducing variables in results which requires consistent and reliable methods of measurement to ensure the accuracy of the results obtained.

1.9.Delimitation of the Study

This study is limited to Diabetes Mellitus patients from Diagnostics Laboratory Services Database, and the Chronic Kidney Disease parameters assessed were tested in laboratory clinical practice. The research study includes adult participants only. It eliminates paediatric patients along with individuals with other underlining illnesses or chronic diseases that may alter CKD parameters independently other than Diabetes Mellitus. The data for the study mostly came from medical records and test reports available at Diagnostics Laboratory services database. Aside from routinely gathered data, the study did not include any experimental interventions or follow-up assessments. The study looked only into parameters obtained from patient demographics and the eGFR (from urea and electrolytes test).

CHAPTER 2: LITERATURE REVIEW

2.1.Introduction

This chapter provides a comprehensive review of the relevant literature related to Chronic Kidney Disease in Diabetes Mellitus patients. It elaborates the current knowledge, correlation and gaps found in the literature and establish a conceptual framework for the study.

2.2.Conceptual Framework

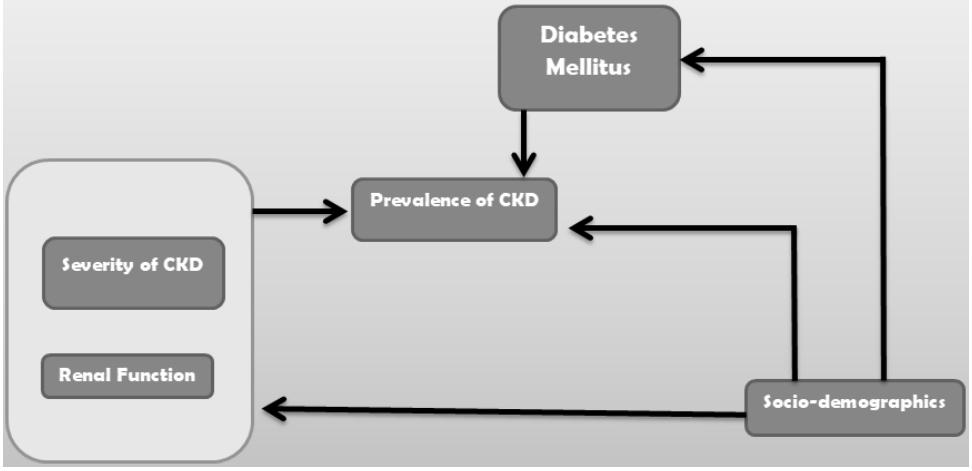

Figure 2.2 Conceptual Framework

Chronic kidney disease (CKD) progression has been linked to Diabetes Mellitus (DM), to be a prevalent risk factor. It has been observed that Diabetes Mellitus adversely affects renal function, resulting in kidney failure and malfunction of the filtration process. Given that long-term exposure to known hyperglycaemia eventually results in renal failure, Diabetes Mellitus is also associated with an elevated risk of chronic kidney disease progression. Patients with Diabetes Mellitus are more likely to suffer Chronic Kidney Disease depending on their age, gender, ethnicity, and socioeconomic status.

2.3.Literature Review in relation to study objectives

2.3.1 Socio-demographic characteristics of CKD patient with DM attended at DLS, Bulawayo.

Written studies have related numerous variations in CKD prevalence based on socio-demographic factors. According to Shah et al., (2022) “The causes identified, such as aging, diet, genetics, stress, long-term use of medication, karma, and other chronic illnesses may be the result of cultural influences, gender, health education level, or stage of CKD progression. ”. “This study reported that cooperation was significantly different among diabetic patients, as assessed by many factors such as care, lifestyle, self-management, and government support to prevent CKD” (Shah et al., 2022). The author(s) hypothesized that by selecting respondents and analysing socio-demographic, socioeconomic, general CKD perception knowledge, self-monitoring advocacy, preventive behaviour, treatment compliance, and psychosocial factors, predictors of chronic kidney disease (CKD) prevention among diabetic patients could be identified. This intern can give a generalised understanding of variations in CKD prevalence based on socio-demographic factors.

Relevant literature gave recurring evidence of common variations such as age, gender, race and or ethnicity had an effect on CKD progression in DM patients. Zhang & Rothenbacher (2008) points out that “This systematic review summarized the prevalence of CKD in various population-based studies, which used a standardized definition of CKD and considered age-, gender- and ethnic-specific prevalence of CKD”. “The review reported that old age, hypertension, having cardiac disease, smoking, obesity, having history of type 2 diabetes mellitus were predictor variables for chronic kidney disease among diabetic patients”(Fenta et al., 2023).

With age, according to Damtie et al., (1970) “As age increases, there is progressive loss of nephrons and decreased renal blood flow, which leads to CKD”. “Overall, the prevalence of CKD varied widely among the study populations and increased clearly with age” (Zhang & Rothenbacher, 2008). Looking at the gender of an individual, in one study, authors have concluded that women frequently have higher prevalence of CKD than in men (Wu et al., 2016). “In general, females had a higher prevalence than males, especially in the middle aged groups”(Zhang & Rothenbacher, 2008). Another distinction that was apparent was the difference in race in the prevalence of CKD in DM patients, according to Zhang & Rothenbacher (2008) “African Americans had a lower prevalence than Caucasians, and Asian populations had a relatively high prevalence.” This may more or less give a clear comparison between black Africans Caucasians and or other races from the data collected for the study.

Other studies have noticed that patients who had DM for longer time would eventually have greater chances of developing CKD. “This corresponds with the findings of several studies which reported that the likelihood of developing CKD was greater among patients with longer duration of diabetes” (Damtie et al., 1970). Obesity and Systolic blood pressure were variations associated with CKD progression in some studies.

“According to our study, elevated SBP was a risk factor for CKD.”(Damtie et al., 1970). “Obesity is associated with renal damage leading to albuminuria and poor outcomes of chronic kidney disease, pointing to the need for prevention”(Damtie et al., 1970).

2.3.2 To assess the prevalence of CKD

The prevalence of CKD in a number population-based literature took into account the prevalence of CKD to prominently be unique to age, gender, and ethnicity. A study done by Zhang & Rothenbacher (2008) had categorised the prevalence of CKD into subheadings that included the age specific prevalence, gender specific prevalence and ethnic specific prevalence.

Age specific

Islam et al.,(2009) in their study concluded with results indicating age-specific prevalence of stage 3 0r 4 CKD at 20 to 49, 50 to 69 and ≥70 age was 1.5%, 11.7%, and 39.0% . "The prevalence of diabetes is high in older subjects, affecting more than 20% of subjects > 65 years" (Russo et al., 2018). Jitraknatee et al., (2020) point out that "Regarding age and glycaemic control, individuals older than 75 years and those with a haemoglobin A1c ≥ 8% had the highest prevalence of 61.3% (51.7–70.1) and 38.6% (34.3–43.2), respectively".

Gender specific

A study done by Sulaiman et al., (2021) found females to have a higher prevalence of diabetic kidney disease. "Women of all ages had 28% decreased odds of DKD (OR 0.72, 95% CI 0.62–0.83); however, they had a greater prevalence of advanced DKD (OR 1.67, 95% CI 1.05–2.64), dyslipidemia (OR 1.42, 95% CI 1.16–1.74), and obesity (OR 1.87, 95% CI 1.60–2.20) compared to men"(Yu et al., 2012). "The prevalence of eGFR <60 mL/ min/1.73 m 2 was significantly higher in women than in men (4.1 versus 2.2%, P = 0.000), and became larger with increasing age in both genders (P <0.001 for both men and women)"(Chen et al., 2008). "Even though women with T2DM are more prone to develop complications, the prevalence of CKD among diabetic males was slightly higher (39.7%) compared with female patients (31.2%) in our study." (Mhundwa et al., 2023).

Ethnicity Specific

Numerous studies on the influence of ethnicity of CKD proved to be more in the black groups as compared to the white. “CKD stage 3 was more prevalent in Whites compared to South Asians—OR 0.79 (95% CI: 0.71–0.87) and Blacks—OR 0.49 (95% CI: 0.43–0.57).”(Dreyer et al., 2009). “The crude prevalence of hypertension was 9.5%, and by ethnicity was 8.2% for White, 11.3% for South Asian and 11.1% for Black groups”(Hull et al., 2011). In the study done by Ali et al., (2013) pointed out the estimated-stage kidney failure was 32%, 38% and 44% in the White, south Asian and Black.

The stages of the eGFR and CKD in DM patients

Published studies have characterised the progression of Chronic Kidney Disease by a very low eGFR. “The study in Japan revealed that elderly patients with type 2 diabetes, renal dysfunction is characterized by low eGFR” (Fenta et al.,2023). Recent studies have shown that the population with diabetes have clinically significant CKD, as defined by an eGFR of <60 ml/minute. According to Mhundwa et al., (2023)“Clinically, overt CKD has an estimated glomerular filtration rate (eGFR) persistently less than 60 mL/min over a period of at least 3 months”. “The median eGFR was 102.3 ml/minute/1.73 m2 and 17% of the patients had more than stage 1 renal insufficiency (eGFR < 60 ml/minute/1.73 m2)”(Ngassa et al., 2015). Another study conducted by (Fenta et a., 2023) “Chronic kidney disease (CKD) is the abnormalities of kidney structure or function that are present for more than 3 months characterized by low estimated glomerular filtration rate (eGFR) based on serum creatinine measurements.” Fenta et al., (2023) further point out that “The primary issue for individuals in stages 1 and 2 was that it was asymptomatic at first; metabolic abnormalities were apparent in stages 3 through 5.”

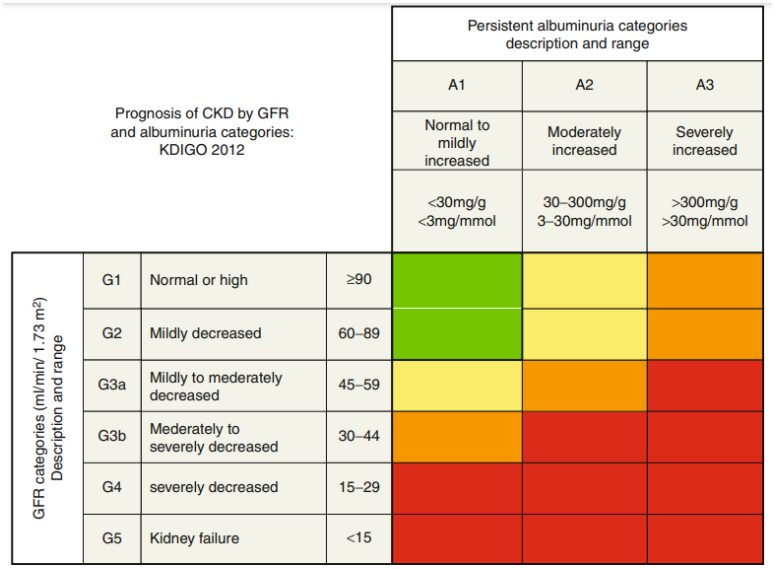

Figure.2.3.2 Stages of CKD, M. Arici.(2014). Staging and prognosis of chronic kidney disease (CKD) 'Management of Chronic Kidney Disease'?[Photograph]. Springer Heidelberg New York Dordrecht London.

2.4.Summary

In summary, diabetes mellitus (DM) is a risk factor for chronic kidney disease (CKD). Age, gender, and ethnicity are variables that have an impact the prevalence of CKD in diabetes mellitus patients. The prevalence of CKD has been noted to be higher among older people, women, and specific ethnic groups. Reduced kidney function is indicated by an estimated glomerular filtration rate (eGFR) of less than 60 mL/min, an analysis of the variables and assessing renal failure parameters can aid in the management of Chronic Kidney Disease in Diabetes Mellitus patients.

CHAPTER 3: METHODOLOGY

3.1. Introduction

The chapter provides a comprehensive overview of the research design, Data collection, Data analysis and presentation. It encompasses several subtopics that are crucial in the research study process, the focus mainly being on the Research Design, Population and Sampling, Inclusion Criteria, Exclusion Criteria, Data Collection Instruments, Data Collection Procedure, Analysis and Organization of Data, Ethical Considerations and lastly the summary.

3.2.The Research Design

A cross-sectional retrospective study was done from Data collected from Diagnostics Laboratory Services, in Bulawayo, from month of January to October, 2023. The study design represents an observation research in which data was gathered at a single point in time, without requiring long-term participant follow-up. In order to examine the study's framework, a sample of individuals with Diabetes Mellitus had their data and laboratory reports collected at a single time point. The study aims to analyse the prevalence of chronic kidney disease (CKD) in Diabetes Mellitus (DM) patients broadly. The study design is patterned accordingly to the study objectives and as well answers the study questions.

3.3.Sample size

The January to October period (10 months) a total of 109 patients diagnosed with DM were attended, to which a census sampling was employed where the whole population of 109 study participants were sampled hence a sample size of 109 was obtained via the nom probability sampling.

3.4.Population and Sampling

All data was collected by Diagnostics Laboratory Services. The Laboratory gives services to Hospitalised clients from Mater Dei Hospital, Mpilo Hospital, Royal Women's, United Bulawayo Hospital, as well clients referred by other government and private medical practitioners not mentioned by name. The sampling techniques used, is the census sampling as data was extracted from the Laboratory's database to which it opens its services to different hospitals, private and government practitioners. The window period of the study is from January to October of the year 2023.

3.5.Inclusion Criteria

Patients who meet the following criteria were included in the study:

- Adults who are aged 18 years and above.
- Diagnosed with diabetes mellitus.
- Have undergone biochemical testing at the DLS laboratory in Bulawayo.

3.6.Exclusion Criteria

Individuals with an existing diagnosis of chronic kidney disease (CKD) who are not diabetic.

3.7.Data Collection Instruments

In this section the data collection instruments used, in the context of Diagnostics Laboratory Services is discussed. In this case, the laboratory utilizes the Beckman Coulter AU480 is employed for measuring the eGFR (from urea and electrolytes test), specifically using blood specimens obtained from a plane red top tube to run a UnE test. The selection of the Beckman AU480 machine is based on its proven reliability, accuracy, and compatibility with the specific tests being conducted at Diagnostics Laboratory Services.

3.8.Data Collection Procedure

Diagnostics Laboratory Services maintains a comprehensive database that contains laboratory reports regarding the various diagnostic tests conducted, patient profiles, and test results. This database is regularly updated and serves as a repository of valuable data that can be utilized for research purposes. Appropriate data protection and privacy measures were done to ensure the confidentiality and anonymity of the individuals whose data is being extracted from the database. To safeguard the rights and privacy of every individual concerned, ethical standards and applicable data protection laws were strictly adhered to.

3.9.Analysis and Organization of Data

Cross-sectional retrospective study concept was used in analysing progression of chronic kidney disease (CKD) in Diabetes. The data was collected from a representative sample of Diabetes Mellitus patients at a single time point. Demographic information and laboratory results are gathered and analysed to explore prevalence of Chronic Kidney Disease. Statistical analyses identified potential correlations. Valuable insight into prevalence rates and associations aided in understanding the comorbidity and informing evidence based decision making with a more defined and understood knowledge for improved patient health-

care. The study's independent and dependent variables are diabetes mellitus, socio-demographic characteristics and prevalence of chronic kidney disease, severity of chronic kidney disease and renal function. The data was be retrieved from the DLS Laboratories database and exported from the associated computer to an excel spread sheet, after which it was tabulated and presented in both tabular and pie form guided by the study objectives.

3.10. Ethical Consideration

The study was approved by the Africa University Research Ethics Committee and the study site as well (Diagnostics Laboratory Sciences). According to the Africa University Research Ethics Committee (AUREC), the study thereby safeguards human subjects. No name or personal information from all anonymous participant data was divulged and was confidentiality preserved at all costs. This prevents participant's private rights from being compromised during the course of the study. The outcomes of the participants were then be reviewed through communication with the team leaders and/or senior scientists involved in the study. General Government and or Private Information was collected from the participants. Conclusively, AUREC approve the study's continuation. Any overall changes and or suggestions given by the AUREC or Source of Study Data was put to consideration and reviewed were necessary.

3.11. Summary

The study employed a cross-sectional retrospective design, collecting data from Diagnostics Laboratory Services in Bulawayo, Zimbabwe. The aim is to analyse the prevalence of chronic kidney disease (CKD) in Diabetes Mellitus (DM) patients broadly in Bulawayo. The population includes Diabetes Mellitus patients who underwent biochemical testing at the laboratory, with Census sampling techniques used for participant selection. Inclusion criteria involve adults diagnosed with Diabetes Mellitus who underwent testing at the laboratory, while patients with comorbidities and paediatric participants are excluded. Data collection instruments include the Beckman Coulter AU480 machine for measuring collected blood samples from Diabetes Mellitus patients. Data is collected from the laboratory's database, ensuring confidentiality. Data analysis involves exploring prevalence of Chronic Kidney Disease using statistical methods. Ethical considerations, such as obtaining approval and protecting participant privacy, are addressed.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1.Introduction

This chapter outlines of the data collected and examined concerning the prevalence of chronic kidney disease (CKD) in diabetes mellitus (DM) attended at Diagnostics Laboratory Services (DLS) in Bulawayo, Zimbabwe from January to October 2023.

4.2. Data Presentation and Analysis

4.2.1. Socio-demographic characteristics of CKD patient with DM.

The January to October period (10 months) dictated the sample size using a census method of collected data for the study. The number of participants reached 109 by the end of the sampling period.

Table 4.2.1 Socio-demographic factors (N=109)

Variables	Grouping	Number (n)	Percentage
Age	18-40	8	7%
	41-50	11	10%
	51-60	27	25%
	61-70	35	32%
	71-80	17	16%
	>80	11	10%
Gender	Female	63	58%
	Male	46	42%
Ethnicity	Black	79	72%
	White	30	28%
Residency	Rural	26	24%
	Urban	83	76%

In the study, a total number of 109 participants were included for the investigation. Among the participants, 63 cases with a percentage of 58% were female and 46 cases with a percentage of 42% were male. In terms of the age distribution in the study, 8 participants (7%) were between 17 to 41 years old, 11 participants (10%) were between 40 and 51 years old, 27 participants (25%) were between 50 and 61 years old, 35 participants (32%) were between 60 and 71 years old, 17 participants (16%) were between 70 and 81 years and lastly 11 participants (10%) were over 80

years old. Most of the participants, 79 patients (72%), were black and 30 patients (28%) were white. Regarding the residential areas of participants, 83 participants (76%) lived in urban in an area and 26 participants (24%) lived in rural areas.

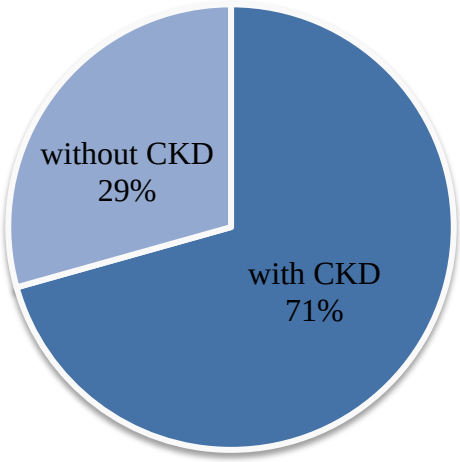

Figure 4.2.1.1 DM patient with and without CKD

In the study, 77 participants (71%) had an eGFR indicating different levels of renal failure and 32 participants (29%) had normal eGFR results.

A significant observation in the study participants on the severity of CKD with Gender and Ethnicity was made.

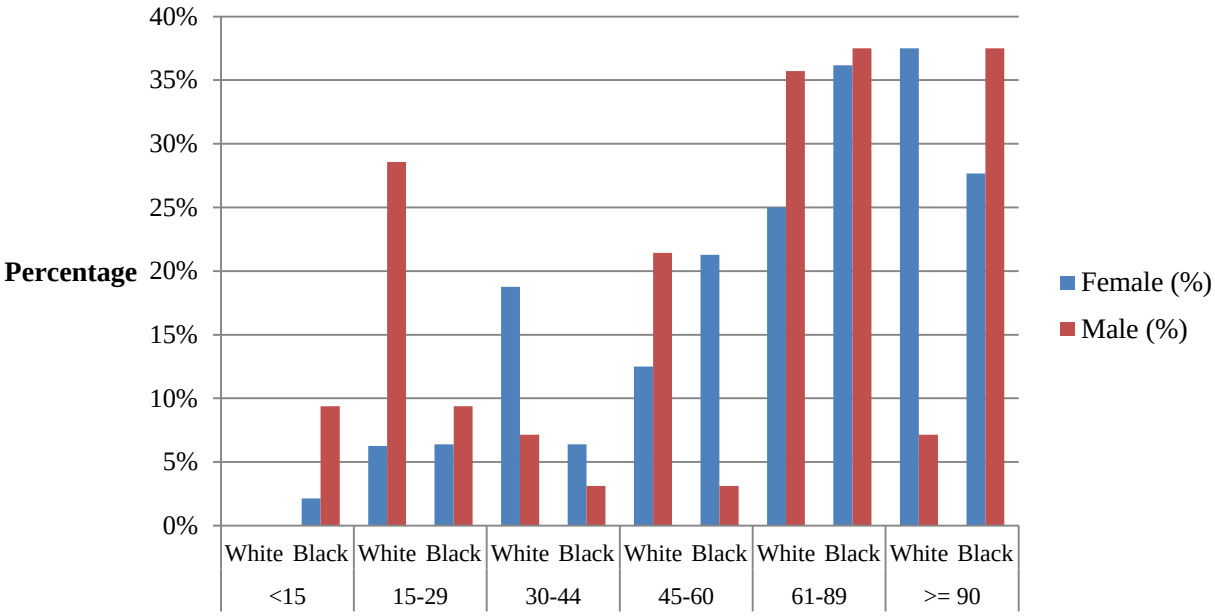

Figure 4.2.1.2 eGFR variation with Gender and Ethnicity

In Figure 4.2.1.2 the variation of eGFR with gender and race, showed the severity of Chronic Kidney Disease to be more in males and ethnically white participants, as to females and ethnically black participants. The study, the analysis of plotting age against study participant estimated glomerular filtration rate showed a directly proportional relationship on a line graph.

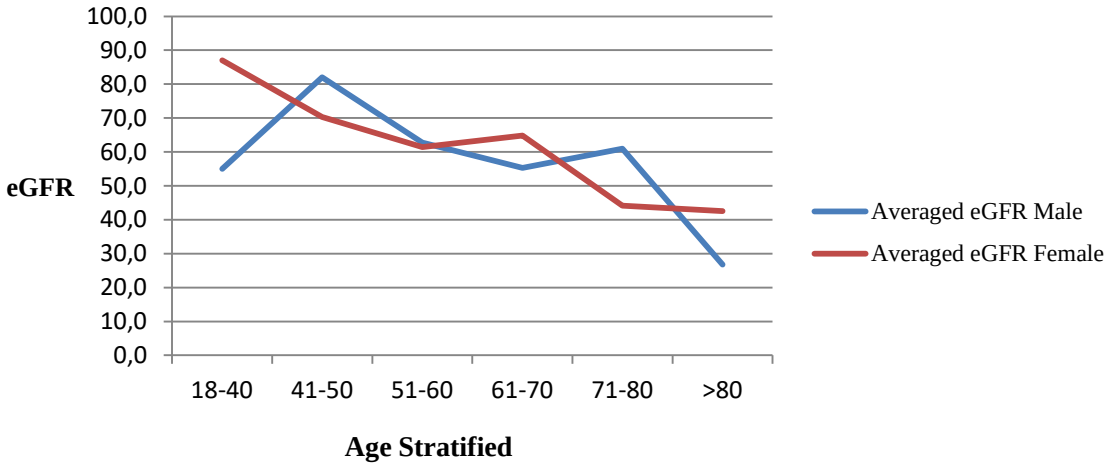

Figure 4.2.1.3 eGFR variation with age: In DM patients with CKD

The variation in age across both male and female with progressive CKD showed the lowering of the eGFR as the age increased.

4.2.2. Prevalence of CKD in Diabetes Mellitus patients.

There is a higher occurrence of kidney failure in females as compared to males, with an average calculated prevalence of 40.35% for females and 30.26% for males. There is a higher occurrence of kidney failure in participants who are ethnically black as compared to the participants who are ethnically white, with a prevalence of 49.52% for participants who are ethnically black and 21.11% for participants who are ethnically white(table 4.2.3)

Table.4.2.2 Prevalence of CKD in DM stratified age, Gender and Ethnicity (n=109)

Stratified Age	**18-40**	**41-50**	**51-60**	**61-70**	**71-80**	**>80**	**Prevalence**
With CKD (eGFR<90)	**3**	**6**	**21**	**23**	**14**	**10**	**12,8**
Female (n)	2	3	10	13	12	4	-
Female (%)	1.83%	2.75%	9.17%	11.92%	11.01%	3.67%	**40.35%**
Male (n)	1	3	11	10	2	6	-
Male (%)	0.92%	2.75%	10.09%	9.17%	1.83%	5.5%	**30.26%**
Black (n)	2	6	16	14	10	6	-
Black (%)	1.83%	5.5%	14.68%	12.84%	9.17%	5.5%	**49.52%**
White (n)	1	0	5	9	4	4	-
White (%)	0.92%	0%	4.59%	8.26%	3.67%	3.67%	**21.11%**

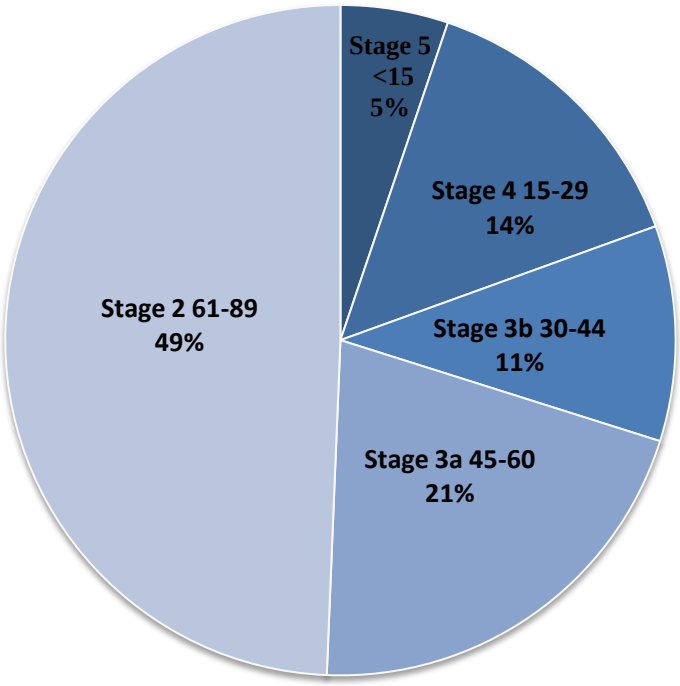

Figure 4.2.2 Stratified Severity stages of CKD in DM patients (n=77)

Nearly all CKD patients with regards to severe kidney function failure are in stage 2 (49%), then stage 3a (21%), Stage 4 (14%), Stage 3b (11%) and lastly stage 5 (5%). Of the 109 participant's had their eGFR measured (examined in a Urea and Electrolytes test), 77 participants (71%) in the study, were found to have developed chronic kidney disease (CKD) with an eGFR value below 90 at different severe stages.

The stages and the participant's renal function was measured and characterised using the estimated glomerular filtration rate (eGFR). 77 participants were concluded to be Chronic Kidney Diseased. Using the eGFR, 49% of the participants were classified under stage 2, 21% of the participants were classified under stage 3a, 11% of the participants were classified under stage 3b, 14% of the participants were classified under stage 4, and 5% of the participants were classified under stage 5, as shown in Figure 4.2.2.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1.Introduction

In this chapter, the main analysed findings from chapter 4 descriptively were detailed and concluded on.

5.2.Discussion

The study examined the prevalence of Chronic Kidney Disease in Diabetes Mellitus patients attended at Diagnostics laboratory services in Bulawayo, Zimbabwe. Prevalence of Chronic Kidney Disease in Diabetes Mellitus patients has been a common health hazard under surveillance as it has been seen to affect individuals of different characteristics and have different severities in some characteristics. “While the prevalence of CKD tends to be higher in women, the disease is more severe in men, who also have a higher risk of all-cause and cardiovascular disease (CVD) mortality across different levels of renal function.” (ElHafeez et al, 2018). In the variation of eGFR with gender and race, the study showed the severity of Chronic Kidney Disease to be more in males and ethnically white participants, as to females and ethnically black participants. Despite Diabetes Mellitus having a negative on renal function there are other factors to which may have also contributed to Chronic Kidney Disease. A study done by Nyasha et al (2013) clearly deduced on more their study participants having hypertension as to not only being diabetic in causing Chronic Kidney Disease. This then concludes on the fact that if the study participants had complications that included hypertension, it then contributed to the severity and progression of Chronic kidney disease in Diabetes Mellitus patients. In the study, socio-demographic factors showed that the study participants 76% came from urban areas while on the other hand 24% came from rural areas.

This indicates that individuals staying in urban areas who are diabetic are more likely to develop Chronic Kidney Disease as compared to individuals situated in rural areas, this would suggest ineffective management of Chronic Kidney disease and or possibly as well the under management of the underlying condition, Diabetes Mellitus.

A variation was seen in the study, were age proportionally correlated with the decline of renal function. The older an individual with Diabetes Mellitus got the greater the physiological decline in the renal function. “The physiological decline of renal function with age may have also played a role, since senescence is associated with a gradual decline of eGFR” (Russo et al., 2018). “The prevalence of DKD increases with age and is more evident by a low eGFR than by albuminuria”(Farah et al, 2021).

In the study, prevalence of chronic kidney disease in Diabetes Mellitus patients is more common in females (40.35%) than in males (30.26%). A study done by ElHafeez et al, (2018) concludes on the same findings, higher prevalence of chronic kidney disease in Diabetes Mellitus patients more in females than the males. “In this analysis of patients with diabetes from a managed care setting, we found that women had a greater prevalence of advanced DKD, hypertension, dyslipidemia, and obesity than men” (Yu et al., 2012).

In the study, 77 participants (71%) had an eGFR indicating different levels of renal failure and 32 participants (29%) had normal eGFR results. In terms of the age distribution in the study, 8 participants (7%) were between 17 to 41 years old, 11 participants (10%) were between 40 and 51 years old, 27 participants (25%) were between 50 and 61 years old, 35 participants (32%) were between 60 and 71 years old, 17 participants (16%) were between 70 and 81 years and lastly 11 participants (10%) were over 80 years old. In a study done by Jitraknatee, J et al (2020), age distribution was 4.4% for <45 years old , 11.0% for 45–55 years old , 20.7% for 56–65 years old, 32.1% for 66–75 years old and 61.3% for >75 years old, showing a fairly similar pattern of renal failure with increase in age in diabetic patients.

There is a higher prevalence of kidney failure in participants who are ethnically black as compared to the participants who are ethnically white, with a prevalence of 49.52% for participants who are ethnically black and 21.11% for participants who are ethnically white.

In a study done by Ali et al., (2013) pointed out the estimated-stage kidney failure was 32% and 44% in White and Black participants. "CKD stage 3 was more prevalent in Whites compared to South Asians—OR 0.79 (95% CI: 0.71–0.87) and Blacks—OR 0.49 (95% CI: 0.43–0.57)."(Dreyer et al., 2009)"

The study showed an association of prevalence of Chronic Kidney Disease in Diabetes Mellitus patients between the age range of 51-60 and higher. In a study done by Islam et al (2009) concluded with results indicating age-specific prevalence of stage 3 0r 4 CKD at 20 to 49, 50 to 69 and ≥70 age was 1.5%, 11.7%, and 39.0%. The study, revealed to have ethnically black participants (72%) as to ethnically white participants (28%). A study done by Farah et al (2021) note a correlation of age and DKD, with <60 age group giving a 46% prevalence and >60 age group giving a 52.8% prevalence. "The prevalence of diabetes is high in older subjects, affecting more than 20% of subjects > 65 years"(Russo et al., 2018).

5.3.Conclusions

At Diagnostics Laboratory Services Bulawayo, Zimbabwe, the prevalence of chronic kidney disease (CKD) in Diabetes Mellitus patients is significantly high. Elements that include gender, old age, ethnically black, ethnically white and people's residential location are among the characteristics that show a strong correlation with chronic kidney disease (CKD) in diabetes mellitus patients. In detail having Diabetes Mellitus and circumstantially natural aging showed to be factors strongly that lead to the decrease of renal function over time. It could suggest also that under management and prolonged Diabetes mellitus health status can further affect renal function as well.

Male study participants exhibited to reach severe end stage renal failure as compared to the female study participants, thus highlighting a difference between the two in terms of the metabolic functions of the kidney and how the male gender may succumb to CKD severely as to women.

5.4.Limitations

- The small sample size may have had an impact on the results of the data.
- The study cannot be generalised as it was confined to data collected from a single Laboratory in Bulawayo.
- The prevalence of the study could not be associated with clinical complications as records could not be acquired to match them to the study findings.
- Possible management and treatment of Diabetes may have led to misguided eGFR result, thus patient may end up having kidney failure complications after a long period of time because of proper management.
- The study type could not allow longitudinal outcomes, and only gave outcomes for a specified person and single time which may falsify the study.
- Combining diabetic patients with Type I diabetes Mellitus and Type II Diabetes Mellitus. Possible differences may have been seen if the analysis of the diabetic individuals were categorised as so.
- Drug management and disease management not related to abusive drug consumption such as healthy lifestyle habits of diabetic individuals would have been good angles to assess the correlation of Diabetes Mellitus and Chronic Kidney Disease. Thus the need to possibly include HbA1c test for Diabetes Management.

5.5.Implications

Patients with diabetes mellitus (DM) are more likely to have chronic kidney disease (CKD), which highlights the need for more research to develop effective management and prevention strategies. This research study helps us understand CKD in patients with diabetes mellitus and offer important information for formulating supplement intake recommendations that are acceptable for management and self-management for those who have been diagnosed.

Given the potential obstacles to putting these workable ideas into practice, health practitioners can take the lead in ensuring that DM patients adhere to these solutions and that they are implemented effectively.

5.6.Recommendations

Early screening and possibly enhanced screening of individuals who are at risk of Chronic Kidney Disease in diabetes mellitus patients are great interventions that can help. By identifying CKD at its early stages can best help avoid delayed treatment and supportive care thus also slowing down or countering the chances of severe kidney failure. With regards to diabetes, is important that management strategies be taken seriously and taken into consideration on how they may affect the function of the kidney therefore optimal management of the underlying condition is better made priority.

Education to all diabetic and non-diabetic population on the circumstances on correlated socio-economic factors that may motivate or indirectly correlate with certain diseases, in order to avoid or improve personal human aspects such as lifestyle can best manage the prevalence. In some cases treatment and management may prove to be difficult and only option of cure or longevity better options would be to have Kidney transplants. The study should be done at a wider scale, so it can be generalised. A cohort study is better used as to a cross-sectional study.

Additionally to studies related to patients with diabetes mellitus it would be good to scientifically correlate to Chronis Kidney Disease by including whether they Type I or Type II Diabetic, possible drug use and management of the underlying condition.

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Appendices

Appendix A: Sheet for data collection

Variables	SOCIO-DEMOGRAPHICS				
Patients SERIAL NUMBER:	RESIDENCY	AGE	SEX	ETHNICITY	eGFR
1					
2					
3					
4					
5					
6					
7					

Appendix B: Time Frame

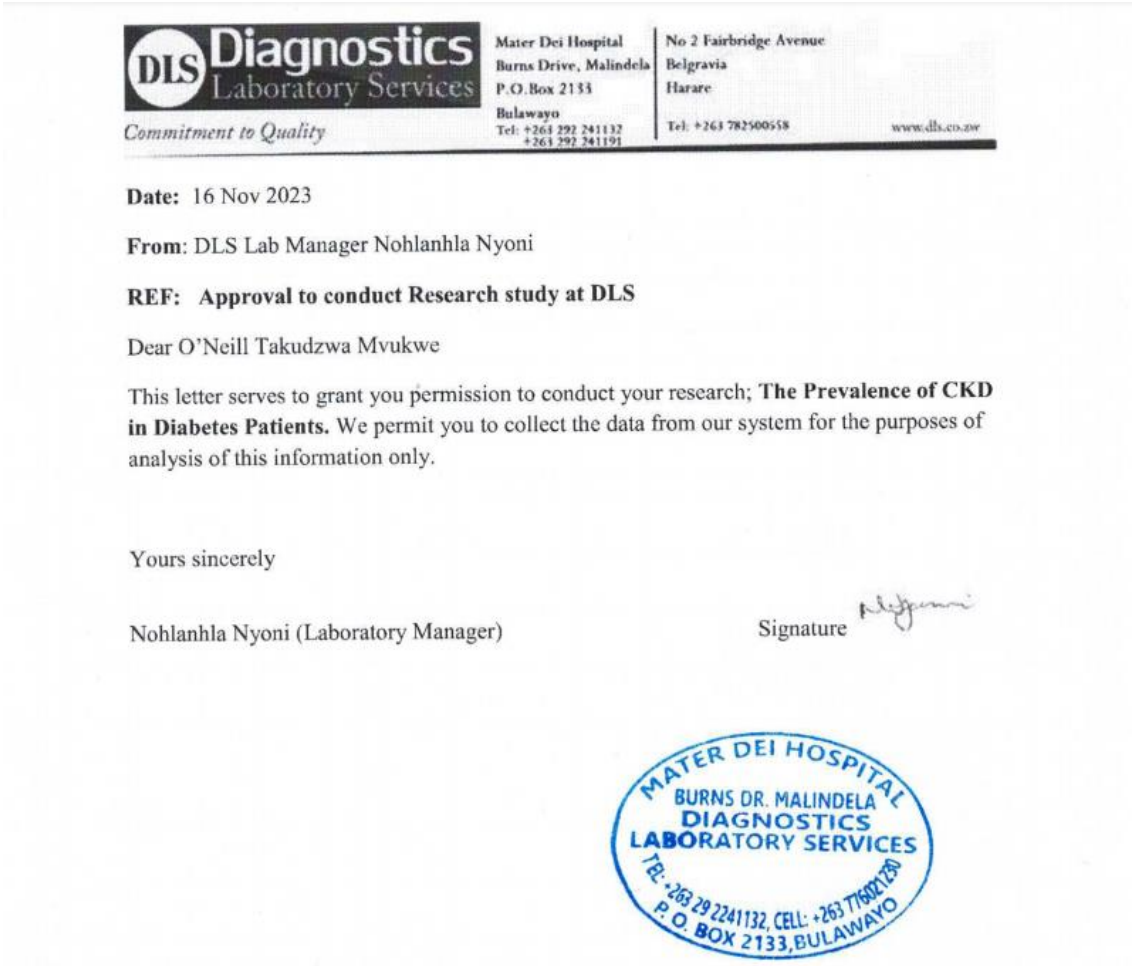
Gnatt Chart: Prevalence of Chronic Kidney Disease in DM patients															
	2023												2024		
DATE:	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
TASKS															
Task 1															
Task 2															
Task 3															
Task 4															
Task 5															

TASKS	DESCRIPTION
1	Proposal Writing progress
2	Site approval letter
3	Data Collection progress
4	Ethics approval
5	Data analysis

Appendix C: Budget

Description	COST IN USD($)
Printing	4
Transport	65
Stationery	15
Total	84

Appendix D: Approval letter from study site



DLS Diagnostics Laboratory Services
Commitment to Quality

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No 2 Fairbridge Avenue
Belgravia
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www.dls.co.zw

Date: 16 Nov 2023

From: DLS Lab Manager Nohlanhla Nyoni

REF: Approval to conduct Research study at DLS

Dear O'Neill Takudzwa Mvukwe

This letter serves to grant you permission to conduct your research; **The Prevalence of CKD in Diabetes Patients.** We permit you to collect the data from our system for the purposes of analysis of this information only.

Yours sincerely

Nohlanhla Nyoni (Laboratory Manager) Signature

MATER DEI HOSPITAL
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DIAGNOSTICS
LABORATORY SERVICES
TEL: +263 29 2241132, CELL: +263 7760021230
P. O. BOX 2133, BULAWAYO

Appendix E: Approval letter from Supervisor

Investing in Africa's Future

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

P.O. BOX 1320, MUTARE, ZIMBABWE – Cell: (1263) 780079459
MAIL: salissoum@africau.edu.

03, March, 2024

To whom it my concern

Dear Sir

Re: Permission to submit to AUREC for O'NEILL TAKUDZWA MVUKWE

Program: Bachelor of Medical laboratory sciences

This letter serves to confirm that I have supervised the above mentioned student and he has satisfied all the requirements of the college and he is ready in conducting research on

The Prevalence of Chronic Kidney Disease in Diabetes Mellitus Patients.

Your facilitation is greatly appreciated

Thank you

Research Supervisor:
Dr Maibouge T.M.Salissou PhD
Endowed Chair of Pathology CHANS Africa University
Phone 0780079459
Email: salissoum@africau.edu
Website: Maibouge T. M. Salissou – Africa University
Po Box 1320

Appendix F: Ethical Approval letter from AUREC

AFRICA UNIVERSITY
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: AU3167/24

11 March, 2024

O'NEILL TAKUDZWA MVUKWE
C/O Africa University
Box 1320
MUTARE

RE: THE PREVALENCE OF CHRONIC KIDNEY DISEASE IN DIABETES MELLITUS PATIENTS.

Thank you for the above-titled proposal that 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** AUREC3167/24
  This number should be used on all correspondences, consent forms, and appropriate documents.
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 11, 2024
- **EXPIRATION DATE** March 11, 2025
- **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.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
APPROVED
P.S. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU
ASSISTANT RESEARCH OFFICER: FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE