PREVALENCE AND DETERMINANTS OF DIABETIC PATIENTS READMISSIONS AT SESHEGO DISTRICT HOSPITAL, CAPRICORN DISTRICT, LIMPOPO PROVINCE, SOUTH AFRICA

by

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[redacted]

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DECLARATION

I declare that **prevalence and determinants of diabetic patients' readmissions at Seshego district hospital, Capricorn district, Limpopo province, South Africa** is my own work and has not been submitted before for any other degree at any other institution. All the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Signature:……..

DEDICATION

This dissertation is dedicated to my family for their support and encouragement throughout this academic journey and all the people living with diabetes mellitus.

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ABSTRACT

Background: Diabetes mellitus is a public health concern epidemiolocally and economically. The rates of readmission in diabetic patients are reported to be high as compared to non-diabetic patients. With many factors contributing to readmission of diabetic patients, there are preventable and non-preventable factors. A good understanding of the causes and risk factors associated with readmission is necessary in order to prevent/reduce readmission rates.

Methods: A retrospective descriptive study was conducted which followed a quantitative approach. This study used secondary data from patient clinical records from the paediatrics, male, female and TB ward in Seshego Hospital. The data was analysed using STATA and descriptive statistical analysis was undertaken to identify frequencies and percentages of answers to the research questions. For logistic regression, the independent variables were socio-demographic factors such as age, gender, marital status, race, and employment status. The dependent variable was the diagnosis of diabetes and its readmission into the hospital. The statistical significance of the relationships between the selected variables was determined using the t-test. The level of significance was set at 0.05 and 95% confidence interval will be used to judge statistical significance.

Results: The prevalence of diabetic patients' readmission is very high in the current study. The prevalence of readmission of diabetes increased with increasing age both in males and females patients. The prevalence increased from 6.7% in age group between 18 and 29 years followed by 10%, 13.3% and 70% in males aged 30 – 49 years, 50 – 59 years and above 60 years respectively. The study showed that employment status, number of medication and type of medication are significantly associated with readmission while those high white blood cells count, comorbidities, level of education and marital status were more likely to be readmitted, although they were not statistically significant.

Conclusion: The study revealed high prevalence of readmission of diabetic patients and showed that employment status, number of medication and type of medication are significantly associated with readmission while those with high white blood cells count, comorbidities, level of education and marital status were more likely to be readmitted, although they were not statistically significant.

Recommendations: the current study revealed that there is a need for a primary data to further investigate the causes of readmission in diabetic patients for effective intervention in order to reduce the rates of readmission.

Key words: Determinants, diabetes mellitus, prevalence, readmission,

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ABBREVIATIONS

DM- Diabetes mellitus

T1DM- Type 1 diabetes mellitus

T2DM- Type 2 diabetes mellitus

GDM- Gestational diabetes mellitus

IDF- international diabetes federation

COPD- chronic obstructive pulmonary disease

CVAs- cerebrovascular accidents

LOS- length of stay

DKA- diabetic ketone acidosis

DEFINITION OF CONCEPTS

Diabetes mellitus is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces leading to elevated levels of blood glucose (WHO, 2016). In this study, diabetes mellitus be referred to as a diagnosed chronic disease where blood glucose is elevated.

Readmission patients is defined as patients who have multiple hospitalisation records (Liu et al., 2015). In this study, readmission patients will be referred to as being admitted more than once in a period of twelve months in the hospital.

Diabetic patients are people who have bodies that do not produce or respond to insulin (a hormone produced by the beta cells of the pancreas that is necessary for the use or storage of body fuels (Reference *et al.*, 2011). In this study, diabetic patients will be all people diagnosed with diabetes mellitus (type 1, type 2, or gestational diabetes mellitus).

Determinants are the causes and other factors that influence the occurrence of disease and other health-related events (Kreiss, 2016). In this study, the determinants are causes and risk factors contributing to the occurrence of readmission.

Prevalence is the proportion of persons in a population who have a particular disease or attribute at a specified point in time or over a specified period (Kreiss, 2016). In this case, prevalence is a proportion of patients who had diabetes mellitus between the years 2019 and 2021 at Seshego district hospital

CHAPTER 1 ORIENTATION OF THE STUDY

1.1. Introduction and background

Diabetes mellitus is a public health concern epidemiologically and economically. DM is one of the top 10 causes of death in adults, and was estimated to have caused four million deaths worldwide in 2017 and its management is costly (Saeedi, Petersohn, Salpea, Malanda, Karuranga, Unwin, Colagiuri, Guariguata, Motala, Ogurtsova, Shaw, Bright, & Williams, 2019).

There are two major types of diabetes mellitus namely type 1 diabetes (T1DM) and type 2 diabetes (T2DM). Type 1 diabetes is a chronic condition in which the pancreas produces little or no insulin by itself. T2DM occurs when the body becomes resistant to insulin or does not produce enough insulin. There is also gestational diabetes mellitus (GDM) which is a temporary condition that occurs in pregnancy and carries a long-term risk of developing T2DM. Type 2 diabetes mellitus is the most common diabetes and is usually found in adults (WHO, 2016). T1DM is nowhere near as common as T2DM and approximately 10% of all diabetes cases are type 1 and it is more common in childhood (Lal, 2016).

In 2019, 463 million people were estimated to be living with diabetes, representing 9.3% of the worldwide adult population (20–79 years). This number is expected to increase to 578 million (10.2%) in 2030 and 700 million (10.9%) in 2045 (Saeedi *et al.*, 2019). Among inpatient admissions, Heaton, Desai, Kelton, and Rajpathak, 2016; Enomoto, Shrestha, Rosenthal, Hollenbeak, and Gabbay 2017; Ostling, Wyckoff, Ciarkowski, Pai, Choe, and Bahl and Gianchandani, (2017) reports that patients with diabetes were more likely to be readmitted compared to patients without diabetes and about 20% of patients with DM were reported having two or more admissions in a year. Ostling et al., 2017 also mentioned that diabetic patients have a longer length of stay and have more hospital complications and mortality rates as compared to non-diabetic patients.

Readmission of diabetic patients is an important measure for health care quality and is a driver of costs and management of diabetes is costly on its own and readmission of patients increases the burden to the institution financially (Rubin, 2018). People living with diabetes are at higher risk of readmission than non-

diabetic people (Robbins, Lim Choi Keung, Sankar, Randeva, & Arvanitis, 2019). Readmission rates of patients with DM were reported to be high at 13.7% compared to non-diabetic patients at 8.1% (Sonmez, Kambo, Avtanski, Lutsky, & Poretsky, 2017).

Risk factors associated with readmission of diabetic patients include lower socioeconomic status, race, comorbidity burden, hospital length of stay, and diabetes-related complications (Rubin, 2018; Robbins *et al.*, 2019). With many factors mentioned contributing to readmission of diabetic patients, some are preventable and others are not preventable. A good understanding of the causes and risk factors associated with readmission is important to prevent/reduce readmission rates (Rubin, 2018). Educating the patients about the management of the condition, giving precise discharge instructions, and following the patients up may reduce the rates of readmission. Inpatient diabetes education has been shown to reduce the risk of readmission and may benefit high-risk patients (McCoy, Lipska, Herrin, Jeffery, Krumholz, & Shah, 2017). Reducing readmission rates of diabetic patients has the potential to reduce health care costs while improving care and prolonging the lives of the patients (Rubin, 2018).

Investigating the prevalence and determinants of hospital readmission among diabetic patients will be beneficial to the institution, the healthcare professionals, patients seen in the institution and policymakers. This study will help the policy makers in drafting the guidelines/programs for more effective health education and treatment of diabetes mellitus and the multidisciplinary team of the institution to treat, prevent, and reduce readmission of diabetes. And this will help in reducing the cost spent on readmission by the institution.

1.2. Problem statement

Readmission into hospitals has highly become unaffordable nowadays and necessary measures need to be employed to make them preventable. The frequency of readmission is generally high in hospitals that cater for a huge population (Harisekaran, 2015). The researcher observed several readmission of diabetic patients at Seshego district hospital. Despite patients being discharged at stable conditions and the intervention given by the multidisciplinary team,

diabetic patients are readmitted presenting with high or low glucose. Uncontrolled diabetes mellitus may lead to complications such as renal diseases, blindness, impotence, and death, and managing the complications can be costly to the institution. Few studies reported on the factors contributing to readmission of diabetic patients like the severity of illness, adherence to discharge instruction, improper medication, and quality of post-discharge care among other (Karunakaran, Zhao & Rubin, 2018; Care & Suppl, 2020). In this study, the researcher seeks to identify the determinants of readmission of diabetic patients in the institution.

1.3. Preliminary literature review

Diabetes mellitus has become quite customary in today‘s life irrespective of age group. Effective approaches are available to prevent diabetes, the complications, and premature death that can result from all types of diabetes. It can be prevented by exercising regularly, eating healthily, avoiding smoking, and controlling blood pressure and lipids. Type 1 diabetes cannot be prevented with current knowledge. Diabetes does not have a cure but is manageable (WHO, 2016).

The prevalence of diabetes is increasing worldwide. The burden of diabetes patients among hospitalised patients is also growing and costly, and readmissions contribute to the burden (Rubin, 2018). In this chapter the prevalence and the determinants of readmission of diabetic patients including public health factors that may help in reducing or preventing readmission rates will be outlined.

1.4. Purpose of the study

1.4.1. Aim of the study

The aim of the study was to investigate the prevalence and determinants of diabetic patients' readmissions at Seshego District hospital, Capricorn District.

1.4.2. Objectives of the study

- To determine the prevalence of diabetic patients’ readmissions among diabetic patients admitted at Seshego District hospital, Capricorn District.

- To investigate the determinants of diabetic patients' readmissions at Seshego District hospital, Capricorn District.

1.5. Research questions

The research questions of the current study were two being:

- What is the prevalence of diabetic patients' readmissions at Seshego District hospital in Capricorn District?

- What are the determinants of diabetic patients' readmissions at Seshego District Hospital in Capricorn District?

1.6. Research methodology

The current study used quantitative method which involved the use and analysis of numerical data using statistical techniques (Petzer, 2016). This study used secondary data from patient clinical records to produce descriptive analysis which was retrospective in nature. The research was conducted at Seshego Hospital, which is a district hospital located in Capricorn District of Limpopo province. A detailed methodogy which includes the study population, sampling methods, data collection processes, analysis and ethical considerations will be described in details in Chapter 3 on this report.

1.7. Significance of the study

There are factors contributing to readmission of DM patients which can be preventable. Identifying and understanding the factors contributing to readmission at Seshego hospital could help in developing the interventions to reduce and prevent the rates of readmission in the institution. The findings of the study will help in making recommendations/guidelines in the department that may be used by health care provider in managing inpatients and outpatients who are diabetic to preventing the rate of readmission.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This section presents an overview of the literature related to diabetes readmissions and covers the following topics: the prevalence of diabetes, the prevalence of diabetic patients' admissions and readmissions, determinants of diabetic readmission and the public health interventions to prevent/reduce readmission of diabetic patients.

Database was searched from 2015 to 2021 with search terms including relevant words and terms. The terms that were used through Boolean functions include: diabetes, diabetic patients and readmission, prevalence of diabetes, determinants of diabetic patients readmission, prevalence of readmission and diabetes. This terms were used to obtain relevant data globally, in Africa and in South Africa. The literature was retrieved from the following search engines: Google scholar and Pub-med.

2.2 The global prevalence of diabetes mellitus

The prevalence of DM in adults aged 20–79 years was estimated to be 415 million which was 8.8% in 2015 and predicted to rise to 642 million (10.4%) in 2040. The number of children with T1DM between the age of 0-14 years was 542,000 (IDF, 2015; Ogurtsova, Cho, da Rocha Fernandes, Huang, Guariguata, & Linnenkamp *et al.,* 2017). In 2017, the IDF estimated that 424.9 million adults worldwide had diabetes, with projections of 628.6 million cases by 2045 (Cho, Shaw, Karuranga, Huang, da Rocha Fernandes, & Malanda, 2018). China is the country with the largest number of people living with DM in the world amounting to 116,4 million people (10.9%), India being the second with 77 million (8.9%) people (Saeedi *et al.*, 2019). In the study done in the United State of America (USA), it was reported that in 2016 the estimated prevalence of diagnosed type 1 and type 2 diabetes mellitus were 0.55% (1.3 million U.S. adults) and 8.6% (21.0 million U.S. adults), respectively (Bullard, Cowie, Lessem, Saydah, Menke, & Geiss, 2018). The results found by Xu, Liu, Sun, Du, Snetselaar, & Hu *et al.* (2018) for the prevalence of diagnosed DM for 2016 and 2017 were 0.5% for type 1 DM and 8.5% for type 2 DM, the results did not differ from the study done by (Bullard *et al.*, 2018) in percentages. In 2019, 31 million (13.3%) were

estimated to be living with diabetes in the United State of America (Saeedi *et al.*, 2019).

2.3 Diabetes in African Continent

In Africa, 14.2 million which is 3.8% of people were estimated to be living with diabetes in 2015 and expected to increase to 34.2 million (4.2%) in 2040 (IDF, 2015). In 2017 about 15.5 million (4.2 %) were estimated to be living with diabetes in Africa (Cho *et al.*, 2018) and In 2019, 19 million people were estimated to be living with diabetes mellitus and the number is expected to increase to 29 million in 2030 and 47 million in 2045 (Saeedi *et al.*, 2019). In the study done in Kenya where 2015 data was used, the prevalence of diabetes was 2.4% (Mohamed, Mwangi, Mutua, Kibachio, Hussein, & Ndegwa *et al.,* 2018) and the statistics did not differ much from the 2019 report from the Saeedi *et al.*,(2019) where 2.2% of people living with diabetes was reported. (Robbiati, Putoto, Da conceição, Armando, Segafredo, & Atzori *et al.,* 2020) reported 12% of people living with diabetes in Angola. The prevalence of diabetes in Namibia was reported to be 5.1% where 2013 data was used (Adekanmbi, Uthman, Erqou, Echouffo-Tcheugui, Harhay & Harhay, 2019), 3.5% was reported in 2015 by IDF(Edition, 2015) and 3.8% were reported for 2019 by (Saeedi *et al.*, 2019). The 2015 and 2019 prevalence of DM from IDF of Namibia do not differ much meaning that DM prevalence in this country is well maintained. Many African countries were reported not to submit their data to IDF (Saeedi *et al.*, 2019).

2.4 Diabetes in South Africa

In South Africa, 2.3 million were estimated to be living with DM in 2015 (IDF, 2015), 1.8 million (5.4%) in 2017 (Cho *et al.*, 2018), and 4.6 million (12,8%) was estimated for 2019 (Saeedi *et al.*, 2019). In the study done by Bailey, Ayles, Beyers, Godfrey-Faussett, Muyoyeta, & du Toit *et al.* (2016) in Western Cape it was found that the prevalence of diabetes was 9.4%, while in Gauteng Province (Motlhale & Ncayiyana, 2019) found that 11.2% of people were living with diabetes where non-migrant and migrant were compared and it was found that the highest prevalence was among the non-migrant at 12.6%. In 2012, Limpopo Province had the lowest prevalence of diabetes at 4.6% as compared to other Provinces while South African overall statistics was at 9.5% (Day & Gray, 2018).

2.5 The rate of diabetic patients' admissions and readmissions

In a study done in the USA (New York) by Sonmez et al. (2017), it was found that the readmission rates were high in patients with DM at 13.7% than non-diabetic patients at 8.1% and also mentioned that patients with DM have 2.47 more chance of readmission as compared to non-DM patients. Ostling et al. (2017) reported the high rate of readmission of 26.4% where primary diagnosis of DM was 40.5 %, as compared to those with secondary diagnosis of DM at 25.8% and 22.5% of unknown DM diagnosis. In another study done by Mccoy et al. (2017) in the U.S, a reported 10.8% readmission rate of diabetic patients. In the study done in China, it was found that out of 16 548 diagnosed with T1DM 29.8% were readmitted and 21 072 diagnosed with T2DM 29.0% of the patients readmitted (Liu, Liu, Lv, Li, Cui,& Ma, 2015). In the study done in Eastern Ethopia by Regassa and Tola, (2021) it was reported that 29.48% diabetic patients had a history of admission and 52.2% were readmission within the five years follow up period.

2.6 Determinants of diabetic patients' readmissions

Readmission results from improper medication, early discharge, unmonitored discharge, and meagre care of hospital staff. Identifying the high risk of readmission through data analytics leads to accessibility to healthcare providers to develop programmes to improve the quality of care and institute targeted intervention strategies (Harisekaran, 2015). Therefore, the determinants for readmission of diabetic patients in this study will be grouped in terms of patients', socio-demographic, medical, and health systems-related factors.

2.6.1 Socio-demographic factors

Gender has been associated with readmission of DM patients as male patients were likely to be readmitted than female patients (Ostling *et al.*, 2017) (Karunakaran, Zhao & Rubin, 2018). According to a study by Enomoto *et al.*, (2017) out of 47.4% of men with T2DM 48,2% were readmitted as compared to women 52,6% had T2DM, and 51,8%. In support of the above-mentioned researchers, Sonmez et al. (2018) reported a readmission rate of the male patients of 12, 7% as compared to 9.4% of female patients. Age has been

found to be associated with readmission of diabetic patients as patients > 65 years are more likely to be readmitted than those < 65 years of age (Enomoto et al., 2017; Karunakaran, et al., 2018; King, Atwood, Brown, Lozada, Nelson & Sabo, et al., 2018).

In other studies race was associated with readmission of diabetic patients as Blacks were more likely to be readmitted as compared to other races (Enomoto et al., 2017). Karunakaran et al. (2018) was in accord with Enomoto et al., (2017) where it was reported 50.9% of Black, 15.5% Hispanic, 29.2% White, and 4.4% other races were readmitted. African American patients had a slightly higher risk of readmissions than did White patients (Mccoy *et al.,* 2017). Marital status has also been found to be associated with readmission of diabetic patients as unmarried patients had a higher risk of hospital readmission than patients who were married (Heaton *et al.*, 2016). Disabled, retired, or unemployed patients were reported to be at 26%-55% chances of readmission than employed patients (Karunakaran, Zhao, and Rubin, 2018). High income was associated with a reduced risk of readmission (Mccoy *et al.*, 2017). It was reported that about 73% of the people in Western Cape Province in South Africa were dependent on public hospitals. Due to socio-economic challenges in the country, it was difficult for the government to provide enough for the population, leading to a shortage of hospital beds number, premature discharge, and poor follow-up (Dreyer & Viljoen, 2019).

2.6.2 *Medical related factors*

The presence of any comorbidity increases the chances of readmission (Enomoto *et al.*, 2017). The increased risk of readmission for patients living with DM was found to be present in patients with both primary and secondary diagnoses of DM, although the higher rate of readmission was seen in patients diagnosed with DM as the primary condition (Sonmez *et al.*, 2017). The most prevalent diseases that led to readmission were due to cardiac failure, infections, chronic obstructive pulmonary disease (COPD) and cerebrovascular accidents (CVAs), depression, schizophrenia, hypertension, anemia, overweight, or obesity (Karunakaran, Zhao, & Rubin, 2018) and (Enomoto *et al.,* 2017). Infections were found to be the most contributing

factors causing readmission. It has been shown that diabetes as a condition is a risk factor for infections (Ostling *et al.*, 2017).

The use of insulin was associated with 14% high chances of readmission, while the use of thiazolidinedione is associated with 16% lower chances (Karunakaran, Zhao & Rubin, 2018). (Mccoy *et al.*, 2017) reported that patients using insulin were 80% more likely to be readmitted for severe dysglycemia and 6% more likely to be readmitted for other causes as compared to non-insulin-treated patients. Patients who had polypharmacy are more likely to be readmitted and those who are frail and had polypharmacy had more chances of health problems than patients without these two factors and had higher readmission rates at 30 and 90 days (Rosted, Schultz and Sanders, 2016). Pharmacotherapeutic education can significantly improve medication adherence in patients with T2DM (Marušić, Meliš, Lucijanić, Grgurević, Turčić, & Neto, *et al.,* 2018*).*

2.6.3 Health systems related factors

In studies done by Sonmez et al., (2017) and Robbins et al., (2019) they both indicated that patients with diabetes had a higher length of stay (LOS) than those with no diabetes. Patients who stayed longer in the hospital were more likely to be followed by readmission as compared to those who stayed for a shorter time (Karunakaran, Zhao & Rubin, 2018). More than 5 days length of stay on the index of admission was associated with more than 71% chances of readmission in patients with T2DM (Enomoto et al., 2017). Reducing LOS in patients with DM was possible but might be a challenge since discharge was determined by the wellness of an individual.

When evaluating potentially avoidable causes for 30-day readmission, Dreyer and Viljoen, (2019) found that the biggest contributor was premature discharge (10%), followed by inadequate discharge planning (7%), physician-related errors (5%). It was found that 41% of patients were readmitted within 7 days of being discharged, and 60% were readmitted within 14 days. These figures indicate that a high proportion of patients were either not fit for discharge or developed an adverse event necessitating readmission (Dreyer

& Viljoen, 2019) . Karunakaran et al. (2018) reported that patients discharged against medical advice (AMA) had 60% greater odds of being readmitted as compared to those discharged home and lacking an outpatient visit after discharge is also one of the strongest risk factors of readmission identified. It was reported that retired patients who were admitted at lower grade hospitals were likely to be readmitted (Liu *et al.,* 2015) and (Karunakaran *et al.,* 2018).

2.7 Public health interventions to prevent/reduce readmission of diabetic patients.

2.7.1 Inpatients education

Inpatient DM education has been shown to reduce the risk of readmission and may benefit high-risk patients (Mccoy *et al.*, 2017). Kana, AraqueI, Balasubramanian, Davis, Javed, Niaki, Majumdar & Buller, (2019) shows that 30-days readmission rates of patients with uncontrolled diabetes (severe hypoglycaemia) pre-intervention was 31.7% and reduced to 29% post-intervention time where intervention included inpatient education by the medical team. Appropriate education and the type of medication prescribed, how to use and store the medications, were reported to be important to avoid a dangerous break in care which lead to unplanned readmission (Care & Suppl, 2018). Access to interpretive services in patients who do not speak English was associated with a reduced risk of readmission (King *et al.*, 2018). An accumulating body of evidence suggested that inpatient diabetes education, improving the communication of discharge instructions, and involving patients in medication reconciliation may reduce the risk for early readmissions (Montero, Dubin, Sack, & Magee, 2019).

2.7.2 Proper patient management during and after discharge

The factor that was identified to increase the risk of readmission was not having to follow up visit within 30 days after the index discharge and patients with diabetes could be prioritised to receive outpatient follow-up within 10 days, based on the median time to readmission of 11 days (Karunakaran, Zhao & Rubin, 2018). Jiang, Andrews, Stryer, and Friedman (2015) reported that effective follow-up care could help prevent some readmissions.

Close supervision of junior staff was reported to be crucial to reduce physician-related errors, and supervising consultants to be constantly attentive (Dreyer & Viljoen, 2019). The greater risk of 30-day readmission following the hospitalisation that has been attributed to diabetes could be reduced when inpatient care is provided by a specialised diabetes management team as shown by comparison of usual care to management by specialists who reviewed cases and made recommendations solely through the electronic medical record, rates of both hyper and hypoglyceamia were reduced to 30– 40% by electronic “virtual care” (Care & Suppl, 2020).

2.8 Conclusion

Male, black patients aged >65 years who are not married, unemployed, retired, disabled, were at high risk of readmission than women. The presence of comorbid and intake of more medication (polypharmacy) also showed to increase the risk of readmission. Patients who presented with hypoglycaemia and hyperglycaemia during admission and those who stayed longer in the hospital for more than 5 days showed to be at high risk. Formal education about diabetes (the condition, dietary, treatment, and self-care) showed to reduce the risk of readmission.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methods that the researcher used conducting the study. This includes the study design, how the study sample size was selected and calculated from the study population and the type of systems the researcher used when analysing the data collected. The significance of the study, ethical clearance and study limitation are also emphasised in this chapter.

3.2 Research method

The study used a quantitative approach. A quantitative study approach involves the use and analysis of numerical data using statistical techniques (Petzer, 2016).

3.3 The study design

The type of study design used is the retrospective cross sectional study design. A retrospective study uses existing data that have been recorded for reasons other than research (Hess, 2004). In this case the researcher perused the medical records of patients' data retrieving the information needed. A cross-sectional study is an observational study that measures simultaneously the exposure and health outcome in a given population and in a given geographical area at a certain time (Hemed, 2015).

3.4 The study setting

The study took place at Seshego district hospital which is located in Polokwane Municipality in Capricorn District, Limpopo Province, South Africa. Polokwane Municipality is divided into Polokwane west and Polokwane East and Seshego district hospital is found in Polokwane West. Seshego hospital is situated in a township and is surrounded by a mixture of rural areas, urban areas, and informal settlements.

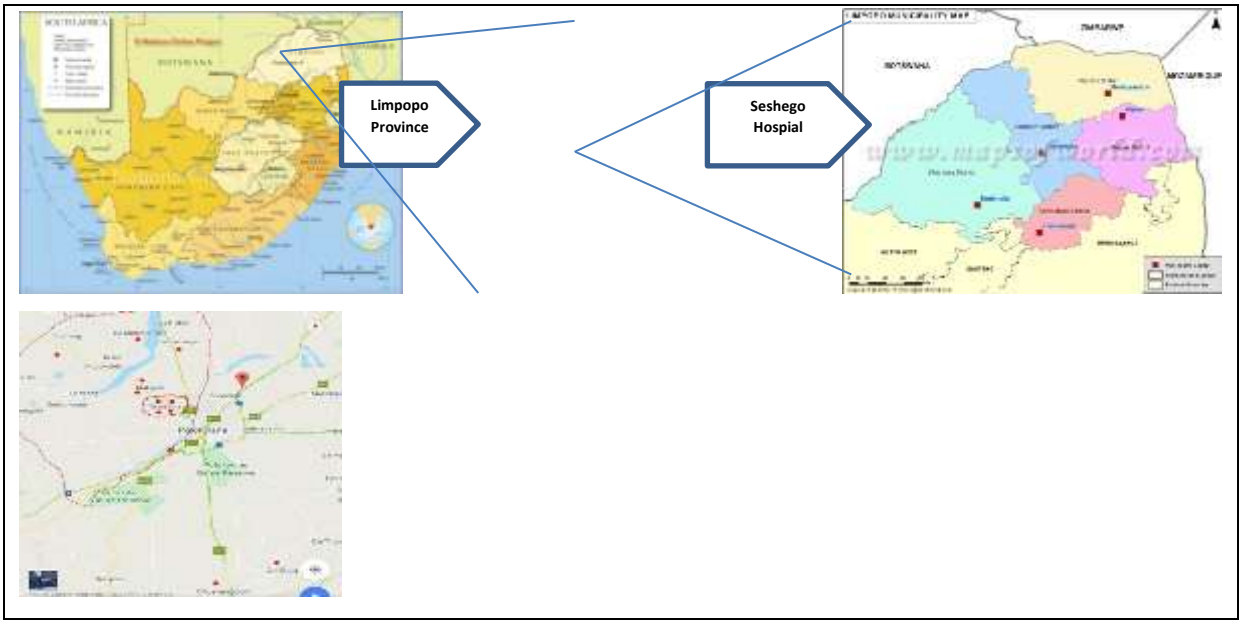


Figure 3.1 Maps of South Africa and the Limpopo Province showing the Seshego Hospital and surrounding areas of Polokwane Municipality located in the Capricorn District.

Seshego District hospital serves 11 clinics namely Maja, Chuene, Manamela, Moletji, Perkesbult, Moshubaba, Semenya, Gateway, Zone 2, Zone 3, and Zone 4. Buite clinic and Rethabile health center which are situated in Polokwane city refer their patients to Seshego Hospital. Seshego District hospital have 5 wards namely male medical, female medical, TB ward, postnatal ward, and paediatric ward. The setting was chosen because the researcher works in the area and observed several readmissions in the institution. Above is the map entailing the catchment areas that are served under Seshego District Hospital together with their clinics.

3.5 Study population

The population for this study was the records of diabetic patients admitted at Seshego District hospital from period January 2019 to December 2021. Population is defined as any collection of specified group of human beings or of non-human entities such as objects (Wani, 2017). The reason for using the period 2019-2021 was because it was the latest period and was going to be easier to find the information needed in the wards and patient records at admin.

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

The study included all records of diabetic patients who have been recorded at Seshego District hospital as admitted or readmitted from the period January 2019 to December 2021.

3.6.2 *Exclusion criteria*

All records of diabetic patients' recorded at Seshego District hospital from the period January 2019 to December 2021 with incomplete information were excluded.

3.7 Sampling strategy

In the current study, the researcher used secondary data, using patients clinical records at Seshego District hospital. The list was drawn from female, male, TB and paediatric ward register books. After listing all the names of patients, the researcher took it to reception (where the clinical records are kept) to retrieve the files of the patients to be used. Files were retrieved using file numbers. The researcher intended to use the simple randomised probability sampling method where the population was going to have the equal chance of being included in the sample. Due to small population size the researcher included all 183 file numbers of patients admitted.

3.8 Study sample size

Sample size estimation is a key issue in the design of most studies. In a study conducted to estimate the prevalence of a given condition in a geographic area, the objective is to sample a sufficient population to get an adequate number of subjects correctly classified as having the condition of interest or not, with given confidence about the amount to which this estimate might be affected by sampling error (Arya, Antonisamy & Kumar, 2012).

The sample size was calculated using the Taherdoost, 2017) formula below.

$$n = \frac{z2p\ (1-p)}{e2}$$

n is the required sample size

p is the percentage occurrence of a state or condition and in this study, the percentage of the patients with DM in South Africa is 12, 7%.

e is the percentage maximum error required which is 5%

Z is the value corresponding to the level of confidence required which is 1.96 (Taherdoost, 2017).

$$n = \frac{z2p\,(1-p)}{e2}$$

$$= \frac{1.96*0.127(1-0.127)}{(0.05)2}$$

$$= 170$$

Therefore, the sample size for this study is 170 for the period of 2019 to 2021. The principle that was used to select the records of diabetic patients readmitted at Seshego hospital was simple randomised sampling. All records of the diabetic patients readmitted were allocated numbers. The sampled record which did not meet the inclusion criteria were excluded and the next record was selected until the sample of 170 was reached.

3.9 Data collection

Data collection plays a significant role in obtaining accurate results for any study being carried out. Yielding accurate results is highly dependent on collecting the appropriate data from reliable sources (Harisekaran, 2015). After receiving the ethical clearance from the University of Limpopo and getting permission from the Department of Health in Limpopo, District office, and Seshego District Hospital, the researcher informed the Information department and nursing manager about the research to be conducted in order to inform their sections. Therefore, the researcher compiled lists of all diabetic patients whom were readmitted from ward register books.

In the current study, the researcher retrieved the 15-20 files daily of diabetic patients readmitted between January 2019 to December 2021 at Seshego District Hospital and all needed data was extracted. The data collection tool that was developed based on the literature from other studies was used by the researcher to collect data. The data collection tool was divided into 3 sections, been socio-demographics factors, medical related factors, and biomedical factor to collect

the following information: age, gender, marital status, educational level, employment status, employment status, bloods (white blood cell count and creatinine), other medical conditions, number of medication taken, and number of readmissions. A validated data collection tool was used. The questionnaires will consist of closed-ended questions. ***See Annexure A***

3.10 Data management and storage

The data collection tools are stored in a file in a locked cupboard in a secure place where the researcher is currently working and the names of the patients were not written on the tools.

3.11 Data analysis

The findings that was collected from the clinical records were captured using excel in Microsoft office. The data was cleaned before analysing the data and all questions were answered. The data was analysed using STATA and descriptive statistical analysis was undertaken to identify frequencies and percentages of answers to the research questions. For logistic regression, the independent variables were socio-demographic factors such as age, gender, marital status, race, and employment status. The dependent variable was the diagnosis of diabetes and its readmission into the hospital. The statistical significance of the relationships between the selected variables was determined using the t-test. The level of significance was set at 0.05 and 95% confidence interval will be used to judge statistical significance.

Descriptive statistics in the form of frequencies and percentages was to summarise the socio-demographic factors, patients' medical factors, and other determinants of readmissions of diabetic patients. The findings of this study was presented in table form and graphs.

3.12 Reliability and validity

Heale and Twycross, (2015) relates reliability to the consistency of a measure. A participant completing an instrument meant to measure motivation should have approximately the same responses each time the test is completed (Heale & Twycross, 2015). It means an observer repeating the same test, or someone else

using the same test should be able to obtain the results (Hunter, 2003). Reliability is concerned with repeatability. In this study, reliability was ensured by using the same questionnaire for all clients' information that was retrieved.

Validity means that the measurements should represent what it is intended to measure (Hunter, 2003). It explains how well the collected data covers the actual area of investigation. In this case, the data collection tool was reviewed by the researcher's supervisor to test content validity. Content validity is defined as the degree to which items in an instrument reflect the content universe to which the instrument will be generalised. It involves the evaluation of a new survey instrument to ensure that it includes all the items that are essential and eliminates undesirable items to a particular construct domain (Taherdoost, 2018).

3.13 Bias

Bias is defined as any trend or deviation from the truth in data collection, data analysis, interpretation, and publication that could cause false conclusions. Bias can occur either intentionally or unintentionally (Šimundić, 2013). The bias that can be encountered in this study is selection bias and the researcher used simple randomised sampling to minimise the bias when selecting study participants and only the participants who meet the inclusion criteria were used. To ensure that all questions are answered, the researcher went through on questionnaire twice to verify if all questions were answered.

3.14 Ethical consideration

Research ethics refers to a system of moral values that is concerned with the degree to which research procedures adhere to professional, legal, and sociological obligations to the study participants (Polit & Beck, 2004). Confidentiality was always maintained, as patient's real names were not used.

3.14.1 Ethical approval and permission to conduct the study

The proposal was presented at the Department of Public Health University of Limpopo for a review, then sent to the School of Healthcare Sciences and Faculty of Health Sciences for further review before it can be sent to the ethics committee at the University of Limpopo called Turfloop Research Ethics

Committee (TREC). Ethical clearance was granted by the Turfloop Research Ethics Committee (TREC), permission to conduct a study also granted by the Provincial and District Department of Health in Limpopo Province and from the Chief Executive Officer (CEO) of Hospital after submitting the approved proposal with ethical clearance certificate Seshego Hospital was informed as the study were going to be conducted at the hospital.

3.14.2 Informed consent

Informed consent is one of the principles of research ethics. It is a process where the participant is informed about the aspect of the research study so that they can make a conscious decision of whether they want to participate or not (Farr, 2008). In this study, since the researcher was using secondary data, informed consent was not applicable however, the data was accessed after permission was granted from the Department of Health, Capricorn district and Seshego hospital to use patient's files. ***See annexure B, C and D.***

3.14.3 Maintain anonymity and confidentiality

Confidentiality refers to separating or modifying any personal, identifying information provided by participants from the data and anonymity refers to collecting data without obtaining any personal, identifying information where the researcher cannot trace the participant's data (Allen, 2017). The confidentiality of the information obtained from the patient's file was maintained. The researcher ensured that all collected data is kept safe and secure, only the people involved in the study had access to the clinical records. Anonymity was ensured by not putting the real names and file numbers of the patients on the data collecting tools, numbers were used to identify the files.

3.14.4 Harm

In the current study, no harm was experienced as the researcher was using secondary data from the clinical records.

3.15 Conclusion

This chapter elaborate on the methodology used in the current study which is about the prevalence and determinants of readmission of diabetic patients at Seshego district Hospital. It presented information about the method used as well as the justification for using the method.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter describes the analysis of the data and the interpretation of the research findings, which were guided by the research question posed in the study. The data was analysed to determine the prevalence and determinants of diabetic patients' readmissions among diabetic patients admitted at Seshego District hospital, Capricorn District of the Limpopo province. The total number of population between January 2019 and December 2021 diagnosed with DM and admitted were 183, forty two files were missing. One hundred and forty one files were retrieved, out of 141 files, 11 files were excluded because they did not have the records and 42 files were not found at the reception were they are supposed to be filed and the total number of 130 records were reviewed.

4.2 Data management and analysis

After the data collection process was finalized, the completed database was securely stored. The information was captured on Microsoft Excel spreadsheet for cleaning and saved on the personal access controlled computer. Descriptive statistical analysis was undertaken using the STATA statistical software version 6A for Windows (STATA Corporation, College Station, Texas) in order to identify frequencies and percentages of answers to the research questions. The statistical significance of the relationships between the selected variables was determined using the t-test. The level of significance was set at 0.05.

4.3 Research results

The results of the current study are presented in sections which are detailed

below as demographics of study population, prevalence of diabetes readmissions and determinants of diabetes readmissions.

4.3.1 Demographics of study population

Figure 4.1 below presents the gender distribution of the study population which shows that majority of the population were males at 52.3% as compared to females at 47.7%.

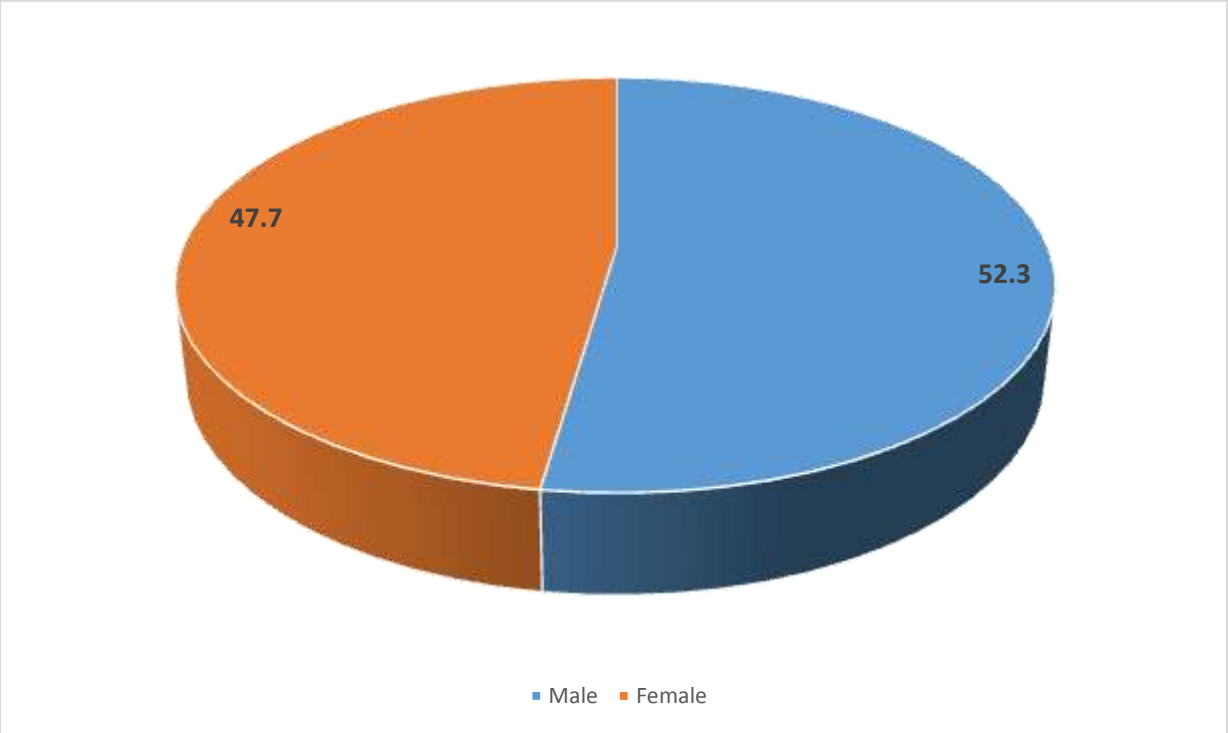


Figure 4.1: Gender distribution of the study population

The table 4.1. Below shows the demographics of diabetic patients readmission by age, marital status, education level and employment status stratified by gender. When looking at age and gender the majority of participants were 35 (51.5%) were males and 21(33.9%) were females in age group above 60 years , followed by those in age group between 50 to 59 years where 21(27.9%) were males and 19(21%) were females. The females between the age of 30 and 49 years, 18 -29 years and those < 18 years were more at 11(17.7%), 6(9.7%) and 11(17.7%) respectively while males of the same mentioned ages were at 10(14.7%),4(5.9%) and 0% respectively. With regard to marital status, 35(57.4 %) of females were single followed by married once at 16(26.2%). The female who are widowed were 8(13.1%)

and the divorced were lower at 1(1.6%). Considering males, 32(47.1%) of them were married, followed by 21(30.9%) single and 12(17.7%) who were widowed. The lowest is those who are divorced at 2.9%(2). With regard to employment status, 30(48.4%) females were unemployed, followed by 29(42.7%) males and 20(32.3%) female pensioners. Results of the current study demonstrate that there is a significant relationship between age and gender, marital status and gender and employment status and gender ($p<0.05$).

Table 4.1: Demographics of study population

	Males	Females	*P-value for trend*
	n (%)	n (%)	
Age in years			
<18	0 (0.0)	11 (17.7)	0.003
18-29	4 (5.9)	6 (9.7)	
30-49	10 (14.7)	11 (17.7)	
50-59	19 (27.9)	13 (21.0)	
>60	35 (51.5)	21 (33.9)	
Marital status			
Single	21 (30.9)	35 (57.4)	0.047
Married	32 (47.1)	16 (26.2)	
Divorced	2 (2.9)	1 (1.6)	
Widowed	12 (17.7)	8 (13.1)	
Educational level			
Primary or No education	12 (17.7)	10 (16.4)	0.625
Secondary	30 (44.1)	29 (47.5)	
Tertiary	4 (5.9)	3 (4.9)	
Not recorded	22 (32.4)	17 (27.9)	
Employment status			
Employed	21 (30.9)	9 (14.5)	0.007
Self employed	4 (5.9)	3 (4.8)	
Unemployed	14 (20.6)	30 (48.4)	
Pensioner/retired	29 (42.7)	20 (32.3)	

The table 4.2 below shows the medication characteristics of the population by gender. The patients taking 2-5 medications and more than 5 medications were both at high risk of readmission at 40.8% and those taking < 2 medication were at 18.5%. Considering gender, male patients taking more than 5 were more at 50%, followed by women at 30.7%. Those who are taking <2 were the same as women taking more than 5 medication at 30.7%. The males and females taking 2-5 medication were lower at 4.4% and 1.6% respectively. With regard to the type of medication, those who are taking oral medication only were more at 56.9 % were male were high at

67.7 % and female at 45.2 %. The females taking injections were more at 30% and male were less at 11.8%. For those taking both oral and injections, females were high at 24.2% than males at 20.6%. The results of the study demonstrate that there is a significant relationship between number of medication and gender and type of medication and gender ($p<0.05$).

Table 4.2: Medication characteristics of study population

	Male	Female	Both gender	***P-value for trend***
Category	**n (%)**	**n (%)**		
Number of medication				
<2	5 (7.4)	19 (30.7)	24 (18.5)	0.002
2-5 medication	29 (4.4)	24 (1.6)	53 (40.8)	
More than 5 medication	34 (50.0)	19 (30.7)	53 (40.8)	
Type of medication				
Injectables	8 (11.8)	19 (30.7)	27 (20.8)	0.013
Oral	46 (67.7)	28 (45.2)	74 (56.9)	
Both	14 (20.6)	15 (24.2)	29 (22.3)	

Table 4.3 below shows the results of patients having other conditions other than diabetes mellitus. In the current study, majority of the patients had diabetes mellitus only at 34.6%, followed by those having hypertension at 28.5%, more than 1 condition at 22.8%, HIV/TB at 11.5% and the lowest were those with other diseases and renal diseases and anaemia.

Table 4.3 Condition related of the study population

	Male	Female	Both gender	***P-value for trend***
Category	**n (%)**	**n (%)**		
Conditions				
DM	17 (25)	28 (45.2)	45 (34.6)	0.118
HPT and CCF	22 (32.4)	15 (24.2)	37 (28.5)	
HIV/TB	10 (14.7)	5 (8.1)	15 (11.5)	
Renal diseases and anaemia	3 (4.4)	0 (0.0)	3 (2.3)	
Other diseases	2 (2.9)	1 (1.6)	3 (2.3)	
More than 1	14 (20.6)	13 (21.0)	27 (22.8)	

Table 4.4 below shows the biomedical characteristics of the study population. Majority of patients were admitted with high glucose were 81(62.3%) were on diabetic state followed by 45 (34.6%) of the patients with normal glucose. A similar trend was noted when considering gender distribution as majority of patients were admitted with high glucose indicating diabetic state in both females and males at 42(67.7%) and 39(57.4%) respectively. Considering participant's blood glucose before discharge, 76 (58,5%) of the patients were on pre-diabetic state followed by 40(30.8%) of those who were on diabetic state. With regards to the white blood cells counts, 61(46.9%) had normal white blood cell, followed by those with high white blood cell counts at 55(42.3%). The participants with high creatinine were 56 (43.1%), followed by 36(27.7%) of normal.

Table 4.4: Biomedical characteristics of study population

	Male	Female	Both gender	***P-value for trend***
Category	**n (%)**	**n (%)**		

HGT on admission					
	Normal	26 (38.2)	19 (30.7)	45 (34.6)	0.382
	Pre – Diabetic	3 (4.4)	1 (1.6)	4 (3.1)	
	Diabetic	39 (57.4)	42 (67.7)	81 (62.3)	
HGT before discharge					
	Normal	9 (13.2)	5 (8.1)	14 (10.8)	0.418
	Pre – Diabetic	41 (60.3)	56 (56.5)	76 (58.5)	
	Diabetic	18 (26.5)	22 (35.5)	40 (30.8)	
WBC count					
	Low	0 (0.0)	1 (1.6)	1 (0.8)	0.654
	High	27 (39.7)	28 (45.2)	55 (42.3)	
	Normal	34 (50.0)	27 (43.6)	61 (46.9)	
	Not recorded	7 (10.3)	6 (9.7)	13 (10.0)	
Creatinine					
	Low	13 (19.1)	13 (21.0)	26 (20.0)	0.952
	High	30 (44.1)	26 (41.9)	56 (43.1)	
	Normal	18 (26.5)	18 (29.0)	36 (27.7)	
	Not recorded	7 (10.3)	5 (8.1)	12 (9.2)	

4.3.2 Prevalence of diabetic patients' readmissions

The prevalence of diabetic readmissions at Seshego hospital between period 2019 and 2021 was slightly high (53.1%) as compared to those who were not readmitted presented in Figure 4.2 below.

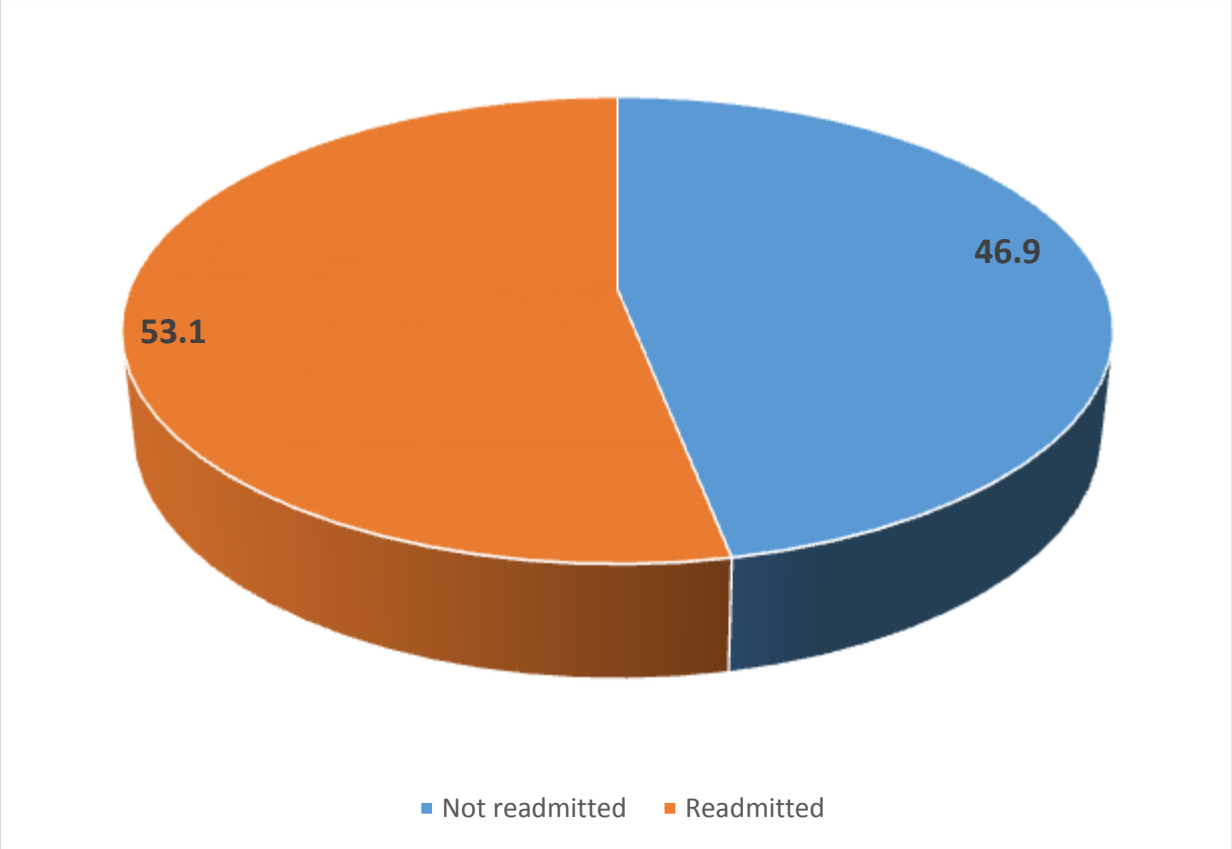
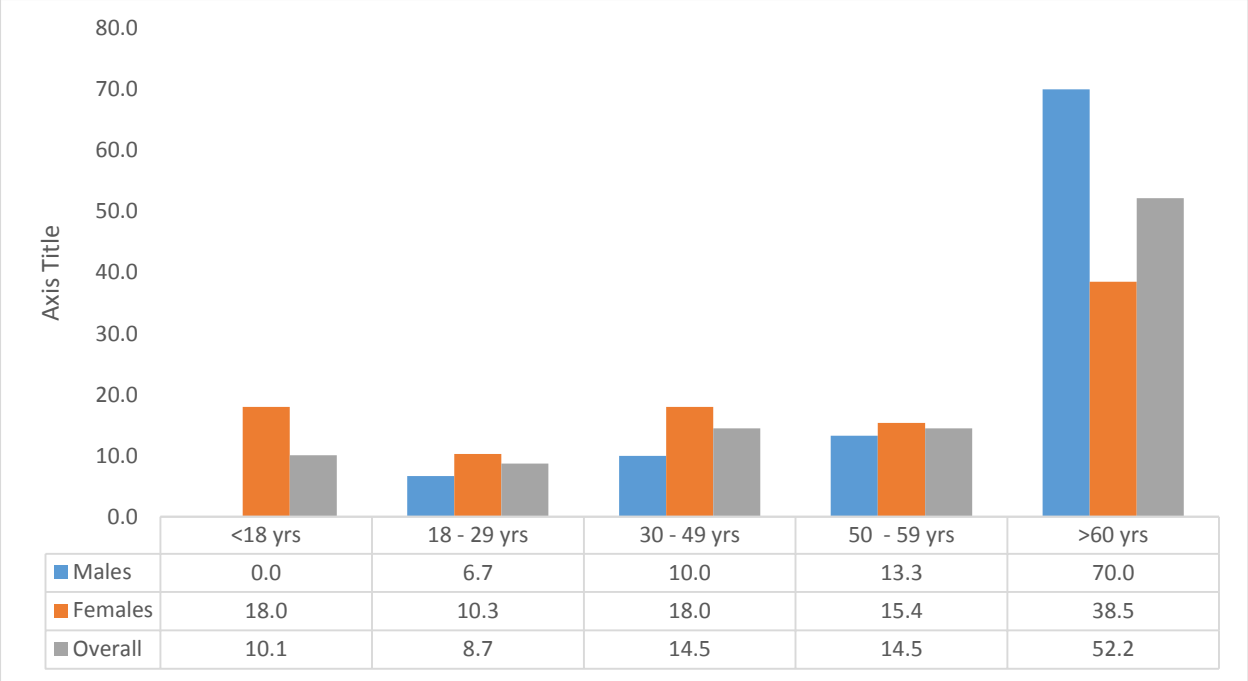


Figure 4.2: Overall prevalence of diabetic patients' readmissions

Figure 4.3 below presents the prevalence of diabetic patients readmitted stratified by their ages and gender. It shows that the prevalence of readmission of diabetes increased with increasing age both in males and females patients. The prevalence increased from 6.7% in age group between 18 and 29 years followed by 10%, 13.3% and 70% in males aged 30 – 49 years, 50 – 59 years and above 60 years respectively. A similar trend was noted in females with prevalence of 18% in age below 18 years followed 10.3%, 18%, 15.4% and 38.5% respectively as presented in Figure 4.3 below.



	<18 yrs	18 - 29 yrs	30 - 49 yrs	50 - 59 yrs	>60 yrs
Males	0.0	6.7	10.0	13.3	70.0
Females	18.0	10.3	18.0	15.4	38.5
Overall	10.1	8.7	14.5	14.5	52.2

Figure 4.3: Prevalence of diabetic patients' readmissions stratified by age groups and gender

Figure 4.4 shows the frequency of readmission of diabetic patients. Patients who were readmitted twice were high at 16.2% followed by those who were readmitted more than three times at 13.9%, followed by13.1% of those who were readmitted once. Those whom were readmitted three times lower at 10%.

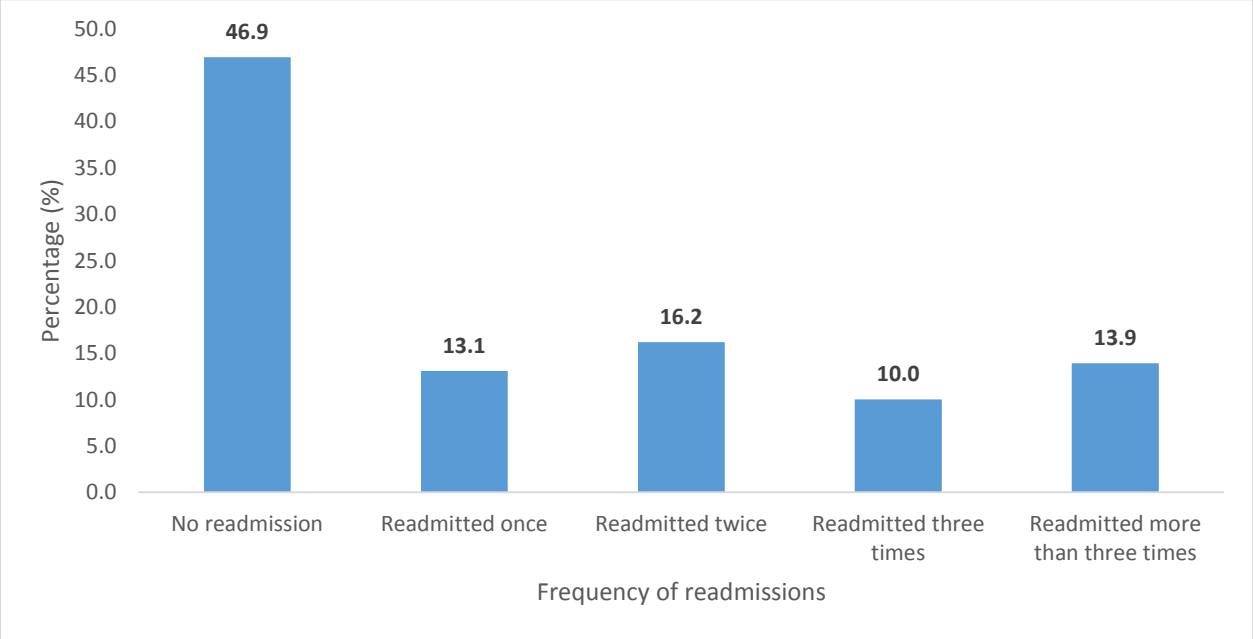


Figure 4.4 frequency of readmission

4.3.3 Determinants of diabetes readmissions

Table 4.5 bellow shows the univariate logistic regression were the association of socio-demographic and medication of diabetic patients readmission reveals that there was significant association employment status, number of medication and the type of medication taken. The self-employed patients were 5.3 times more likely to be readmitted, patients who were unemployed were 5.8 times more likely to be readmitted and the pensioners were 8.25 times more likely to be readmitted as compared to those who were. The association of the number of medication and readmission revealed that the patients taking 2-5 medications are 2 times more likely to be readmitted and those taking more than 5 medications are 2.9 times more likely to be readmitted as compared to those taking <2 medication. The patients who were using both oral and injections treatment were 1.2 times more likely to be readmitted as compared to those taking oral medication and injections, and there was no significant relationship with the patients taking both oral and injections.

There was no statistically significant relationship between age, marital status, level of education and availability of other conditions other than diabetes mellitus with readmission. However, those who are 60 years and above are not significantly associated with readmitted while those between the age of 18 – 29 years who were 0.9 less likely to be readmitted as compared to those >18 years. The widowed were 2.4 times more likely to be readmitted and those who were single were 1.3 times likely to be readmitted. With regard to educational level, the ones with secondary level were 2.6 times more likely and those with primary were 1.7 times more likely to be readmitted. The diabetic patients who have HPT/CCF were 1.4 times more likely to be readmitted followed by those who have more than 1 condition and those who have renal disease and anaemia who are 1.9 timely more likely to be readmitted as compared to those who are having diabetes mellitus only.

Table 4.5 Socio-demographic determinants of diabetic patient's readmissions

	Univariate Logistic Regression	
Age group in years	OR(95%CI)	p-value
≤ 18	Ref	
18 – 29	0.9 (0.2 – 5.0)	0.864
30 – 49	0.5 (0.1 – 2.3)	0.391
50 – 59	0.3 (0.1 – 1.1)	0.066
≥ 60	1.0 (0.3 – 3.9)	0.967
Marital status		
Married	Ref	
Single	1.3 (0.5 – 3.4)	0.616
Divorced	0.6 (0.1 – 7.6)	0.726
Widowed	2.4 (0.8 – 7.0)	0.115
Level of education		
Tertiary	Ref	
Primary	1.7 (0.3 – 11.0)	0.56
Secondary	2.6 (0.5 – 14.4)	0.278
Employment status		
Employed	Ref	
Self employed	5.3 (0.9 – 30.5)	0.060
Unemployed	5.8 (2.0 – 17.0)	0.001
Pensioners	8.25 (2.8 – 24.2)	0.000
Number of medications		
<2	Ref	
2 – 5	2.0 (1.4 – 3.0)	<0.001
More than 5	2.9 (2.1 – 4.3)	<0.001
Type of medication		
Oral	Ref	
Injectables	0.3 (0.1 – 0.9)	0.3
Both	1.2 (0.4 – 3.2)	0.76

The patients whose glucose level on admission and before admission were on pre-diabetic and diabetic state were 0.6 times less likely to be readmitted as compared to those with normal glucose. The patients with high white blood cells were 0.5 less likely to be readmitted compared to the ones with normal white blood cells counts. With regard to the creatinine, the patients with high creatinine were 1.9 times more likely and those with low creatinine were 1.5 times more likely to be readmitted compared to those with normal creatinine.

Table 4.6 Biomedical determinants of diabetic patient's readmissions

	Univariate Logistic Regression	
Age group in years	OR (95%CI)	p-value
Conditions other than DM		
DM	Ref	
HPT and CCF	0.2 (0.02 – 2.1)	0.190
HIV/TB	1.3 (0.5 – 3.2)	0.539
Renal diseases and anaemia	0.3 (0.1 – 1.1)	0.064
Mental health	1.8 (0.1 – 20.7)	0.653
More than 1	1.9 (0.7 – 5.2)	0.199
HGT on admission	OR (95%CI)	p-value
Normal	Ref	
Pre diabetic	0.6 (0.8 – 4.7)	0.633
Diabetic	0.6 (0.3 – 1.2)	0.131
HGT before discharge	OR (95%CI)	p-value
Normal	Ref	
Pre diabetic	0.6 (0.2 – 1.9)	0.375
Diabetic	0.6 (0.2 – 2.2)	0.447
WBC count	OR (95%CI)	p-value
Normal	Ref	
Low	-	
High	1.3 (0.6 – 2.8)	0.399
Creatinine counts	OR (95%CI)	p-value
Normal	Ref	
Low	0.5 (0.2 – 1.5)	0.215

High	0.8 (0.3 – 1.8)	0.539

4.4. Conclusion

In this chapter, the results of the study were interpreted. The next chapter discusses these findings and compares the findings of this study to the relevant literature.

CHAPTER 5: DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter the results of this study are discussed and compared to the relevant literature to address the study objectives which are:

- To determine the prevalence of diabetic patients' readmissions among diabetic patients admitted at Seshego District hospital, Capricorn District.
- To investigate the determinants of diabetic patients' readmissions at Seshego District hospital, Capricorn District.

5.2 Prevalence of diabetic patients readmission

According to the findings of the current study the prevalence of diabetic patients readmission was high which is similar to the study done in Eastern Ethopia by Regassa &Tola, (2021). Comparing it with other studies such as the study done in the US by Ostling et al. (2017), USA (New York) by (Sonmez et al. 2017), US at by Mccoy et al. (2017) the current study was more high. There is an inconsistency with the findings though in all the studies the prevalence were high. The difference may be due to the fact that the current study was only based in one district hospital while other were done in a tertiary hospitals though the difference raise a concern for Seshego hospital to consider looking at the contributing factors leading to high prevalence of diabetic readmission.

Gender has been associated with readmission of DM patients as male patients were likely to be readmitted than females (Ostling *et al.*, 2017) (Karunakaran, *et al.,* 2018). The findings of the current study revealed that high number of diabetic patients readmitted were males, which concurs with the study conducted by Ostling et al., (2017), Sonmez et al. (2018) and Enomoto *et al.*, (2017).

In the current study, it was revealed increased number of patients 60 years and above were readmitted which is similar to the studies conducted in New England, Pennsylvania hospitals, and New Mexico (Enomoto *et al.,* (2017) , and (King,et al., 2018). The finding of this study also revealed that unmarried (single) patients had a higher risk of hospital readmission which concurs with the findings done by

Heaton *et al.*, (2016). With regard to employment status, this study revealed that majority of pensioners and unemployed patients were readmitted which concurs with the study done by Karunakaran, et al., (2018). With regard to the level of education, this study revealed that majority of patients have secondary/high school level, which is in agreement with the study by Karunakaran, *et al.,* (2018).

In the current study, it was revealed that diabetic patients readmission taking oral medication are high as compared to those taking injection and those taking both oral and injection medication. This is in contrast with the study conducted in USA by Mccoy *et al.*, (2017) were they found that patients using insulin were more likely to be readmitted. The patients taking 2-5 and more than 5 medications were both significantly high which is in agreement with the study done in Denmark (Rosted, Schultz and Sanders, 2016). Majority of the patients readmitted in the current study had diabetes mellitus only and this concurs with the study done in New York (Sonmez *et al.*, 2017).

The current study revealed that on admission, high number of patients were on diabetic state on admission and before discharge. The findings of the current study concurs with the one done by Karunakaran, et al., (2018). It also revealed that the majority of the patients in this study had normal white blood cell which is in agreement with the study done by Karunakaran, *et al.,* (2018) where in majority cases were normal.

5.3 Determinants of diabetic patients' readmission.

There are several factors which contributes to readmission of diabetic patients, such as age, marital status, employment status, number and type of medication used, and comorbidities.

5.3.1 Age of the patient

The current study revealed that there is no relationship between age and readmission of diabetic patients and also statistically there was no significant relationship, the findings of the study concurs with the study conducted by Enomoto et al., (2017).

5.3.2 Marital status

The findings of the current study found that there is a relationship between the patients who are unmarried (single) and widowed and readmission of diabetic patients, although the relationship was not significantly significant. This concurs with the study done in United States by Heaton *et al.*, (2016) were they found that unmarried people were 1.44 times more likely to be readmitted.

5.3.3 Employment status

The results of the current study also revealed that employment status is significantly associated with readmission of diabetic patients were pensioners were high followed by the unemployed to be readmitted (p =0.000 and 0.001 respectively). This concurs with the study done in New England by (Karunakaran, *et al.*, 2018).

5.3.4 Level of education

The results of this study found that patients with basic education are more likely to be readmitted, although the association is not statistically significant. Association of level of education and readmission was not reported from the studies found.

5.3.5 Number and type of medication

The current study found that the number of medication has an association with readmission of diabetic patient where those taking more than 5 medication were more likely to be readmitted p = 0.001. This is in agreement with the study done in Denmark by Rosted, Schultz and Sanders, (2016) were they found that the use of polypharmacy is significantly associated with readmission. It was also revealed that the use of insulin injections has no association with readmission of diabetic patients (p=0.3). This is in contrast with the study conducted by Karunakaran, et al., (2018) were they found that using insulin injection association had 14% greater odds of readmission.

5.3.6 Comorbidities

The results of the current study found that diabetic patients with more than one condition and renal diseases were associated more likely to be

readmitted, though it is not statistically significant (p= 0.199 and 0.607 respectively). In agreement with the current study, Enomoto et al., (2017) , and King,et al., (2018) also found renal disease to be associated with readmission with odd ration 1.4 and 1,39 respectively.

5.3.7 Biomedical factors

In the current study, the results revealed that there is no association between glucose levels on admission and glucose levels before discharge and readmission of diabetic patients and they were also not significant statistically. This is in agreement with the study done in Ethiopia where it was not proven whether admission of high glucose was associated with readmission (Regassa and Tola, (2021). In contrast with the current study, Karunakaran, et al., (2018) reported that the patients with glucose level >16.6 mmol/l which is diabetic state before discharge were associated with 1.2 greater odd of readmission. The current findings also found that high white blood cells count were associated with readmission, although this is not statistically significant (p=0.399). The result of the white blood cells in the current study concurs with the study done by Karunakaran, et al, (2018) where they found that the white blood cells count are 1.27 more likely to cause readmission.

5.4 Limitations of the study

The current study had several limitation. Three register books from the wards were missing making it difficult to have enough population, the researcher was unable to get all the files required since they were not found at the reception. Some important information were missing/ not recorded which were necessary for determining the factors contributing to readmission of diabetic patients. The study was done in district hospital of which it caters small number of patients. The type of the study used in the current study was also a limitation since the necessary information to determine the factors contributing to readmission was not enough as the current study used secondary data.

5.5 Conclusion

The prevalence of diabetic patients' readmission is high in the current study. Patients who are 60 years and above are at high risk of readmission especially males. Employment status, number of medication and the type of medication are significantly associated with readmission and the patients with high white blood cells count, comorbidities, basic education and marital status, type of were more likely to be readmitted, although they were not statistically significant. Factors contributing to readmission in the current study may be addressed to reduce the rate of rates of readmission.

5.6 Recommendations

The current study revealed that there is a need for a primary data to further investigate the causes of readmission in diabetic patients for effective intervention in order to reduce the rates.

In the current study, it was revealed that diabetic patients readmission taking oral medication are high as compared to those taking injection and those taking both oral and injection medication. And the patients taking both oral and injections are likely to be readmitted, though there is no association. It is recommended that Seshego hospital should develop a diabetic clinic where patients can be monitored and educated on the use of medication, adherence and other factors that can lead to intake of more medication.

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Annexure A: Data Collection Tool

SOCIODEMOGRAPHIC FACTORS			**X**	**Researcher's block**	
1	Patient gender?	Male		0	
		Female		1	
2	Patient age?	<18		0	
		18-29		1	
		30-49		2	
		49-59		3	
		≥ 60		4	
3	Patient marital status?	Single		0	
		Married		1	
		Divorced		2	
		Widow		3	
4	Education level	Primary		0	
		Secondary		1	
		Tertiary		2	
		Not recorded		3	
5	Patient employment status?	Employed		0	
		Self-employed		1	
		Unemployed		2	
		Pensioner/retired		3	
	MEDICAL FACTOR				
6	Does the patient have other conditions except for DM	Yes		0	If no go to No. 8
		No		1	
7	Which other conditions does the patient have	HPT/CCF/stroke		0	
		HIV/TB		1	
		Renal disease/anaemia		2	

		Other diseases		3	
		More than 1 condition		4	
8	How many medications does the patient take?	< 2		0	
		2-5 medications		1	
		More than 5		2	
9	What type of medication does the patient take for DM?	Injectable		0	
		Oral medication		1	
		Both		2	
10	Was this the first admission?	Yes		1	
		No		0	
11	How many times was the patient readmitted	Once		0	
		Twice		1	
		Three times		2	
		More than 3 times		3	
	LABORATORY/ BLOOD RESULTS				
12	How was the glucose level on the first admission?	Normal		0	
		Pre diabetic		1	
		Diabetic		2	
13	What was the average glucose the day before discharge?	Normal		0	
		Pre diabetic		1	
		Diabetic		2	
14	What was the white blood cells of the patient?	Normal		0	
		Low		1	
		High		2	
		Not recorded		3	
15	What was the creatinine level of the patient?	Normal		1	
		Low		2	
		High		3	
		Not taken		4	

Annexure B: Ethics clearance letter

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 22 August 2022

PROJECT NUMBER: TREC/376/2022: PG

PROJECT:

Title:	Prevalence and determinants of diabetic patients readmissions at Seshego district hospital, Capricorn district, Limpopo Province, South Africa.
Researcher:	RC Maremane
Supervisor:	Dr. E Maimela
Co-Supervisor/s:	Mr DG Mashala
School:	Health Care Sciences
Degree:	Master of Public Health

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

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Annexure C: Approval letter from Provincial Department of Health

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
HEALTH

DEPARTMENT OF HEALTH
CAPRICORN DISTRICT
RECEIVED
17 NOV 2022
DISTRICT EXECUTIVE MANAGER
PRIVATE BAG X9530 POLOKWANE 0700

Ref : LP_2022-10-002
Enquires : Ms PF Mahlokwane
Tel : 015-293 6028
Email : Phoebe.Mahlokwane@dhsd.limpopo.gov.za

MAREMANE RAMOKONE CILVIA

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

PREVALENCE AND DETERMINANTS OF DIABETIC PATIENTS READMISSIONS AT SESHEGO DISTRICT HOSPITAL, CAPRICORN DISTRICT, LIMPOPO PROVINCE, SOUTH AFRICA

1. Permission to conduct research study as per your research proposal is hereby Granted.
2. Kindly note the following:
   a. Present this letter of permission to the Office District Executive Manager a week before the study is conducted.
   b. This permission is **ONLY** for **Seshego Hospital**
   c. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
   d. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   e. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   f. **The approval is only valid for a 1-year period.**
   g. If the proposal has been amended, a new approval should be sought from the Department of Health
   h. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated

pp **Head of Department** 16/11/2022 **Date**

Private Bag X9302, Polokwane
Fidel Castro Ruz House, 18 College Street, Polokwane 0700. Tel: 015-293 6000/12. Fax: 015 293 6211.
Website: http\www.limpopo.gov.za

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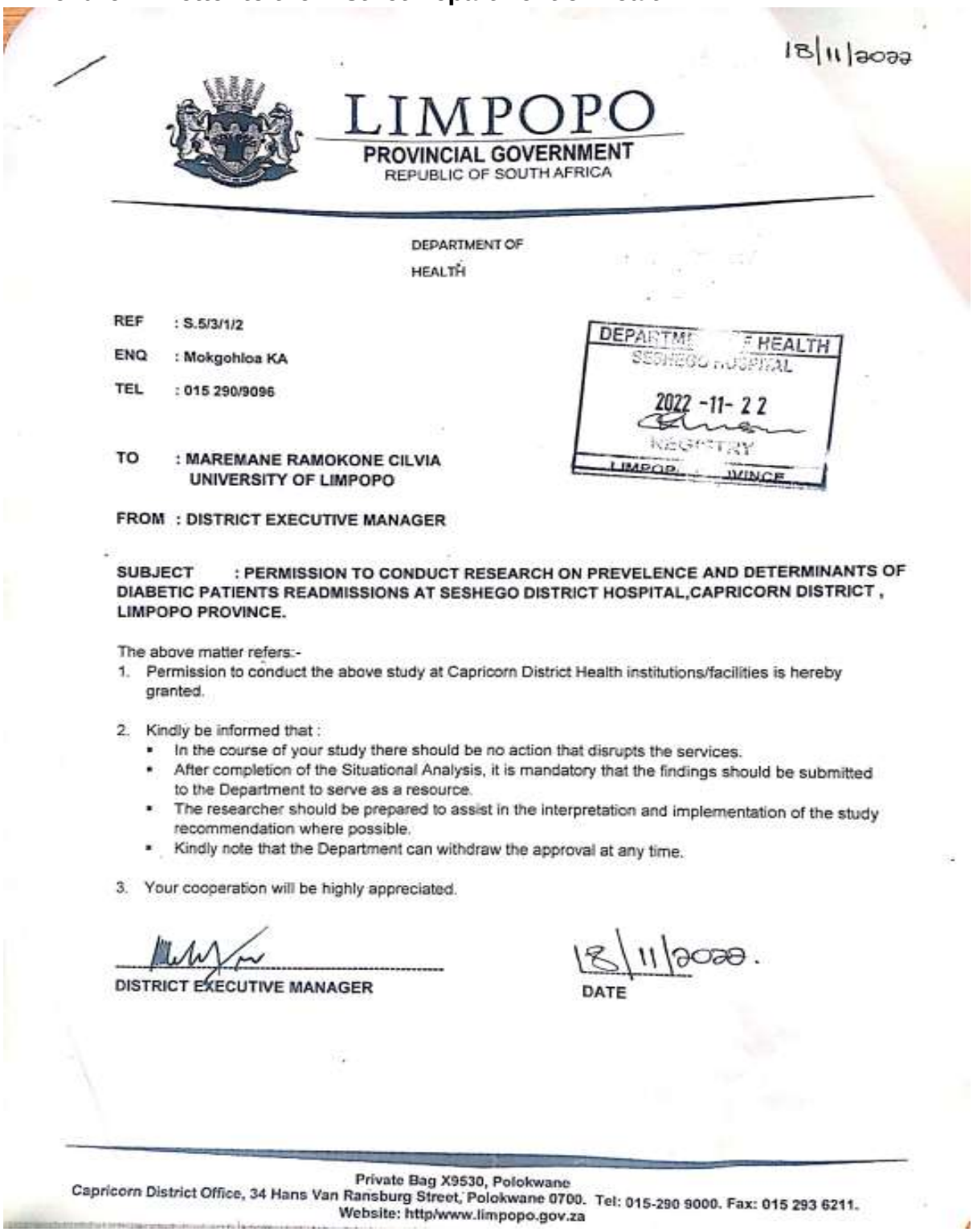
Annexure D: Letter to the District Department of Health



18/11/2022

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
HEALTH

REF : S.5/3/1/2
ENQ : Mokgohloa KA
TEL : 015 290/9096

DEPARTME F HEALTH
SESHEGO HOSPITAL
2022 -11- 22
REGISTRY
LIMPOP WINCE

TO : MAREMANE RAMOKONE CILVIA
UNIVERSITY OF LIMPOPO

FROM : DISTRICT EXECUTIVE MANAGER

SUBJECT : PERMISSION TO CONDUCT RESEARCH ON PREVELENCE AND DETERMINANTS OF DIABETIC PATIENTS READMISSIONS AT SESHEGO DISTRICT HOSPITAL,CAPRICORN DISTRICT , LIMPOPO PROVINCE.

The above matter refers:-

1. Permission to conduct the above study at Capricorn District Health institutions/facilities is hereby granted.

2. Kindly be informed that :
   - In the course of your study there should be no action that disrupts the services.
   - After completion of the Situational Analysis, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - Kindly note that the Department can withdraw the approval at any time.

3. Your cooperation will be highly appreciated.

DISTRICT EXECUTIVE MANAGER

18/11/2022.
DATE

Private Bag X9530, Polokwane
Capricorn District Office, 34 Hans Van Ransburg Street, Polokwane 0700. Tel: 015-290 9000. Fax: 015 293 6211.
Website: http/www.limpopo.gov.za

Annexure E: Language Editor certificate

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Date: 13 December 2022

To Whom it May Concern

I hereby confirm that I have proof-read the document entitled: "Prevalence and determinants of diabetic patients readmissions at Seshego district hospital, Capricorn District, Limpopo Province, South Africa" authored by Maremane RC with student number 200723166. The document has been edited and proofread for grammar, spelling, punctuation, overall style and logical flow. Considering the suggested changes that the author may or may not accept, at his discretion, each of us has our own unique voice as far as both spoken and written language is concerned. In my role as proof-reader I try not to let my own "written voice" overshadow the voice of the author, while at the same time attempting to ensure a readable document.

Please refer any queries to me.

Rapetsoa DB