

**KNOWLEDGE, ATTITUDE, AND
PRACTICES ON DIABETIC FOOT CARE
AMONG NURSING STAFF AT PRIMARY
HEALTH CARE FACILITIES IN SOL
PLAATJE SUB-DISTRICT, KIMBERLEY**

LABALA GUY JUSTE MAFUSI

2020

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CARE FACILITIES IN SOL PLAATJE SUB-DISTRICT, KIMBERLEY**

by

LABALA GUY JUSTE MAFUSI

Mini-dissertation submitted in partial fulfilment of
the requirements for the degree

MASTER OF MEDICINE IN FAMILY MEDICINE

at the

Department of Family Medicine

School of Clinical Medicine

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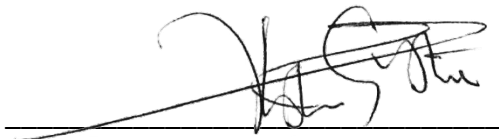
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Study Leader: Prof WJ Steinberg

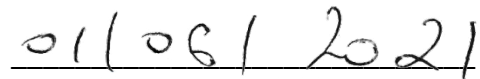
Co-study leader: Dr MC Harmse

DECLARATION

I, Labala Guy-juste Mafusi, hereby declare that the submitted extensive mini-dissertation and the content thereof is the result of my independent work, and has not been submitted before to any institution by myself or any other person in fulfilment of the requirements for the attainment of any qualification. I also declare that this work is submitted for the first time to the University of the Free State, towards a Master of Medicine degree, specializing in Family Medicine.



Labala Guy-juste Mafusi



Date

DEDICATION

I want to thank and glorify God Almighty, the maker of heaven and hearth, for keeping his promises to me and offering me the necessary endurance, strength, and wisdom to complete this project. Without his assistance, obtaining this degree would not have been possible.

*“It is better to take refuge in the Lord
than to trust in humans.*

*It is better to take refuge in the Lord
than to trust in princes.”*

Psalm 118, 8–9

I want to dedicate this research project to:

- my beloved wife Laurianne Mumpoto and children: Erwin, Eden, and Sacre-Anael;
- evangelist Tyffany Mokwa and all my brothers and sisters in Christ; and
- my family and friends.

Your encouragement and support throughout this extensive endeavour are highly appreciated. Your understanding and love have meant to me what words cannot express.

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- Mr FC Van Rooyen from the Department of Biostatistics, University of the Free State, for assistance with the data analysis.
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LIST OF ABBREVIATIONS

AKA	–	Above Knee Amputation
BKA	–	Below Knee Amputation
DFD	–	Diabetic Foot Disease
DFU	–	Diabetic Foot Ulcer
DM	–	Diabetes Mellitus
HCWs	–	Health Care Workers
IDF	–	International Diabetic Foot
IWGDF	–	International working group on Diabetic Foot
KAP	–	Knowledge, Attitude and Practice
LEA	–	Lower Extremity Amputation
LOPs	–	Loss of Protective Sensation
NHS	–	National Health Security
PADs	–	Peripheral Arterial Diseases
RMSH	–	Robert Mangaliso Sobukwe Hospital
SEMDSA	–	Society for Endocrinology, Metabolism, and Diabetes of South Africa

DEFINITION OF TERMS

Nursing staff:

A person trained in the scientific basis of nursing, meeting specific prescribed standards of education and clinical competencies to provide services that are essential to or helpful in the promotion, maintenance, and restoration of health and well-being.

Care:

The provision of what is necessary for the health, welfare, maintenance, and protection of someone or something.

Diabetic Foot:

Infection, ulceration, or destruction of deep tissues associated with neurological abnormalities and various degrees of peripheral vascular diseases in the lower limb.

Diabetic foot care:

Theoretical: Daily inspection, cleaning, and thorough drying of the feet of a person with diabetes to prevent complications.¹⁰⁸

Operational: Performing screening examination on the feet of patients with diabetes that includes assessing the skin, nails, temperature, colour, pulses, range of motion, and sensation using a monofilament test.¹⁰⁸

ABSTRACT

Background:

As essential team members of the healthcare system, nurses have more contact with the patients and are indispensable in patients' education. They can ameliorate diabetic patients' quality of life by aiding in preparing and implementing educational programs that assist patients in growing self-care behaviours associated with diabetic foot care. Furthermore, they can stop or prevent diabetic foot problems by pointing out risk groups in the community.

To reduce Diabetic Foot Disease's load sensibly, improve patient education and preventive and screening programmes on Diabetic Foot Care, healthcare providers need to be knowledgeably possessing the right attitude, which is crucial in offering any meaningful advice to their clients. Positive attitudes, combined with sound knowledge, prevent compromising health care standards.

However, for nurses to efficiently offer education, they need organised training programs combining theory and practice. Nurses involved in the management of diabetes-related foot problems must be encouraged to take part in these programs.

Objectives:

To assess the knowledge, attitude, and practice of nursing staff regarding diabetic foot care in Sol Plaatje primary healthcare centres in the Northern Cape.

Methodology:

The researcher used a descriptive cross-sectional study with a self-administered questionnaire to assess the knowledge, practice, and nursing staff attitude on diabetic foot care. A total number of one hundred and twenty-eight nurses providing primary care to patients within the Sol-Plaatje sub-district were targeted to participate in the study from three groups: professional nurses, enrolled nurses, and auxiliary nurses.

Results:

Responses were received from 105 participants constituting 82% of the targeted population. Of the participants, 88% were professional nurses, and the majority, 95%, were female; the median age was 48 years and the median year of practice was 15 years.

The results showed that 58% of this sample had a good knowledge of South African Diabetic foot guidelines even though compliance level was low, highlighting a lack of training on diabetic foot care with 86% needing diabetic foot care training whilst 94% knew the importance of foot assessment on diabetic patients. The majority, 59%, did not know the importance of diabetic foot prevention and 57% did not know of the 60-Second Screening Tool for high-risk diabetic foot, and 70% did not know about the 10g monofilament tool used for foot neurology check. 98% expressed that diabetic foot education is an essential part of their job, yet only 46% indicated that they record foot examination, whilst 82% do not do a 60-Second comprehensive assessment. The majority, 91% of Nurses displayed a positive attitude towards caring for diabetic foot patients despite 59% of poor screening attitude.

Also, the knowledge of specialist referrals was insufficient among nurses.

Conclusions:

This study revealed that most frontline healthcare providers (nurses) in Sol Plaatje Sub-District are aware of the diabetic foot guideline for primary care in contrast to the majority not being aware of the 60-Second Screening Tool for high-risk diabetic foot and the 10g monofilament tool. It was also noted that respondents agree that diabetic foot education is an essential part of their jobs. Nurses do not regularly record patient diabetic foot examination findings. They also requested training in diabetic foot care. Poor screening attitude may be attributed to inadequate training and suboptimal update of knowledge.

Recommendations:

My recommendation is to promote the 60-Second Screening Tool for high-risk diabetic care and avail tool for foot neurology check whilst also improving training and development among healthcare providers (nurses) to equip them with the right knowledge on diabetic foot care and improve their attitude on diabetic foot prevention, which will increase their compliance to guidelines.

There is also a need to make available material on diabetic foot care whilst also improving referral systems to avoid delay in specialist care and amputation complication.

CHAPTER 1: INTRODUCTION

1.1 Background

Diabetic Foot Disease (DFD) is a general term that refers to a range of diseases that can affect the foot of diabetic patients and constitutes one of the most dangerous complications of diabetes mellitus. It can be defined mainly as the destruction of deep tissues with peripheral neuropathy and peripheral vascular disease resulting in ulceration and infection in the lower limb.¹⁻⁴ It affects approximately 6% of people with diabetes.^{5,6} Among diabetic foot patients, about 1.5% require amputation⁷, with the majority starting as ulcers, which with good screening assessing the risk of complication and meticulous foot care can be delayed or stopped.⁸

Diabetic Foot Syndrome is a considerable problem for the healthcare system. It poses a huge burden with consequences on the economy of people suffering from the disease, their families, clinicians, and society affecting social participation, livelihood, and life and care quality.^{2,9,10} Mortality rates associated with the development of Diabetic foot ulcer (DFU) are estimated to be 5% in the 1st 12 months and 42% within 5-year.¹¹ Diabetic foot patients make more use of healthcare services than diabetic patients who do not have foot problems. Evidence suggests anecdotally and historically that some foot-care behaviours may prevent, delay, or stop diabetes-related foot problems. Evidence also put forward that diabetic patients do not implement educational interventions' behaviour strategies most of the time.¹²

As described by Distiller et al.¹³, Diabetes is diagnosed for the first time in a patient after being undiagnosed for around seven years. But by then, 30% of these individuals would have developed, among others, foot complications.^{14,15} Most of them have type2 diabetes, which comprises more than 90% of diabetes cases, like in different parts of the world.⁹

The increase in diabetes prevalence also increases the number of people with DFD, diabetic foot problems, and complications such as infections, gangrene and/ or destruction of the deep tissue, significant and premature morbidity and mortality, and long-term disability.¹⁶⁻¹⁸

They are probably the most feared, severe, extraordinarily costly, and devastating, especially when it ends in the amputation of parts of the lower limb.^{2,9} The Foot problems are related to varying levels of neurological and peripheral vascular abnormalities in the lower limb. They are partly caused by poor footwear, foot deformities, and injury in the lower limb.^{8,10} The remarkable number of diabetic patients associated with poor and inadequate healthcare resources makes mandatory education for prevention and improved diabetic foot complications.^{19,20}

Diabetes-related lower extremity amputation accounts for approximately 50–70%. About 85% of these amputations are paved the way by a foot ulcer, which is the most common diabetic injury, deteriorating subsequently to a serious infection or tissue destruction leading eventually to amputation.^{2,14,21} Approximately 10% of the diabetic population have a foot ulcer. A diabetic patient's lifetime probability for developing a foot ulcer amounts to 25%, of which half will become infected. Approximately 1 in 5 cases of infected DFU requires amputation.²² The yearly incidence of a new foot ulcer for a diabetic patient approximates 1–4%. Up to 75% of LEA is being performed in these patients.^{2,23}

Prevention and delay of diabetic foot complications require diabetic patients to play an active role in their management and be educated about their condition to recognize complications early and act appropriately.⁹ The importance of feet self-examination daily cannot be overemphasised, and action must be taken to observe abnormalities.¹⁷ It is also essential that Health Care Workers actively encourage at every encounter smoking cessation in all patients with chronic wounds, especially those with arterial insufficiency.^{24,25}

The delay in the referral of complicated diabetic foot patients for a specialist opinion is more observed in non-trained healthcare providers and accentuates foot complication compromising thus the outcome. Also, the delay is associated with the lack of knowledge of foot care problems by the healthcare providers and the patients and constitutes significant reasons for bad outcomes, especially in underdeveloped nations.²⁶

The stretch of foot lesions varies from place to place mainly due to the socio-economic inequalities associated with the quality of footwear and standard of care. Thus, implementing goal-oriented and focused diabetic foot guidelines should be prioritized to achieve a more

cost-effective type of healthcare spending and improve patient results by improving continuous professional education and development with better care provision.^{19,20}

The International Diabetes Federation (IDF) noted that the global prevalence of diabetes is increasing, from 415 million patients (2015) to 463 million (2019) and estimated to be 578 million by 2030 and 700 million by 2045.²⁷ Similarly, in Africa, it is expected to rise from 14.7 million to 34.2 million by 2040.² This increase is subsequent to rapid urbanisation, longevity, an inactive lifestyle, and dietary patterns change.^{16,126,28} South African diabetes prevalence might increase significantly with time, as approximately 5 million more people are pre-diabetics.¹⁴

A survey done in the Free State Province, South Africa, (2007 and 2009) reported the percentage of 4% and 1.8%, respectively, among women and men who self-reported with cases of diabetes mellitus, which according to the author, has wide-ranging consequences on the individual people, community, and South Africa's economic status.²⁹

The Indian population has the highest prevalence of diabetes (11–13%) due to a strong genetic predisposition, followed by the coloured community (8–10%), blacks (5–8%), and whites with about 4%.⁹ All these groups of people are found in the Northern Cape Province. Therefore, they need urgent attention to deal with the disease in terms of diagnosis, management for control, and, especially, prevention of disease-related complications for those who already have the disease.⁹

1.2 Role of Nurses on Diabetic Foot Care and Prevention

Diabetes is a chronic disease globally considered the most common non-communicable pathology^{2,3}, and Diabetic Education is vital for prevention.³⁰

It is a severe condition with devastating feet problems and complications for the affected patients across the globe. It affects poor and rich, old and young, industrialised, or the economically less industrialised in equal measure with little discrimination.^{16,26,31}

Diabetes is an epidemic occupying the 4th or 5th position among the cause of death in most industrialised and developing countries.²

Diabetes-related foot problems are a veritable disaster whose prevention requires the healthcare system's interventions to halt its consequences from continuing to destroy the patient's life.²² One course of action to approach the problem is to educate and sensitise health care workers about the seriousness of the disease if not taken care of properly. For it is assumed that if the nursing personnel who is for most of the time the prime contact with the patient, possess adequate knowledge about Diabetic foot, they will be able to assist, relay information to patients and help the health care system in preventing much of the disaster with appropriate early interventions.³² The severity of ulceration is parallel to the time it takes for a newly diagnosed diabetic foot ulcer patient to get to a wound care specialist for assessment or expert opinion.^{33,34}

A meta-analysis study on the effectiveness of a diabetes management program has charted the need to improve care quality besides good diabetes care recommendations and related foot problems.³⁵ A cross-sectional study of the model evaluation has shown that evaluating teaching and training programs is necessary to produce satisfaction and keep high the participants' training and education quality.³⁶

A study done in African countries that included 56,173 diabetic patients found that foot ulcer prevalence was 13%. A follow up of these patients showed that the prevalence increased over time, 15% had amputations, and 145 died during in-hospital admissions. Healthcare Workers and patients screening and educational programs and intervention that evaluate foot vascular and neurological status play an essential role in the attempt to oppose or prevent diabetic foot disease progression in the African continent.²⁸

A cross-sectional study on nurses' knowledge, attitude, and practice on diabetic foot in Pakistan by Haseeb et al.³⁷ found in the nurses' population that only 54% had appropriate knowledge about diabetic foot ulcers. The study reflected that nurses generally had an inadequate level of ulcer care knowledge, notwithstanding a better attitude. Adequate knowledge was most noticed in nurses with work experience and formal training in wound care. Therefore, evidence-based educational programs are required to achieve excellent clinical attitude and practice. Nurses should be offered occasions to venture into research

whilst also increasing their awareness of research significance in the clinical practice to better understand the evidence-based practice and improve their patients' care.

Therefore, measures must be put in place in terms of early diagnosis, proper management and control of the disease, and prevention of complications.³ A team approach is needed to prevent or avoid severe diabetic foot complications whilst managing diabetic foot ulcers.¹⁷ The International Working Group on the Diabetic Foot (2011) declared that: "A strategy that includes prevention, patient and staff education, multidisciplinary treatment of foot ulcers, and close monitoring can reduce amputation by 49-85%".³⁸

A descriptive cross-sectional study on 200 nurses in Sri Lanka, Kumarasinghe et al.³⁹ found a deficiency in nurses' basic knowledge and poor attitudes imputed to insufficient training, substandard knowledge, and indifference in wound care research. They noticed that essential gaps exist in nurses' knowledge due to lack of evidence-based practice, formal wound care training, continuous professional development, and wound care research. Also, nurses' knowledge is strongly associated with nursing experience in wound care and the unit or work department.

As essential team members of the healthcare system, nurses have more contact with the patients and have a crucial role in patients' education.³² They can boost the diabetic patient's quality of life by preparing and implementing educational plans to develop patient diabetic foot self-care behaviours. They also have a special charge to check for clinical evidence-based practice to lay and maintain precise and accessible basic knowledge with educational background, besides promoting competent self-care.³⁰ Furthermore, nurses can halt the disease's progression when they can identify the population at risk of developing foot problems in the community.⁵

Insufficient knowledge compromises the standards of care regardless of attitudes, and most of the diabetic foot complications are attributed to healthcare workers' ignorance and poor health systems.^{11,40}

Throughout the years, research presents the association that connects patients' good outcomes with good self-care behaviours. They better understand their daily diabetic foot disease management when they have sound knowledge, and that understanding can delay

complications. Thus, nurses must be innovative and promote health education teaching to their patients to make them responsible for their foot care.⁴¹

There is a need for nurses' knowledge update through extensive revision of their curricula over healthcare institutions to boost diabetic foot ulcer patients' quality of care.⁴²

More training plans combining theory and practice have to be arranged, making it easier for nurses to participate in the care of diabetes-related foot problems.³²

1.3 Research Problem

The alarming increase of diabetic foot problems warrants all stakeholders' attention to halt many preventable complications such as amputations and overcome diabetic foot-related deaths. Despite information in various articles or papers regarding diabetes-related foot dangers, the evidence suggests that a gap still exists between practice and theory in implementing the multiple recommendations supplied.

A cross-sectional study done in 2018 to examine diabetic foot disease awareness amongst diabetic patients in South Africa reveals that 90% of the 200 participants said they never had previous Diabetic Foot Disease education. Even though 76% of people with diabetes reported altered sensation in their lower limbs, only 22% of participants said they had their feet examined.¹⁶ These studies also highlighted an upward trend in the incidence of lower limb amputation. Many patients had minimal access to screening for problems in the feet and demonstrated that DFD's awareness still not optimal about the current DFC guidelines.^{9,43}

To reduce DFD's load sensibly, improve patient education and preventive and screening programmes on DFC, healthcare providers need to be knowledgeably possessing the right attitude, which is crucial in offering any meaningful advice to their clients.¹⁶ This view imposes an evaluation of primary healthcare providers' knowledge, attitude, and practices on diabetic foot care.

1.4 Research gap

To successfully understand the level of application of diabetic foot care guidelines, it was necessary to deduce the level of knowledge, attitude, and practice of primary healthcare nurses. Whilst there was a guideline published by SEMDSA¹ to guide diabetic foot care and prevention in the country, no study had been done to assess knowledge on the guidelines by public healthcare workers in Northern Cape. This study's main objective was to bring to light diabetic foot care practices and attitudes in Sol Plaatje Sub-District, Northern Cape.

1.5 Justification of the study

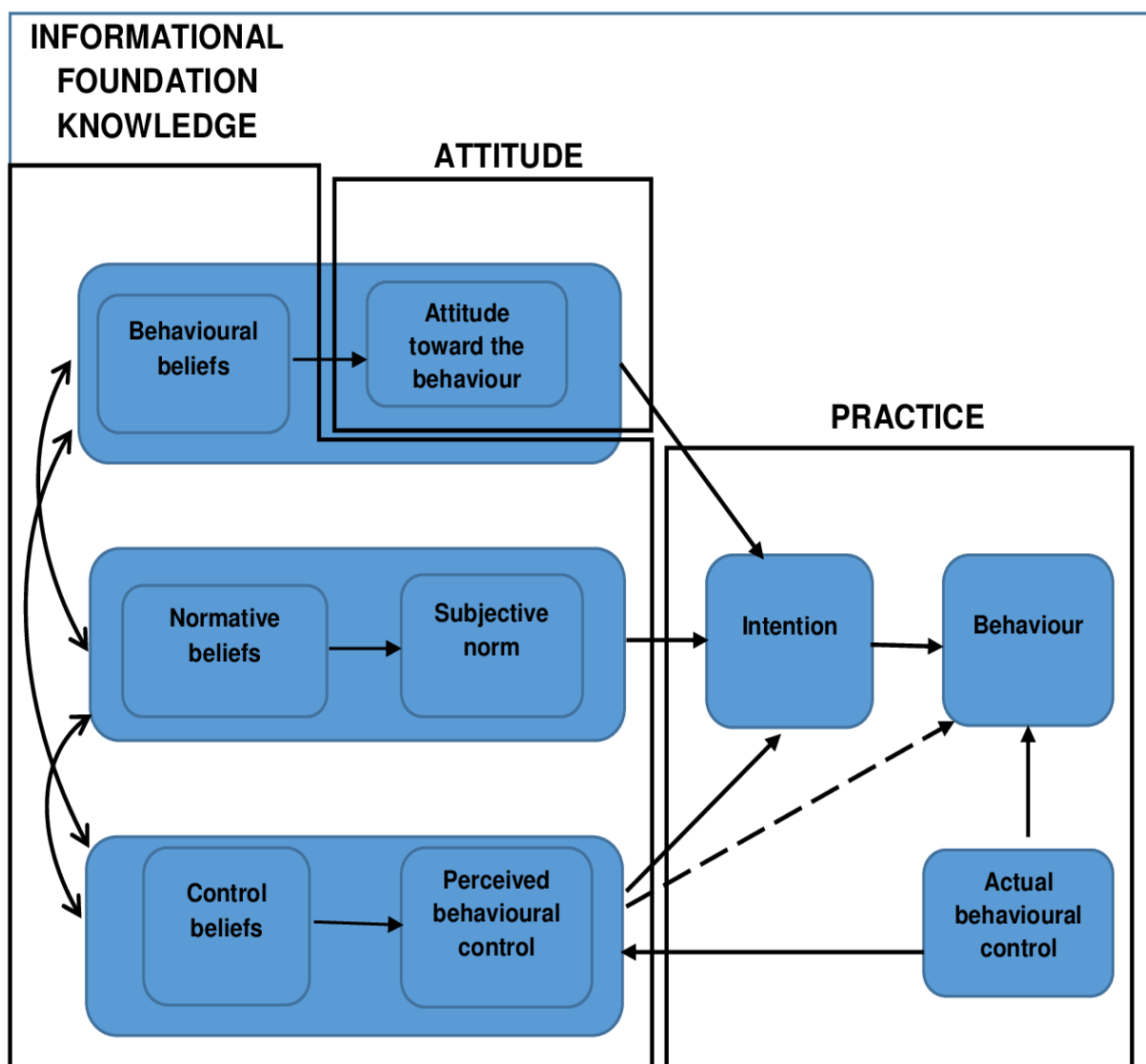
This study seeks to assess the knowledge, attitude, and practice of nursing staff on diabetic foot care in the Northern Cape, Sol Plaatje Sub-district, for the reason of lack of such study thus far. The information is key for making recommendation on diabetic foot care and highlight measures promoting diabetic foot prevention to avoid or delay complication of lower extremity amputation (LEA). The Sol Plaatje Sub-district is part of Frances Baard District Municipality in Kimberley city, Northern Cape Province of South Africa, thus named after Sol T. Plaatje. It has an average population of 255,041 and incorporates the diamond mining city of Kimberley.⁴⁴

1.6 Conceptual framework

The clinician's awareness of diabetic foot prevention aspects determines the level of care carried by a particular individual. Factors such as knowledge and attitude can influence their level of involvement in diabetic foot care. To promote healthcare providers' abilities and get the nurses practically and theoretically involved in diabetic foot care and management, relevant training sessions and programs should be in place to encourage nurses' participation. Other educational resources such as virtual diabetes clinic site, continuing professional development, printed educational materials, educational outreach, didactic format, audit

feedback, diabetes, diabetic foot guidelines, and multifaceted interventions are effective methods of educating healthcare professionals.^{32,45,46}

Studies conducted in Pakistan showed that sound knowledge of the disease and the healthcare workers' positive attitude ensure better clinical practice in diabetic foot care.³⁷ The link between informational foundation knowledge, attitude, and practice is shown in Figure 1.1 below.



[Source: Ajzen et al., 2011:101-102]

Figure 1.1: Conceptual framework

1.7 Aim and Objectives

1.7.1 Main aim

To determine the knowledge, attitude, and practices of primary healthcare providers (nurses) on diabetic foot care and prevention in Sol Plaatje sub-district Public Health Facilities, Northern Cape, South Africa.

1.7.2 Objectives

1. To assess the knowledge of Northern Cape nursing staff on diabetic foot care.
2. To evaluate the nursing staff's attitude on diabetic foot care.
3. To assess the practices of nursing staff on diabetic foot examination.
4. To identify gaps, false information, and a lack of skills among nursing personnel in primary health centres surrounding Kimberley.

1.8 Statement of hypothesis

- i. We expect to find little relationship between the primary healthcare nursing staff's diabetic foot care knowledge and their practice towards diabetic foot care and prevention in the Sol Plaatje sub-district.
- ii. We expect to find little relationship between the primary healthcare nursing staff's attitude towards the diabetic foot and their practice towards diabetic foot care and prevention in the Sol Plaatje sub-district.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter highlights various authors on the causes, risk factors, and diabetic foot pathophysiology. It will also emphasise the symptoms, diagnosis, prevention, and management with benefits of early referral of diabetic foot patients. Further, it will offer insight into the 60-Second Screening Tool for high-risk diabetic feet and the Ipswich Touch Test.

2.2 Background

Dr. Larry Distiller, the founder and managing director of the centre for Diabetes and Endocrinology in Johannesburg, South Africa, warned that South Africa is in trouble with the presence of the tsunami diabetes constantly increasing in number and stated that providing care for diabetes itself is not expensive. Still, the exorbitant costs associated with the management of diabetes arise rather from its complications.^{13,38} She also stated that it is vital and feasible to prevent the disease by early diagnosis and offer good basic care to the population. Unfortunately, not much is being done to address the problem.¹

Prevention of the first ulcer and subsequent amputation is vital and must be the main objective.¹⁹ Health care professionals can assist the diabetic patient by simultaneously doing foot examination and education, bearing in mind that the time to act is now and not delayed tomorrow. Once diabetes has been diagnosed, it is worthy of having an assessment done by different diabetes professionals in the team to establish a baseline to work from to normalise blood sugar levels, encourage healing and prevent more complications.^{17,26}

The primary prevention objective should aim at protecting the healthy population from getting a disease or sustaining an injury. Prevention, identification, and treatment of diabetes-related complications are achieved better with early recognition of the disease and education.^{22,47} Diabetes is usually diagnosed already at its chronic stages; however, on a few

occasions, symptoms exist at the pre-diabetes stage. Thus, patients are supposed to have examination upon making the diagnosis and throughout routine check-ups. Regular exams consist, for diabetic patients, of a series of tests and skin focused evaluation on detecting complications at an early stage of diabetes.⁴⁷

Diabetic foot, even though considered a major Public Health problem, exists only in a few epidemiological studies. From a few systematic review studies and meta-analysis research, it was found by Zhang P, et al.⁵ that DFU global prevalence was 6.3% (5.4–7.3%) with male dominating at 4.5% and female 3.5%, higher in type2 Diabetes (6.4%) compared with type1 (5.5%). North America led with the highest prevalence (13%), Oceania the smallest (3.0%). The Asian, European, and African prevalence's were respectively 5.5%, 5.1%, and 7.2%. Most DFU patients were old, with small body mass, diabetes of more extended time, and more cardiovascular risks than diabetic patients without foot problems.⁵

In Africa, the number of undiagnosed diabetic patients is about 69%, and 77% of deaths due to diabetes occurred in those younger than 60 years of age.³⁴

Bradshaw et al.⁴⁸ reported an increased prevalence in the South African diabetic population aged 30 years and above from 5.5% (2000) to 9.1% (2009).

In 2019, there were more than 4 581 000 (12.8%) diabetes cases, the highest proportion of adult diabetics in Africa, out of a total adult population of 35 833 200. An 137% increase in the 2017 figure of 5.4%. This increase has put a considerable load on the health system of South Africa because of neurovascular complications.^{15,27,49} Among the origins of the high number of Diabetic foot problems in South African people there is poor health education and the bad experience of those undertaking foot care. According to published data, Public hospitals account for 60% estimates of atraumatic LEAs compared to 78.5% from two separate Public hospitals unpublished data.³¹

In a systematic review study in 2017, a comprehensive review demonstrated that lower-limb amputations were higher in people with diabetes than in people without diabetes.⁵⁰ Also, many studies about lower-limb amputations have found male diabetic peoples to have an increased incidence.

Black diabetic patients and their Hispanic counterparts have an increased lower extremity amputation risk than whites, whilst Asian patients do not.⁵⁰

In South Africa (2009), there were about 2,000 new diabetes-related amputations annually.^{15,49} Every year, in the United States of America, about 60% of non-traumatic lower extremity amputation surgery is done on diabetic patients.¹⁴ Worldwide, leg amputation diabetes-related happens every 30 seconds, which is a veritable disaster needing particular attention. In 2011, in the Pacific, the Middle East, and Northern Africa, every 7 minutes, there was one LEA on diabetic patients aged 15 years and above.³⁸

The diabetic foot amputation rate in many African nations, even though it is high (0.3–45%), does not reflect the reality on the ground because of cultural and traditional factors making it difficult for diabetic patients to consent to lower-limb amputation surgery.⁵

As per Stats South Africa 2017⁵¹, diabetes with its feet related complications accounts for 58 deaths daily and was the second leading underlying natural causes of death after Tuberculosis in South Africa, in 2015, with approximately 460,236 deaths. It led to 5.4% of deaths and contributed to 7.1% of deaths among women. Even though Tuberculosis is still the number one underlying natural cause of death, its proportion has declined over time, while diabetes mellitus and other diseases proportion have been increasing, climbing from 5th position in 2013 to 2nd position in 2015.^{51,52}

The five-year mortality following a DFU or LEA sits respectively at 50% and 70% and has greater mortality rates than many malignancies. Unfortunately, many are not aware and try to undermine it.^{42,53}

It is necessary to record that diabetic foot ulcer complications' management failure has increased diabetic limb amputation rate among clinic patients.¹⁹

A descriptive study in Kwa-Zulu Natal by Pillay S et al. (2019)⁴³ found that lower limb amputation incidence was upward, especially in urban areas. Diabetes mellitus was a major reason for atraumatic foot amputation. In South Africa, patients lack access to a multidisciplinary foot care team and have less screening access for foot problems. They suggested that emphasis should focus on prevention and strategy to delay lower limb

amputation through improved diabetes control, increased foot education, and the introduction of specialised foot clinics.

A random survey done at Robert Mangaliso Sobukwe Hospital (RMSH), formerly Kimberley Hospital Complex, theatre register, from December 2017 to November 2018, showed a total of 235 cases of Lower Extremity amputations (LEAs): 132 cases(≈56%) of above-knee amputations (AKA), 52 cases (22%) of below-knee amputation (BKA), 13 cases(≈6%) and 38 cases(16%) of respective foot and toe amputations. It was assumed that the majority were diabetics compared to other studies done in Iran by Rostami F et al.⁵⁴ They noted a high limb amputation prevalence in diabetic patients. This hypothesis is supported and can be corroborated by the random unpublished survey done in RMSH, Surgical wards (March 2019), where above 80% of patients with LEAs had diabetes.

Many studies of different design and population state that lower limb amputation incidence in diabetic people's ranges between 7 and 206 per 100,000 inhabitants per year, not considering other causes of amputations.² And, as per Bourcier M.E, et al.⁵⁵, diabetic patients have a 15 to 40-times more significant risk of leg amputations because of neuropathic, vascular, and infective complications.

As per Fadini G.P, et al.²⁸, these complications represent a growing concern for public health and are burdened by high hospital mortality rates. The requirements are still not met, and the foot's damaging characteristics worsen with different issues about culture, hygiene, and health care.²⁸

The lifetime risk estimation for diabetic foot ulceration navigates around 10 to 25%. In the Northern American population, diabetes-related foot problems and complications constitute the main reason for hospital admissions and account for approximately 20 to 30% of all diabetes-related admissions.^{14,33,56} Sadly, such data are inexistent for the population of South Africa.²⁶

A study by Rayman G et al.⁵⁷ on identification method for in-patients diabetics running the risk of developing foot ulceration in the UK reported that diabetic foot disease risk prediction through community and out-patients screening protect the foot successfully and should target patients at significant risk of disease mostly old patients bed-bound and with

comorbidities. The study found that only less than a third of patients in the UK were offered foot assessment, and about 3% of in-patients had grown a new foot lesion. One of the barriers of not assessing the patient was the non-availability of the 10 g monofilament. Its use also requires training, has cost implications, and can be lost and need replacement after use.

A study by Green-Morris¹⁹, evaluating the effectiveness of foot care provision in rural clinics, Mississippi Delta community, USA, noted that patients' lack of understanding of healthcare instructions resulted in developing new ulcers at home. Patients are aware that diabetes is not curable, and self-care is necessary to prevent complications, but they do not know what to do at home to achieve that. Also, patients reported that they were not offered education and advice on diabetic foot ulcer prevention and self-care management. The education inconsistency substantiates the nurses' need for sound knowledge to prevent diabetic patients from developing foot problems.

Patients further admitted that care providers failed to update their knowledge on the appropriate directives to follow diabetic foot care and management practices. Evidence has also illustrated that foot care basic education at routine visits to the clinic impact positively diabetic foot complications management.¹⁹

A study by Kaya Z et al.³² on 435 nurses in Turkey, 2018 stated that 66% of the participating nurses had no training regarding diabetic foot care, 80.9% failed to educate diabetic patients with already foot complications, and 77,5% was unable to assess or examine diabetic patients feet. Thus, nurses could not offer diabetic patients at risk of complication the necessary education on foot problem prevention and care. Therefore, there is a need to plan and organise training sessions to offer practical attitude and theoretical knowledge facilitating and encouraging nurses' participation in the management and care of the diabetic foot.

Professor Edward Jude of Tameside Hospital, NHS Foundation Trust in the United Kingdom, stated at the international diabetic conference in February 2018 that primary health care professionals see 80% of diabetic foot cases worldwide. Yet, they are not aware of what they need to assess and when is the right time for patient specialist referral. And most of the time, there is no appropriate guidelines on diabetic foot available at their disposal.²²

Professor Johan Wens, a general practitioner, working at the University of Antwerp, Belgium, stated at the international conference on diabetic Foot that Primary Healthcare professionals require diabetic foot care education as diabetic foot management delay may give way to LEAs with loss of the lower limb. It is, therefore, critical to refer at early recognition to an appropriate specialised centre or specialist.²² This can be done only if Healthcare workers can examine the foot and identify the problem.

A random survey of 18 community health care centres in the Western Cape in 2008 established at 11.3% the healthcare providers recording of diabetic patients' foot assessment.⁵⁸ Another study done at a regional hospital in Kwa-Zulu Natal on 750 diabetes records found that a foot evaluation had been recorded in only 6% of patients.⁵⁹ Unfortunately, in the Northern Cape, no such data exist, but should there be any, we assume that the situation would not be different.

A cross-sectional study on the evaluation of nurses' knowledge and attitude concerning diabetic foot care in Pakistan (2019) by Kamran et al.⁶⁰ found that only 56% of the nurses possessed good diabetic foot knowledge while 67% lacked formal wound training. Hence, core knowledge was deficient likely due to insufficient training activity with inadequate knowledge update and minimal research interest in wound care. Because a lack of knowledge badly affects the healthcare system, even with positive attitudes, there was a need for a comprehensive revision of nursing courses, training, and updating their knowledge.

An experimental study in Western rural Australia by Schoen DE et al.⁴⁶ on improving practitioners' diabetic foot knowledge through education offering in remote areas stated that rural areas did not have available diabetic foot educational brochures and Monofilament tools. The clinical settings guidelines were low, whilst the professionals' knowledge of diabetic high-risk category identification was good. The study reported inadequate knowledge levels among untrained HCWs for foot risk assessment.

A cross-sectional study assessing nurses' knowledge regarding diabetic foot in Brazil (2019) by Arruda LSNS et al.⁶¹ reported that no nurse possessed good diabetic foot prevention knowledge while performing better for the monofilament tool. Physical examination execution was low with nurses' unsatisfactory level of knowledge concerning diabetic foot

care and updating healthcare professionals for educational practices regarding foot assessment.

A descriptive study by Abdullah W et al.³⁰ in Jeddah, Saudi Arabia found a significant increase in nurses' knowledge with poor practice regarding foot screening with more than 37% of diabetic patients developing neuropathic complications by lack of proper foot care and early recognition and management of risk factors which prevent foot ulcers. They recommended creating a structured training education program for nurses dealing with diabetic foot disorders.

A cross-sectional study evaluating foot care barriers, knowledge, and practices among people with diabetes by Seid A et al.⁶² in Amhara's capital city, Northwest Ethiopia, quoted lack of communication as common foot care barriers between nurses' knowledge and diabetic patients. They recommended that policymakers initiate foot care interventional education programs and establish a specialised diabetic clinic integrating follow-up into foot care education to tackle the problem.

A cross-sectional study assessing knowledge and foot self-care practices in people with diabetes, Dar es Salaam, Tanzania (2015) by Chiwanga FS, et al.⁶³ found a high prevalence of diabetic foot among public clinic patients in Dar es Salaam. They urge establishing diabetic clinics with foot care services to identify patients at risk and offer early management.

2.3 Pathophysiology of diabetic foot

Diabetic foot etiology is multifactorial, including neurovascular and immunologic components complications associated with poor glycaemic control.^{4,64,65} The hyperglycaemic state produces oxidative stress on nerve cells, leading to autonomic and motor-sensory nerve damage, the main cause of diabetic lower extremity ulcers, resulting finally in ischaemia. Peripheral neuropathy leads the cause of lower leg surgery, with about 75% of all cases.^{54,66} Cellular and neurovascular changes occur, leading to anatomic defects, muscle imbalance, and skin ulcers. In contrast, autonomic nerves damage the oil and sweat gland, decreasing thus foot's capacity to moisturise the skin, which creates possible infection sites by breakage

and cracking of the skin.^{67,68} Non-fitting shoes and minor injuries potentially severe increase sevenfold the probability of diabetic foot ulcer.⁵² Loss of protective sensation (LOPs) plays an important role in impairing the perceptive physical ability, thus increasing integuments damage. Autonomic nerve damages affect vascular and glandular systems causing dry and fragile skin compared to structural muscle modifications caused by motor nerves' damage, affecting injured areas' susceptibility.⁶⁴

2.4 Causes and Risk Factors of Diabetic Foot Problems

Many cardiovascular risk factors contribute to foot problems. Smoking affects blood circulation, increasing microvascular damage, and infection risks. Quitting smoking prevent foot complications. Diabetes causes neurovascular injuries through different metabolic and cellular mechanisms. Uncontrolled diabetes increases peripheral artery diseases (PADs) and loss of protective sensitivity (LOPS) risk resulting in ischaemia and foot ulcers. Diabetic peripheral neuropathy prevalence is up to 2.8% whilst it sits at 0.4% for PAD and 13% for Charcot's foot.^{69,70,78}

Walking barefoot, delaying referral, and lack of foot care insight associate with untrained healthcare staff constitute diabetic foot common risk factors in underdeveloped nations.^{69,70}

Smoking any form of tobacco accelerates damage to blood vessels, especially small blood vessels, which leads to poor circulation - and is a major risk factor for foot infections, and quitting can be one of the best things to do to prevent health complications or problems with the feet.^{69,70}

2.4.1 Footwear

Non-fitting shoes constitute a diabetic foot risk. The foot should be inspected and assessed for pain and callus' formation, in which case well-fitting shoes should be prescribed or obtained.^{69,70}

2.4.2 Nerve damage

Nerve damage is commonly seen in people with longstanding and uncontrolled diabetes, impairing their sensation and making them prone to minor injuries. A constant hyperglycaemic state leads to arteriopathy compromising blood circulation to injured areas, affecting the healing process.^{69,70}

2.4.3 Infections

Skin infections, especially fungal, are common in people with diabetes and carry a high bacterial superinfection risk. All foot lesions must not be delayed treatment. Experienced professionals should appropriately manage toenails. Smoking cessation should be offered all the time to prevent smoking-related foot vascular damage, tissue healing impairment, and infection risk.^{69,70}

2.5 Symptoms of Diabetic Foot Problems

Compromised blood circulation in diabetic patients plays a crucial role in foot complications. Diabetic patients should be aware of warning signs and symptoms on their feet and seek consultation without delay. Symptoms they should monitor for their feet are:⁷¹

- Numbness, non-healing sores, loss of feeling, tingling/ burning sensation;
- Breaks/ Cracks, swelling, skin colour change, Loss of hair;
- Callus, corns, blister, bunions burning/tingling sensation; and
- Ingrown toenail, plantar warts.

Diabetic patients should consult without delay on the presentation of the following foot symptoms and signs: ⁽⁷¹⁾

- Pain increasing severity to exclude serious infective and neurological foot problems;
- Deep or breakthrough wounds;
- Cellulitis;
- High temperatures associated with inflammation or wounds to rule out life-threatening ailments; and
- Acute mental impairment.

2.6 Diabetic Foot screening and diagnosis ⁶⁹⁻⁷¹

Conducting a full foot assessment is essential for the early detection of problems. Feet assessment should consist of careful inspection, palpation, and neurological check with the general patient examination. Examiner should explore the past medical and surgical history of amputations, blood sugar control, and ulcers.

Laboratory tests and imaging to be considered or ordered are:

- Kidney function tests for any sign of impairment;
- Liver enzymes test for any sign of liver failure;
- Full blood count (FBC) for any sign of infection;
- Blood glucose, laboratory or finger prick for checking sugar level;
- ✓ Cardiac enzyme tests to rule out coronary artery disease;
- ✓ Foot/ Leg X-rays for damage in the bones and gas in the feet or legs tissues;
- ✓ Doppler ultrasound for checking lower limbs vascular blood flow;
- ✓ Angiogram in case of poor circulation to improve it.

2.6.1 60-Second Screening Tool for High-Risk Diabetic Foot

This screening test is a test developed by Sibbald (2012)⁷² to identify the high-risk diabetic foot status. The test helps screen both feet for any “yes” item to refer for specialist assessment or management care as outlined in the SEMDSA guideline risk categorisation system for diabetic feet (see Tables 2.1 and 2.2)¹, modified from IWGDF (2008). The high-risk foot should be followed-up in a short time for management and rescreening, including the wish for education and other activities considerations.

Table 2.1: Simplified 60-Second Screen for the HIGH-RISK DIABETIC FOOT 2012^{72,73}

Name: _____		CHECK BOTH FEET	
ID#: _____ Phone #: _____			
Facility: _____		(Circle correct response)	
DOB (dd/mm/yy): ____/____/____			
Gender: M <input type="checkbox"/> F <input type="checkbox"/> Years with diabetes: _____		“YES” on either foot = HIGH RISK	
Ethnicity: Black <input type="checkbox"/> Asian <input type="checkbox"/> Caucasian <input type="checkbox"/> Mixed <input type="checkbox"/> Other _____			
Date of Exam (dd/mm/yy): ____/____/____		LEFT	RIGHT
HISTORY	1. Previous ulcer	NO YES	NO YES
	2. Previous amputation	NO YES	NO YES
	3. Deformity	NO YES	NO YES
PHYSICAL EXAM	4. Ingrown toenail (thickened nail fold)	NO YES	NO YES
	5. Absent pedal pulses (Dorsalis Pedis and/or Posterior Tibial)	NO YES	NO YES
	6. Active ulcer	NO YES	NO YES
FOOT LESIONS Remember to check 4 th and 5 th web spaces/nails for fungal infection and check for inappropriate footwear.	7. Blisters	NO YES	NO YES
	8. Calluses (thick scale on plantar skin)	NO YES	NO YES
	9. Fissure (linear crack)	NO YES	NO YES
	10. Monofilament exam (record negative reaction):	NO YES	NO YES
NEUROPATHY MORE THAN 4/10 SITES LACKING FEELING = “YES”	a) Right ____/10 negatives (4 negatives = Yes)		
	b) Left ____/10 negatives (4 negatives = Yes)		
	Total # of YES: _____	Total # of YES: _____	

PLAN

a) POSITIVE SCREEN- Results when there are one or more “Yes” responses. **Refer to a foot specialist or team for prevention, treatment and follow up.** (Bony deformity, current ulcer, absent pulse are most urgent). These individuals are at increased risk of a foot ulcer and/or infection. Patients should be educated on what changes to observe and report, while waiting for the specialist appointment.

Referral to: _____ **Appointment time:** _____

b) NEGATIVE SCREEN- Results when there are all “No” responses. **No referral required.** Educate patient to report any new changes to their healthcare provider and re-examine in 1 year.

One Year Date for Re-Examination (dd/mm/yy): _____/_____/_____

Completed By: _____ **Date:** _____

Additional Note:

For **POSITIVE SCREEN**, in addition to referral plan above, **positive risk factors** can be linked to the care recommendations in “Root Risk Classification and Follow- Up Guide” table on the bottom of reverse side. Local referral patterns may vary depending on expertise and available resources

General instructions:

This simplified screening tool assesses each foot and should be applied by any healthcare provider. The preparation consists of having available a 10g monofilament and requesting patients to be barefoot.

The screening requires:

- Informing the patient about the test, tools used and explaining the rationale for the exam.
- Filling the top of the left section of the screening test with the patient’s demographic data.
- Check both feet and tick a “Yes” or “No” answer for questions 1–10.
- “Yes” answer needs a short time follow-up or referral for specialist care.

Table 2.2: Screening for the high-risk Diabetic foot: A 60-second Tool (2012) © Sibbald⁷²

Question	"Yes" Response
1	"Yes", if previous ulcer from history is observed: Ask the patient and assess both lower legs and feet for the presence of a healed ulcer as evidenced by scar tissue.
2	"Yes", if previous amputation of digit(s), foot or limb is observed.
3	"Yes", if deformity and/or abnormality in shape or structure of either foot is observed (bony prominences/ hammer toes).
4	"Yes", if absent pedal pulses (palpate dorsalis pedis and if absent check posterior tibial). A yes answer requires absence of both pulses.
5	"Yes", if active ulcer(s) present: Openings in the skin with a dermal or deeper base.
6	"Yes", if ingrown toenail present. Inspect distal corners for embedded nail and/or thickened nail fold skin.
7	"Yes", if callus present (thick plantar skin): Assess and inspect for presence of thick areas of keratin on the bottom or sides of feet and toes.
8	"Yes", if blister(s) present: Observe for fluid (serum, blood or pus) under intact skin surface.
9	"Yes", if fissure (linear crack): Observe for a linear break with dermal base or deeper base.
10	"Yes", if monofilament exam identified 4 or more negative reactions (lack of feeling): Follow the monofilament exam instructions below. Each foot is examined separately.

2.6.2 *Peripheral neuropathy*

Screening is essential in determining and identifying patients with impaired foot sensation. Most guidelines suggest the use of a 10 g monofilament tool for nerve assessment in diabetic patients. Tuning Fork test and Biothesiometer may be used in combination with the 10g monofilament.

Since Nice Guideline 19 (NICE, 2015) is explicitly tailored to the specialist practitioner as it is complex and its multivariate risk stratification outcomes are a barrier to both training and uptake. The International Working Group on the Diabetic Foot (IWGDF) has incorporated the use of the Ipswich touch test (IpTT) in its recently updated guidelines.⁷⁴

2.6.2.1 Monofilament test

The 10g Semmes-Weinstein monofilament is a non-invasive, objective, accurate and straightforward, calibrated hand-held nylon thread that clasps upon delivering a power of 10g.⁷⁵ It is used in screening diabetic patients' feet for LOPS. It has nine plantar Testing sites and applications consisting of the distal big toe, third and fifth toes; heads of first, third, and fifth metatarsal; medial and lateral foot, the heel; and one dorsal site. The test temporarily loses its buckling strength after several episodes of use during the same day or permanently after a more prolonged time. Since it wears off with repeating use, and its durability depends on that, a recovery period of 24 hours is advocated over 100 compression cycles or after assessing 10–15 patients. Depending on the type, it should be replaced every three months of regular use or after using it on 70–90 patients.^{4,70}

2.6.2.1.1 Monofilament technique

To assess a correct measurement, it is vital to use a properly calibrated device with 10g of linear pressure. The Procedure is fulfilled with the patient sitting or lying down, both legs extended and plantar exposed. After explaining the procedure and making the patient

accustomed to the monofilament sensation, he/she closes the eyes and acknowledges every touch felt. The 10g monofilament tool is orientated at 90° on the skin and pressing it to buckle to 1 cm, and after 1 or 2 seconds, it will be removed. Different Testing sites should be sequenced randomly with a brief pause preventing the patient from estimating the next touch. Consider or record LOPS results at a place only if the patient is unable to feel after three tries. Any single area of LOPS places the patient at foot complications risk. The heel has a high probability of false-positive results, mainly in people walking barefoot.^{4,70}

2.6.2.2 Ipswich Touch Test (IpTT)

Also called Light touch test⁴, was proposed by Rayman G et al.⁵⁷ in his study titled Ipswich touch test. It is used to identify or screen for the LOPS by non-specialist practitioners or in case of equipment unavailability. The test is compatible with the 10 g monofilament and 128Hz tuning fork in determining LOPS and has been incorporated in the recently updated guideline of the IWGD.⁷⁴ The test is a simplified sensory testing to lightly touching the tips of the first, third, and fifth toes to promote foot screening of in-patients with diabetes.⁵⁷ Compared with the 10g monofilament, the results showed that it performed well; it is a simplified sensory test easy to manipulate and teach to others, always available for screening high-risk diabetic foot in-patients.

2.6.2.2.1 Ipswich Touch Test technique

- a. Set up equipment and make the patient understand the test principle
- b. The patient should ideally close both eyes and acknowledge the touch
- c. Proceed with the test by lightly touching with the index finger the tips of the patient's uneven toes for approximately 2 second on both feet
- d. Beware not to exert pressure, to poke, or to push whilst touching the toes
- e. No sensation in two or more sites will likely indicate the Loss of protective sensation.

2.6.2.3 128 Hz Tuning fork

The tuning fork device assesses peripheral neuropathy by detecting vibration loss whilst the 10g monofilament detects loss of protective sensation. It determines the length and quality of vibration in comparison to the examiner.⁷⁵

2.6.2.3.1 Tuning fork technique

Once the tuning fork has been activated by striking it against a hard object, the testing is performed in the following order:^{4,75}

- 1) The examiner first demonstrates the sensation feeling by applying the fork on the patient upper limb;
- 2) The examiner ensures that the patient does not focus sight on the test site;
- 3) The examiner applies the fork on a bony prominence at the dorsal aspect of the big toe;
- 4) The examiner applies perpendicularly with maintained pressure the fork on the toe;
- 5) The examiner will repeat the test, taking into account to alternate with a simulated application;
- 6) Two positives answer rules out neuropathy whilst two negative answers confirm it;
- 7) A more proximal part of the foot or leg should also be considered if the patient is unable to feel the vibration on the toe; and
- 8) The examiner should give positive feedback to the patient to encourage him/her.

2.6.3 *Peripheral arterial disease (PAD)*

History should check for claudication and pain at rest suggestive of diabetic patient's peripheral arterial disease. Feel for the presence or absence of both feet dorsalis pedis and posterior tibialis pulses to determine whether they are absent or present.

PAD is diagnosed using the Ankle-brachial index measure, which classifies diabetic foot patients into low, moderate, or high-risk categories. The severity of the peripheral arterial disease is interpreted as follow:⁷⁰

- 1) 0.91-1.3—Normal
- 2) 0.70-0.90—Mild obstruction
- 3) 0.40-0.69—Moderate obstruction
- 4) <0.40—Severe obstruction
- 5) >1.3—Poorly compressible vessel

2.7 Diabetic Foot Prevention and management

2.7.1 SEMDSA guideline and recommendations

The following measures are necessary to prevent and treat diabetic foot problems:¹

1. General measures:
 - ✓ Optimisation of the blood sugar, lipids, and blood pressure control
 - ✓ Advocate and encourage Smoking cutting/cessation
 - ✓ Encourage obese patients to lose weight for vascular problems prevention.
2. Footwear and care education advice.

The healthcare professional should give to the patient and his/her caregiver the appropriate foot care advice on teamwork partnership and decision making. This should start upon diagnosing the patient and be a continuous process.

The healthcare provider should be responsible for regularly checking the diabetic foot patient's footwear. The shoes should be of the correct size, fitting well the toes, bending sole, and not higher than 4cm heel. Intensive and regular education should be offered to patients with already loss of sensation history or with a foot ulcer and referred for specialist shoes making and assessment.

3. Foot examination of the skin, bones (deformities), nerves, and vessels.

From the diagnosis, feet should be thoroughly assessed, especially for type 2 diabetic patients. A normal foot examination will require an annual assessment of the patient's feet, whilst abnormal findings will require frequent exams. Providers should also be aware that up to 13% of people already have severe neurovascular foot problems by the time the diagnosis is made.

Foot examination includes assessing integuments, neurovascular structures. It should be done preferably by a trained care provider who will look for deformities and the presence of any other abnormalities such as ulcer and callus formation, inflammation, and signs of infection at particularly toe web spaces, foot temperature, and traumatic injuries. The provider should document any findings of hammertoes, bunions, reduced joint mobility, Charcot's foot.

SEMDSA¹ recommends assessing Neuropathy for LOPS using the 10g monofilament over using a 128 Hz Tuning fork preferably. Alternatively, providers will use a cotton wool ball or fingertip in the two previous tests' absence. Tests description and technique (see 2.6.2).

4. Risk categorisation to low, moderate, and high risk.

The table below displays diabetic foot patients' different risk categories.

Table 2.3: Risk categorisation system for diabetic feet¹

category	Risk profile	Frequency of foot examinations/ level of care
Low risk	People with no risk factors and no previous history of foot ulcer/ amputation	General foot care and education; annual examination at primary care
Moderate risk	People with one risk factor (neuropathy, peripheral arterial	Every visit Secondary level care

	disease, or foot deformity) and no previous history of foot ulcer/ amputation	
High risk	People with two or more risk factors (neuropathy, peripheral arterial disease, or foot deformity) and/ or a previous history of foot ulcer/ amputation	Every visit Tertiary level
Active foot problem	People with ulceration or spreading infection or critical limb ischaemia or gangrene or suspicion of an acute Charcot arthropathy, or an unexplained hot, red, swollen foot with or without pain.	Every visit

Moderate and high-risk diabetic foot patients should preferably be referred to a foot care specialist and benefit from intensified education.

5. Ulcerative and non-ulcerative foot Management and referral and follow-up planning.

5.1. Painless neuropathy with LOPS

All diabetic patients with LOPS are high-risk for a foot ulcer and should be offered education, examined regularly, and referred to a specialist as necessary to prevent foot ulceration.

5.2. Painful peripheral neuropathy

The following medications or classes are recommended the first-line choice treating peripheral neuropathy:

- ✓ Tricyclic antidepressants
- ✓ Serotonin-noradrenaline reuptake inhibitors

- ✓ Pregabalin and Gabapentin

Refer all patients not improving after more than two weeks of treatment for further assessment, and those with Charcot's foot should be referred to an orthopaedic surgeon or podiatrist.

5.3. Non-ulcerative foot pathology requiring podiatric or orthopaedic care.

Diabetic patients with the foot presence of callus and deformities warrant specialist referral.

5.4. PAD Suspicion.

Diabetic patients in the absence of foot pulses, even without ischaemic symptoms, warrant vascular surgeon assessment.

5.5. Ulcerative foot disease

Diabetic patients with foot ulcers should preferably be managed at secondary or tertiary health institutions.

Summary of SEMDSA recommendations:

- I. Healthcare professionals should be trained to educate diabetic patients on ulcer care and prevention, identify and manage diabetic foot complications;
- II. Type 2 diabetic patients require an annual systemic foot assessment or more, depending on their risk category for ulcer prevention and neuropathy screening;
- III. 10g monofilament and tuning fork are the preferred screening tests for peripheral neuropathy;
- IV. High-risk diabetic foot patients warrant extensive education and timely referral to a trained healthcare provider/ foot care specialist;
- V. Neuropathy prevention is achievable with proper blood sugar treatment and control;⁷⁶ and
- VI. Amitriptyline, duloxetine, and pregabalin constitute first-line agents and may be used in combination if necessary.

As per Green-Morris G.¹⁹, successful foot care education is necessary to:

- Enhance diabetic patients foot health and care knowledge;
- Reduce diabetes-related costs directly or indirectly;
- Boost patient and institution economic status;
- Expand and share learned experiences opportunities; and
- Bring closer or join together practice and knowledge.

2.7.2 International Working Group on Diabetic Foot (IWGDF) prevention of foot problem

The choice of the IWGDF practical guideline over the South African Adult Primary Care 2019/2020 on foot prevention is motivated by the absence of diabetic foot literature in the South African Adult Primary Care 2019/2020 which speaks about diabetes in general but not it's foot complications; however, the SEMDSA diabetic foot care guidelines for primary healthcare professionals uses the IWGDF guidelines for foot problem.

The IWGDF identifies five essential elements as cornerstones of foot problems prevention and management:⁴

1. Recognition and identification of the foot at risk;
2. Routine and regular inspection and assessment of the foot at risk;
3. Training and teaching of healthcare providers, families, and patients;
4. Wearing suitable shoes regularly; and
5. Ulceration risk factor Treatment

These five concepts should integrate the management and care of high-risk diabetic patients, and Healthcare providers should receive training to talk and discuss them conveniently.

2.7.2.1 Recognizing the foot at risk

Foot annual examination identifying PAD and LOPS signs and symptoms is warranted for low-risk diabetic foot patients and should include applying the following steps:

- Previous history of foot or leg problems, notably amputation, intermittent claudication, and ulcer formation;
- The patient present neurovascular status; and
- Education and management of problems.

Providers should strive to look for neuropathy' causes by doing necessary tests and appropriate examinations.

2.7.2.2 Inspection and assessment of the foot at risk

Footcare and blood sugar monitoring's worthiness should be stressed at each follow-up visit, and the follow-up interval depends on the guidelines to prevent diabetic foot disease progression.^{96,98}

Short follow-up intervals will be necessary for moderate and high-risk diabetic foot patients. It is not worth repeating neuropathy testing for an individual's diabetic already known neuropathic. Peripheral neuropathy, once established, will not reverse. The follow-up of asymptomatic neuropathy should continue at the primary care level according to the institution's peripheral arterial disease guidelines.⁷⁰

Diabetic patients known with Loss of protective sensation or artery disease should benefit from a complete and holistic assessment or evaluation of all systems.

2.7.2.3 Patients, family, and healthcare provider's foot care training

Well, structured and organised education repeatedly dispensed plays a vital role in diabetic foot disease prevention. It aims to improve patients' overall knowledge and increase their motivation and skills, facilitating adherence behaviour. Educators should display specific skills to the patient for the appropriate foot care. A healthcare member should present these meetings to the individual diabetic patient or small groups, in multiple sessions and varying methods, considering gender difference and the specific patient's culture. Furthermore, Healthcare professionals in charge of diabetic foot education should periodically update their knowledge and skills to present evidence-based protocols to high-risk diabetic foot patients (see Fig.2.1).

Information given to the diabetic patient or their caregiver orally or in writing should be on:

- ✓ Exercise, smoking cessation, blood sugar control, and obesity;
- ✓ Basic foot care advice;
- ✓ Patient risk of diabetic foot disease;
- ✓ How to deal with foot emergencies situation and when to seek help;
- ✓ Identify with the patient a reliable person to assist in foot assessment if there are visual problems or other limiting physical factors;
- ✓ Daily foot inspection importance; and
- ✓ Evaluating the following principles and practices with the patient: ⁴
 1. The patient must avoid the barefoot or in-socks walk, no matter the surface;
 2. Shoes must fit well with regular borders and socks changed daily;
 3. Mandatory manual and visual inspection of shoes before use;
 4. Use of lukewarm water for daily foot washing and keeping webspace dry at all times;
 5. Avoiding hot water or heater to warm the feet; and
 6. The need to seek specialized care for foot injuries and avoiding chemical agent use.⁷⁰

Whether patient foot care education is effective or not in preventing diabetic foot disease still needs an answer as only limited evidence exists. However, the IWGDF suggests that patient education improves foot care knowledge, conduct and habits.⁷⁷

2.7.2.4 *Suitable footwear wearing*

Barefoot walking constitutes the leading cause of foot ulceration through traumatic injury in diabetic patients with loss of foot protective sensation. These patients should be aware of the danger and wear shoes whenever inside or outside the house. The shoes should preferably be made for them to adapt well with their feet patterns. On the other hand, diabetic patients non-neuropathic or conserving their vasculature may select pre-made shoes at their convenience. Extra precaution should be taken on both groups of patients when they have a foot deformity or a previous amputation or ulcer history.

According to Mishra SC et al.⁷⁰, most athlete's foot diseases derive from excessive sweating caused by occlusive shoes favouring fungal infection. In countries with high temperatures, diabetic patients' shoes should be of a large toe box and smooth sole with adjustable laces. Unfortunately, there is a bitter observation from diabetic patients noncomplying with footwear prescriptions, specifically at home.

2.7.2.5 *Ulceration risk factors management*

Diabetic patients should receive routine and appropriate care and treatment of cardiovascular risk, foot infection and inflammation, foot injury and mechanical problems, and foot tumours. Surgical intervention is necessary for diabetic people with foot deformities facing ulcer reoccurrence. Those with medically treatable foot problems should receive extensive treatment aimed at preventing and stopping relapse.

2.7.3 *Blood sugar control*

Diabetic patients should target blood sugar control early to prevent peripheral neuropathy successfully, even though evidence lacks to back this hypothesis.¹ Diabetes management Standard guidelines advocate monitoring and discussing with patients glycaemic and A1C optimization to delay advancing peripheral neuropathy.⁷⁴

2.8 Diabetic foot patient referral

Referral without delay for specialist assessment and care diabetic patients presenting with acute limb ischaemia symptoms, foot ulcers associated with infection, wet-gangrene, skin colour change, and open fracture. The patient should understand why the referral and healthcare professional referring the patient should make necessary arrangements to facilitate multidisciplinary care early.⁷⁸

Before referring, healthcare providers should provide to the patient the primary wound care and avoid using cytotoxic agents. Extra precautions will be needed to adjust the foot dressing to avoid imposing weight on foot inside the ambulance. The healthcare professional should not delay giving antibiotics and keep in mind to collect tissue for laboratory culture. On the other hand, patients with minor complaints or without complications may be referred electively for special investigations.^{9,70}

2.9 Organisation of care for diabetic foot disease

The IWGDF⁴ has highlighted that a team using a biopsychosocial approach will successfully manage diabetic foot patients. Even though resources and personnel vary from areas, the following programs are necessary:

- I. Patients and healthcare providers. Education;
- II. A systemic approach for detection and assessment of diabetic patients;
- III. Accessibility to footwear specialist;
- IV. Provision of appropriate foot treatment;
- V. Root cause analysis of events for standard care; and
- VI. Well organised follow-up for chronic patients.

Ideally all the nations should have at least the following three levels of diabetic foot care (see Table 2.4):

Table 2.4: Levels of care for diabetic foot disease¹

Level of care	Interdisciplinary specialists involved
Level 1	General practitioner, podiatrist, and diabetes nurse
Level 2	Diabetologist, Surgeon (general, Orthopaedic, or foot), vascular specialist (endovascular and open revascularisation), infectious disease specialist or clinical microbiologist, podiatrist, and diabetes nurse, in collaboration with a shoe-technician, orthoptist, or prosthetist
Level 3	A level 2-foot centre that is specialised in diabetic foot care, with multiple experts from several disciplines each specialised in this area working together, and that acts as a tertiary reference centre

Studies worldwide have shown that setting up an interdisciplinary foot care team and implementing prevention and management of diabetic foot disease according to the principles outlined in this guideline is associated with a decrease in the frequency of diabetes-related lower-extremity amputations. If it is impossible to create a full team from the outset, aim to build one step-by-step, introducing the various disciplines as possible. This team must work in both primary and secondary care settings with mutual respect and understanding, having at all times, one person is available for consultation or patient assessment. (see Fig. 2.1)

2.10 Summary

Diabetic foot care and prevention measures require a holistic approach from the knowledge, attitude, and practices of healthcare providers to assess, identify, and address various feet problems from different groups of patients within the society. Nursing staffs need to be adequately equipped with the requisite training on diabetic foot care to empower them with the required knowledge to assist patients with diabetes-related foot problems.



Diabetes Foot Care Guidelines for Primary Healthcare Professionals



STRATEGIES TO PREVENT FOOT ULCERS AND AMPUTATION

1. Education of patient, family and healthcare providers.
2. Appropriate footwear.
3. Regular inspection and examination to identify the foot at risk.
4. Appropriate and timely referral.

PATIENT EDUCATION: DO'S & DON'TS FOR THE FOOT AT RISK

DO's :-

- ✓ Inspect your feet daily, including areas between the toes
- ✓ Ask someone else to inspect your feet if your vision is poor
- ✓ Wash your feet daily
- ✓ Dry your feet carefully, especially between the toes
- ✓ Test the water temperature with your hand, not your foot
- ✓ Inspect and feel the inside of your shoes daily
- ✓ Moisten dry/cracked feet daily by applying oils/creams
- ✓ Change your socks/stockings daily
- ✓ Clip your nails straight across (fig. 1)
- ✓ Insist that your doctor/nurse examine your bare feet
- ✓ Notify your doctor/nurse at once if you have a blister/cut/scratch/sore



Figure 1

DON'Ts :-

- X Do not let your feet soak in standing water or foot spa's
- X Do not walk barefoot
- X Do not wear shoes without socks
- X Do not use chemicals or plasters to remove corns and calluses
- X Do not cut corns and calluses yourself
- X Do not apply moisturising oils/creams between your toes
- X Do not treat your own feet (e.g. clipping nails) if your vision is poor
- X Do not use hot water bottles and heaters near your feet

ANNUAL FOOT SCREENING IDENTIFICATION OF THE FOOT AT RISK

WHO TO SCREEN?

Type 1 diabetes > 5 years duration
All type 2 diabetes from diagnosis

HOW TO SCREEN?

Complete the compulsory annual questionnaire below

ANNUAL FOOT ASSESSMENT QUESTIONNAIRE

ARE ANY OF THE FOLLOWING PRESENT IN EITHER THE LEFT OR RIGHT FOOT?

CATEGORY A

Bone/Joint Abnormality		
Deformity (e.g. claw toes, hammer toes, hallux valgus)	Yes	No
Bony prominences, areas of abnormal pressure	Yes	No
Loss of joint mobility (e.g. hallux rigidus)	Yes	No
Skin		
Callus, corns, cracks, interdigital maceration	Yes	No
Inappropriate footwear	Yes	No

CATEGORY B

Protective sensation		
Monofilament sensation abnormal at any spot on <2 attempts	Yes	No
Ulcer	Yes	No
Past history of		
Ulcer	Yes	No
Amputation	Yes	No
Vascular		
Claudication or rest pain	Yes	No
Absent dorsalis pedis pulse and absent posterior tibial pulse	Yes	No

ACTION REQUIRED

If any one answer is 'yes' the foot is at risk for ulceration/amputation.
The foot must then be assessed at EVERY visit.
Intervene and refer appropriately.

INTERVENTION

ALL CATEGORIES (A&B)
Patient foot education
Quit smoking
Optimise glycaemic control
Optimise blood pressure control
Optimise lipid profile

REFERRAL

CATEGORY A
Refer to centre with access to podiatrist

CATEGORY B
Refer to secondary care facility with access to specialist care

APPROPRIATE FOOTWEAR

- Inappropriate footwear is a major preventable cause of ulceration. Patients with normal protective sensation can select off-the-shelf footwear. Patients with neuropathy/ischemia/deformities need extra care with footwear.
1. The shoe should not be too tight or too loose.
 2. Internal shoe length should be 1-2 cm longer than the foot.
 3. Internal shoe width should be equal to the width of the foot (fig. 2).
 4. Toe height should allow enough room for the toes.
 5. Fitting must be evaluated with the patient standing.
 6. Refer to an orthotist (for special footwear) if:
 - fitting is too tight due to deformities.
 - there are signs of abnormal loading (hyperaemia, callus, ulceration).



Figure 2



Figure 3

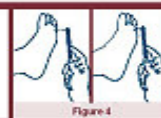


Figure 4

EXAMINATION OF THE FOOT FOR PROTECTIVE SENSATION USING THE 10g (SEMMES-WEINSTEIN) MONOFILAMENT

1. Apply the filament on the patient's hand so he/she knows what to expect.
 2. The patient must not be able to see if and where filament is applied.
 3. Three sites must be tested on each foot (fig. 3)
 4. Apply monofilament perpendicular to the skin surface with sufficient force to cause the filament to buckle against the skin for no more than 2 seconds (fig. 4). Do not allow the filament to slide across the skin and do not probe repetitively at the test site.
 5. Ask the patient IF (yes/no) and WHERE (left/right) they feel the pressure.
 6. Perform this twice at the same site, but also perform at least one "sham" application, in which no filament is applied (total three questions/site).
- Protective sensation is absent with two out of three incorrect answers at any one site, and the patient is then considered to be at risk for ulceration. Additional information may be obtained by assessing vibration sense (128Hz tuning fork), ankle reflexes, pain sensation (pinprick) and light - touch (cotton wool).

Figure 2.1: SEMDSA Diabetes Foot Care Guidelines for Primary Healthcare Professionals¹

CHAPTER 3: METHODOLOGY

3.1 Introduction

Research methodology explains how the researcher derived at the stated objectives; the research designs used to gather information, the instruments used, the population sampling, the target population, and the sampling techniques used to implement this study.

3.2 Research design

The researcher used a cross-sectional study that used a self-administered questionnaire to establish nurses' knowledge, attitude, and practices on diabetic foot care in June - July 2020. This study design was selected since it focuses on drawing certain groups of people's characteristics and behaviour towards a particular idea.⁷⁹

3.3 Study area

The study was carried out in public health centres within Sol Plaatje Municipality in the Frances Baard District, Northern Cape. Sol Plaatje Sub-district comprises 14 clinics, namely: Galeshewe Community Health Centre, Ritchie, City Clinic, Beaconsfield, Floors clinic, Betty Gaetsewe, Masakhane, Mapule Matsepane, Dr. Winston Torres, Platfontein, Madoyle Clinic, Phutanang, Greenpoint, and Riverton Clinic.

Northern Cape is the least populated province in South Africa, with an estimated 1 263 875 as of 2019. Approximately thirty-one percent of the populace is younger than 15 years, 64% are between 15-64 years, and 5% are over 60 years. The province has the largest land area in the country with a surface area of 372 889 km².⁸⁰

3.4 Study population

A study population is defined as the total number of individuals or units from which the researcher is designed to collect information.⁸¹ It can further be classified as the target population and the accessible population. The researcher targeted all the nurses. A total number of 128 individuals were taken from the human resource database from the 14 clinics in Sol Plaatje Sub-district. The accessible population is the one the researcher could get in touch with and from which the findings were obtained. The accessible population consisted of participants from all the 14 clinics in Sol Plaatje Sub-district.

Table 3.1: Distribution of participating nurses by professional qualification

Category	Target population	Reached population
Professional nurse	104	92
Enrolled nurse	5	3
Auxiliary nurse	19	9
Unspecified		1
Total	128	105

3.5 Eligibility criteria

3.5.1 Inclusion criteria

To be included in the study, the nursing staff had to meet the following criteria:

- Be a professional nurse, enrolled nurse, or auxiliary nurse;
- Working in one of the 14 public clinics in Sol Plaatje Sub-district;

- Providing healthcare to patients; and
- Agree to participate in the study.

3.5.2 Exclusion criteria

Were automatically excluded the following persons:

- Nurses not directly involved in providing healthcare; and
- Any nurse who did not consent to the study.

3.6 Sample size

A sample is a selected representative of the target population with characteristics that reflect the population under study.^{79,82} The researcher did not conduct any selection instead chose everyone who met the inclusion criteria. However, the feedback was received from 105 participants with a response rate of 82%. The remaining 18 of the sample could not be reached as they were either on annual leave or quarantine/self-isolation from Covid-19, thus absent during visits to their respective clinics. One was discarded for incorrectly filling the forms, and 4 declined to give consent.

3.7 Data collection

The quality of data can be expressed in terms of its representative features of reliability, which can be ensured using a suitable data collection method.⁸¹ Self-administered questionnaires were used to gather data from participants. The questionnaire comprised close-ended questions in English, which negated the need for translation as everyone was assumed to understand the language.

3.7.1 Research instrument

Online or computer data collection tools such as internet surveys or Google forms provide unique advantages such as covering a wide geographical area at relatively low cost within a short time compared to other formats. However, they posed several challenges such as uncertainty of data validity, difficulty generating a sample online, some respondents not having access to computers or simply computer illiterate, etc.⁸² The researcher used questionnaires to collect data; this instrument was adopted after consideration of reliability and time taken to collect the data.

3.7.2 Questionnaire content

A questionnaire is a set of formulated, printed, or written questions with a choice of answers, devised to probe and obtain responses from respondents or a systematic compilation of questions submitted to a sample population from which information is desired.⁸³ The instrument contains structured close-ended questions. The author designed questions in conjunction with the SEMDSA guidelines¹ and the 60-Second screening tools for high-risk diabetic foot.^{72,73} Closed questions allow the respondents to respond within predetermined parameters. The questionnaire was a standard one modified to the local situation. (See Appendix A)

The questionnaire consisted of 4 sub-sections designed to assess the following:

- I. Nursing staff's demographic variables (gender, age, professional qualification, and years of experience);
- II. Knowledge of diabetic foot care;
- III. Attitudes towards diabetic foot patient; and
- IV. Practices on diabetic foot care

The 'knowledge' section comprised 30 questions designed to assess the nurse's knowledge level on diabetic foot care in the following areas: (1) diabetic foot complications; (2) diabetic foot associated risks; (3) diabetic foot causes (4) diabetic foot examination. The questions were structured as statements that required respondents to respond as 'true' 'false' or 'don't know.'

The 'attitude' section consisted of 11 questions designed to assess the following; (1) the role of the nurses on diabetic foot care; (2) time constraints to provide diabetic foot education during routine consultations; (3) diabetic foot examination to be included in the patient's file record; (4) attitude of nurses on foot care; (5) priority between sugar control and foot problem prevention; respondents were asked to highlight whether they agree or disagree with the statements.

The 'practice' section was based on the SEMDSA guideline on diabetic foot care, particularly foot assessment for diabetic patients at risk for ulceration and lower-limb amputation identification. The respondents were asked to state whether they practice and record foot examination of the patients, discuss diet and smoking cessation, and have any wound management experience using the scale 'yes' and 'no'.

3.7.3 Questionnaire development

The tool used was validated in prior studies (outside of SA), which assessed nurses' knowledge of diabetic foot ulcer disease and their attitudes towards affected patients but was modified to suit this study. The modification was done using the 'SEMDSA' guideline.¹ Other questions were formulated using the 60-seconds screening tool for high-risk diabetic foot⁸⁴ and how to do a 3-minutes diabetic foot exam.⁸⁵ Further validation, as a measuring tool, was achieved by peer review of colleagues within the department of family medicine at the University of the Free State (SA).

3.8 Validity

Data validity is the correctness and reasonableness of data. Various types of validity contribute to the overall validity of a study. The two main dimensions are internal and external validity.⁸¹

Internal validity has to do with the degree of certitude that perceived effects in an experiment arises from the cause or the experimental treatment (condition), rather than intervening, external, or extraneous variables. It is intensified by increasing the control of these variables.⁸¹

External validity has to do with the extent to which research findings can be applied to the real world, beyond the research's controlled setting; it is a matter of generalization.⁸¹

3.9 Reliability

Reliability is an essential validity pre-requisite. It is possible to have a reliable measure without being valid; nevertheless, a valid measure must be reliable as well. Inter-Observer reliability was used to assess the degree to which different rates/observers agree when measuring the same phenomenon simultaneously.⁷⁹

The questionnaires were hand-delivered to ensure that they were completed by the respondents, thereby requesting their assistance in each case. Explanation of the nature and purpose of the research was also given. The questionnaires' structure was relatively short to avoid vagueness, and effort was made to avoid too many open-ended questions.

3.9.1 Pilot study

It is essential to test questionnaires because mistakes or vagueness in the questionnaires can lead to false responses and recommendations once the main data collection phase has been

started. It also helps obtain the questions assessment and the data collected reliability and refine questionnaires so that respondents would not have difficulty answering them.

For this study, a pilot test was done by the researcher at the City clinic in the last week of April 2020 before the actual data collection commencement. Four professional nurses and one auxiliary nurse completed the questionnaires. They were then interviewed individually regarding the clarity and appropriateness, and the length of the questionnaire, and no amendment was deemed necessary. The researcher does not think that the power imbalance influenced this critique.

3.9.2 Data collection procedures

The self-administered questionnaires were distributed to participants at the respective clinics. Participants were selected based on information in the respective human resource department. Group meetings were conducted shortly after their morning briefings to explain the purpose of the survey. At times individual sessions were done to clarify any sticking points. The anonymous questionnaires were collected from participants at their workstations by the unit manager on the same day for some. Other participants who could not provide immediate feedback managed to submit the following day. An 82% response rate was achieved within a month from 10 June to 10 July.

3.10 Minimisation of errors, bias and Limitation of the study

To avoid errors and minimise bias, the following things were done;

- a) A standard set of questionnaires was used;
- b) Questionnaires were pre-tested to ensure the clarity, completeness, and suitability of questions; and
- c) All participants were selected from a population of the study to get a broad view of the responses.

The following points are some limitation the study:

1. The study focused on nursing care providers working in Sol Plaatje Sub-district and cannot be generalised to all nursing care providers in the country without assumptions;
2. The study concentrated on individual accounts of healthcare providers in assessing the nursing staff's knowledge, attitude, and practices. Some levels of under/over-reporting may therefore have affected the study results;
3. Some questionnaires had incomplete sections. Some of the respondents were not aware of what was required, thus making it difficult to tell which respondent had not completed his/her questionnaire due to the questionnaire's numbering system.

3.11 Ethical considerations to

1. The Health Science Research Ethics Committee at UFS approved the protocol of the Faculty of Health Science, UFS (Ethics clearance # UFS-HSD2019/1884/2104), and permission to conduct the study was also given by the Northern Cape Province ethics committee.
2. The participants were given an information sheet, which also served as a consent form. It was assumed that completion of the form after reading the information sheet was consenting to participate in the study. Some clauses contained in these forms included but were not limited to:
 - a) Participation in the project was voluntary, and one could refuse to participate;
 - b) The participants were informed that by completing the forms, they were consenting to engage in the study;
 - c) No participant was injured or harmed physically or emotionally; and
 - d) The results may be published in a journal.

3. All information received from the study was treated with confidentiality and used for intended purposes. All questionnaires were assigned a unique identification number (1–105), and no names of participants were recorded to maintain anonymity.
4. Completed questionnaires were stored safely and securely only accessible to the researcher to prevent unauthorised access.
5. Further approval for participation was obtained from the various unit managers in charge of the respective clinics.

3.12 Data processing

During data entry, each field was assigned a unique number from 1–105. It was proofread and counter checked for missing information, duplicate responses, and inconsistencies before being captured into an excel spreadsheet. The computer was password-protected to prevent unauthorised access.

3.13 Data analysis

Data analysis involves inspecting, cleaning, converting, and modelling data to highlight valuable information, proposing conclusions, and support decision-making.⁸³ Data was presented using both qualitative and quantitative methods using Microsoft Office tools (Excel and Word 2010). This was done to give meaningful and logical information on the results of the survey.

Other data presentation techniques included tables, pie charts, and bar graphs to convert data collected into meaningful and useful information. This was achieved with assistance from the Department of Biostatistics at the University of Free State.

3.14 Summary

This chapter presents information on sources of data that is primary and secondary research instruments. Also explained are the research design, population, sample size, target population, and sampling techniques. In the next chapter, the data will be presented with some analysis of the research findings.

CHAPTER 4: DATA PRESENTATION AND RESULTS ANALYSIS

4.1 Introduction

The preceding chapter highlighted the research methodology; this chapter will concentrate on data presentation and analysis. In this chapter, all the research findings will be presented and critically analysed using different techniques.

4.2 Questionnaire response rate

The researcher managed to get an 82% response rate from the targeted questionnaires distributed. The questionnaires singled out professional nurses, enrolled nurses, and auxiliary nurses. This information is given in Table 4.1 below.

Table 4.1: Overall response rate

Category	Target population	Accessible population	Response rate %
Professional nurse	104	92	88.5%
Enrolled nurse	5	3	60%
Auxiliary nurse	19	9	47%
Unspecified		1	
Overall	128	105	82%

The relatively low 82% overall response was mainly due to Covid-19 associated problems, among others clinics being closed for disinfection, staff absenteeism for isolation or quarantine purposes at the time of the researcher's visit to the institution, making it difficult for the interviewer to get a very high response rate.

It should be noted that there was a low number on the enrolled nurse category as the Department of Health is in the process of phasing out this category and migrating to enrolled nursing auxiliary. This will eventually result in the category being entirely phased out.

4.3 Section A: Socio-demographic Characteristics

The sample of respondents of this study had the following demographic characteristics:

4.3.1 Gender frequency

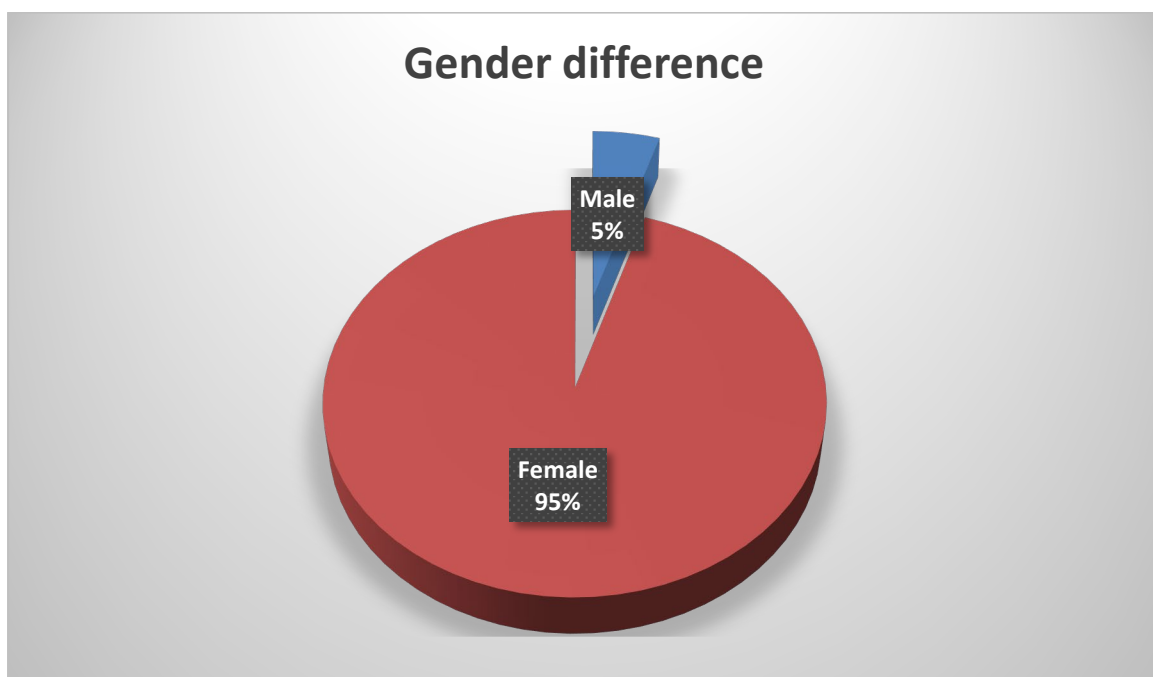


Figure 4.1: Gender difference

The information obtained highlights that most nurses in PHC in the Sol Plaatjes Sub-district are females; they make up 95% while their male counterparts make up 5%.

4.3.2 Age category

The minimum age was 24 years, and the maximum age was 73 years, with a median of 48 years. The extremes of the age range can be explained by the recall of retired nurses to fill the shortage of posts. The age group 41 to 60 constituted the majority of the sample. The 30 years and below and 61years and above age group constituted the low percentage with respectively 9% (9/104) and 6% (6/104). There was one missing data.

The mean age is tabulated and the age distribution graphically presented in table 4.2 and figure 4.2

Table 4.2: Mean age

Variable	N	Median	Minimum	Maximum	Lower quartile	Upper quartile
Age	104	48	24	73	40	54

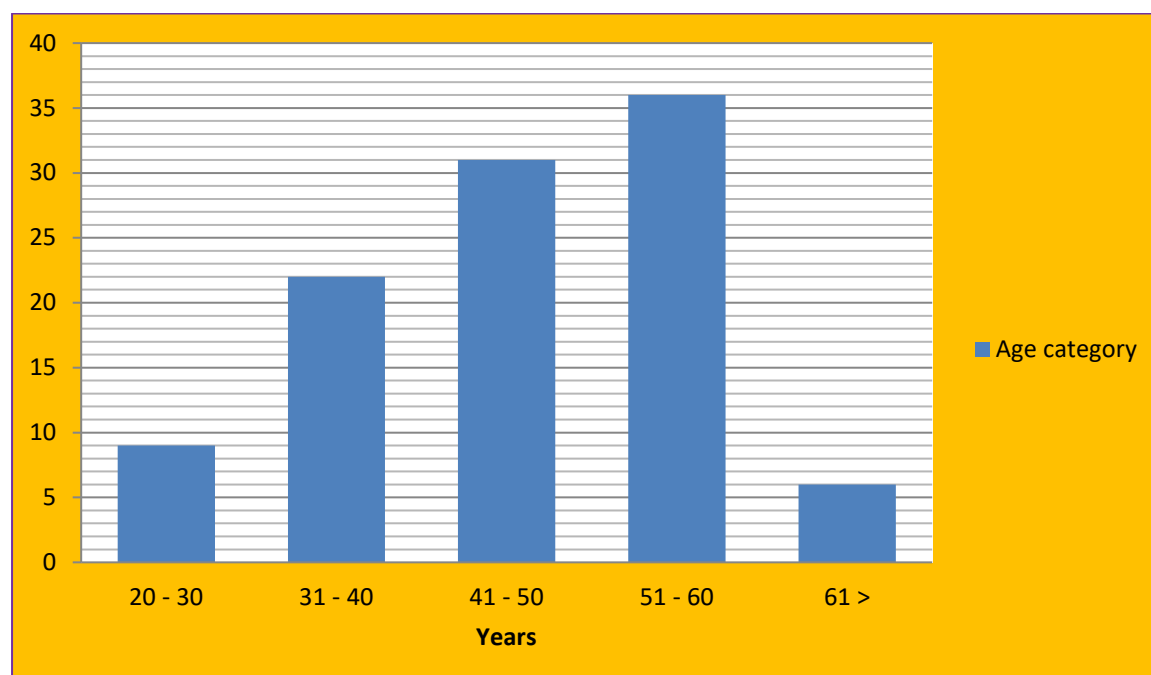


Figure 4.2: Age category

4.3.3 Employment category

This analysis was necessary to get the demographic composition of the population.

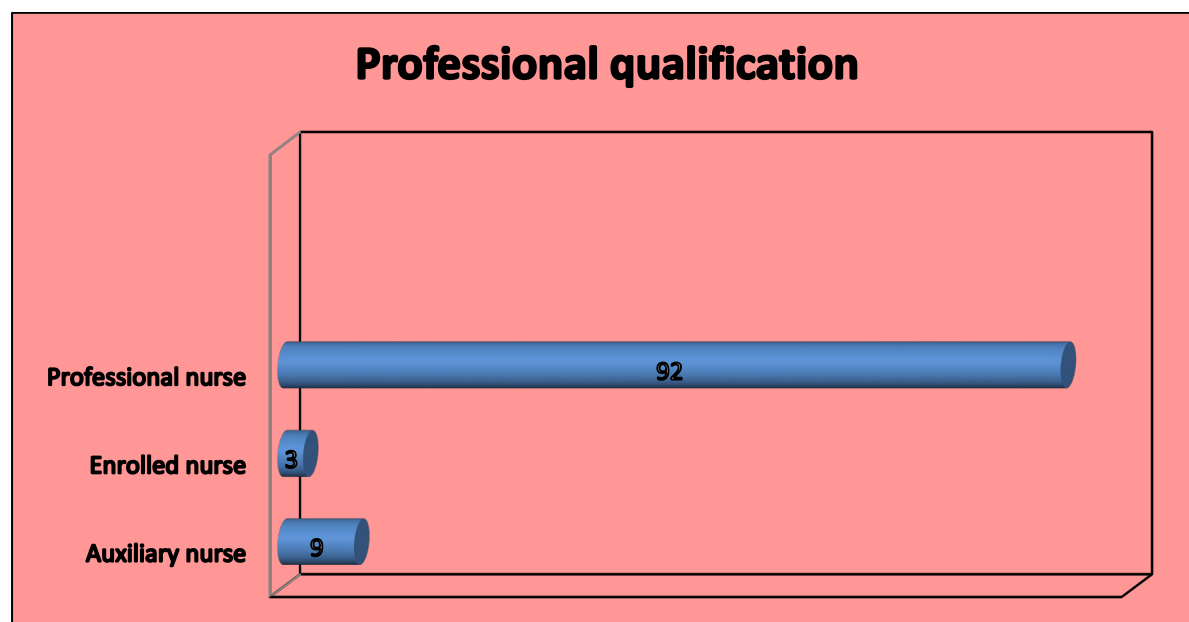


Figure 4.3: Professional qualification

4.3.4 Years of experience

It can be noted that the majority of the respondents who had less than 10 years of experience fell in the age group between 20–30 years and 31–40 years whilst the majority who had over 10 years' experience was found in the 41 years and above. The pie chart below reflects this data.

Table 4.3: Mean years of experience

Variable	N	Median	Minimum	Maximum	Lower quartile	Upper quartile
Years of experience	101	15yrs	1yr	43yrs	10yrs	24yrs

Table 4.3 above indicates that the minimum year of experience was 1 year whilst the maximum was 43 years with an average experience of 15 years, which is advantageous for the patients.

The figure below shows that the majority (67%) had more than 10 years of experience whilst 33% had 10 years or less, among which only 14% had more than 5 years.

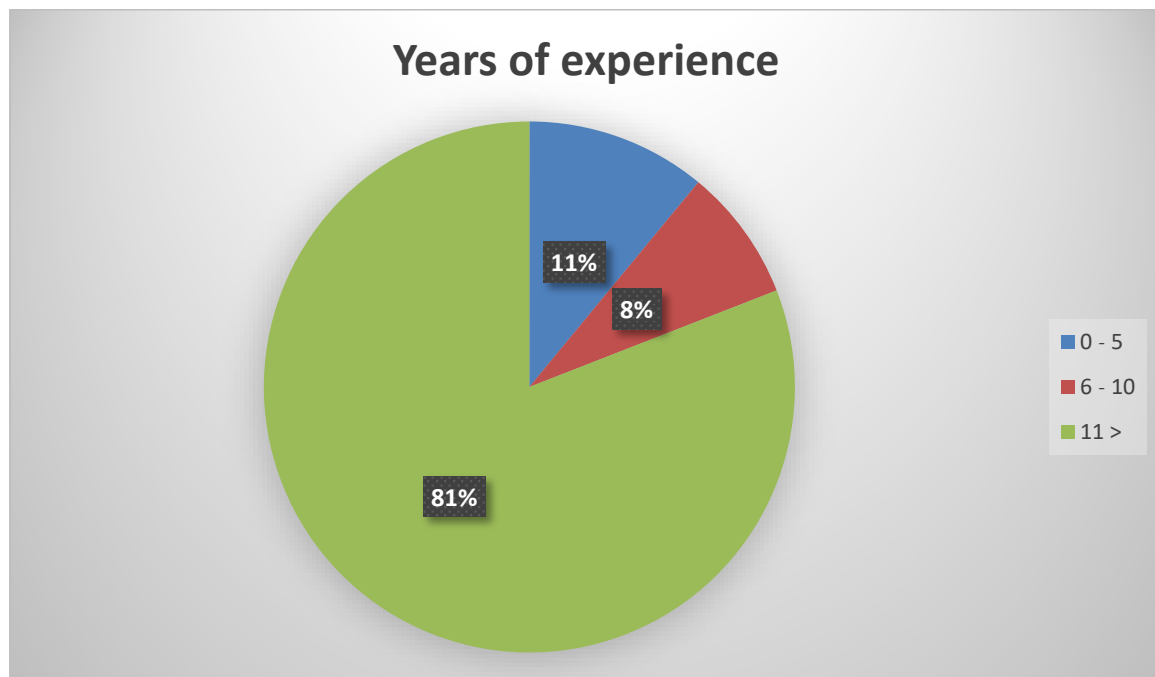


Figure 4.4: Years of experience

4.4 Knowledge assessments

In this section data are not presented in the questionnaire sequence as the researcher found it easy to group together in a table all categories of questions assessing the same parameters.

4.4.1 *South Africa has a diabetic foot guideline for primary healthcare professionals*

To understand if the respondents knew whether the country has guidelines or policies regarding diabetic foot, the interviewer asked them to indicate whether they were aware of such guidelines or policy.

Table 4.4: South Africa has a diabetic foot guideline

TRUE	FALSE	DON'T KNOW	TOTAL
61	8	36	105
58.10%	7.62%	34.29%	100.01%

From Table 4.4 it is clear that the majority 61/105 (58.15%) of respondents are aware of the existence of the South African Diabetic Foot guideline. The last version was issued in September 2017, "JEMDSA Vol.22 No.1". Eight out of the 105 (7.62%) said that the country did not have such a guideline. The remaining significant 36/105 (34.29%) were not aware of such guidelines' existence.

There is a need to increase awareness of the nursing staff on this guideline's availability as a considerable number of nursing staff are not aware of its existence.

4.4.2 Diabetic foot is associated with neurological and vascular damages

The results show that a small proportion (6/105) (5%) of the respondents were not aware of the association between the diabetic foot and neurovascular damage, whilst a minute number (4/105) (4%) did not know of the association. Still, the overwhelming majority (95/105) (90%) were aware of the association. Figure 4.5 displays these findings.

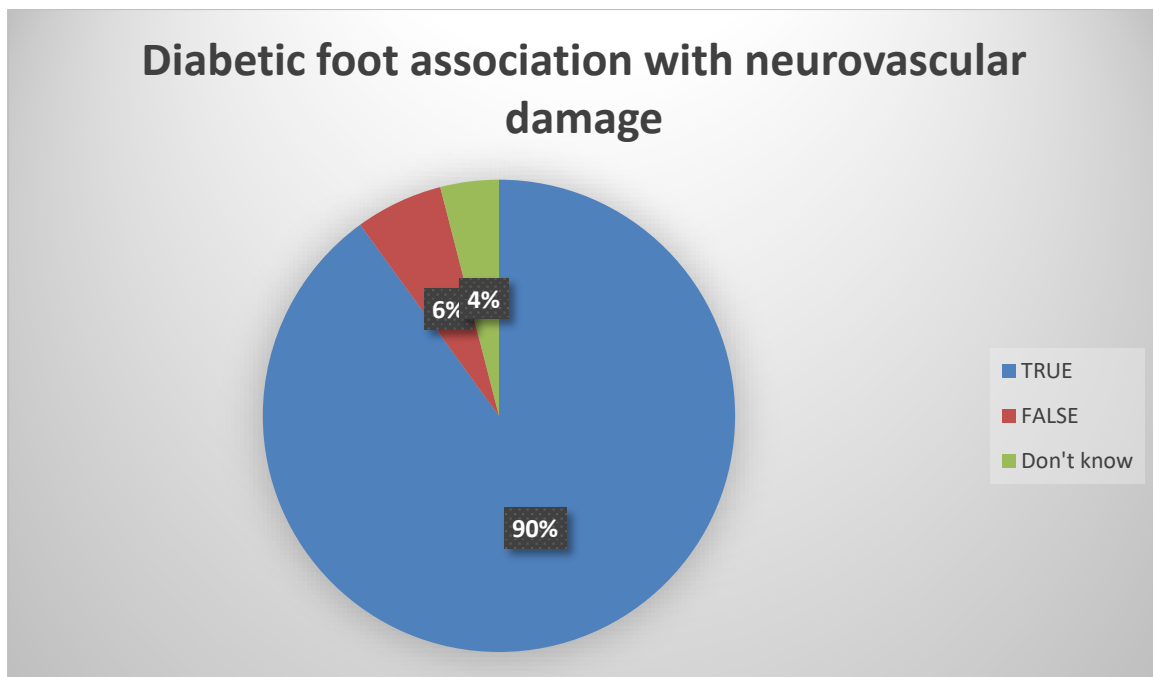


Figure 4.5: Association between the diabetic foot and neurovascular damage

The results show that many of the respondents know that an association exists between neurovascular damage and diabetic foot disease.

4.4.3 A 60-second test is a screening tool for low-risk diabetic foot

The researcher sought to establish if the respondents were aware of the importance of screening in preventing diabetes-related foot problems as outlined in the SEMDSA guideline.¹

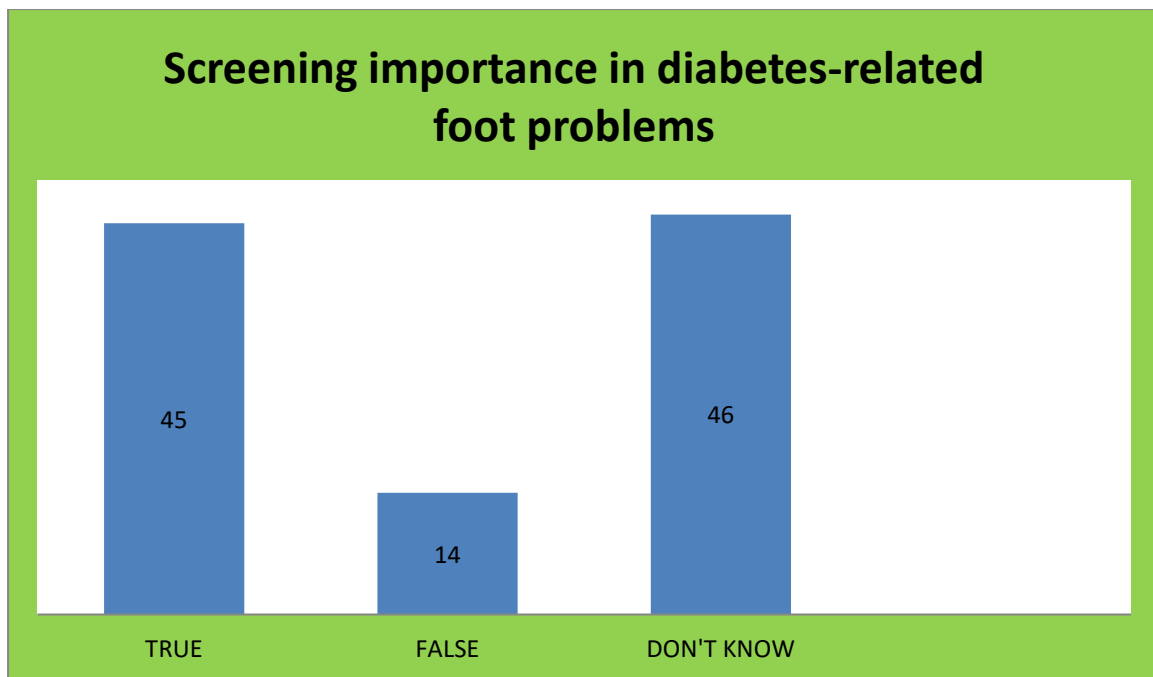


Figure 4.6: Screening importance in Diabetes-related foot problems

Figure 4.6 shows that 43% (45/105) of the interviewed nurses stated that screening is for low diabetic foot risk whilst the majority, 44% (46/105), were not aware of the diabetes-related foot problem's screening category. A marginal 13% (14/105) revealed that screening is not for the low-risk diabetic foot.

These results illustrate that most interviewees are not aware of the screening tool for high-risk diabetic foot, which is a cause of concern for preventing complications. Such results contrast to results shown in Table 4.5, where most of the interviewees highlighted that they were aware of diabetic foot guidelines in SA. This indicates that the SEMDSA guideline needs to highlight the importance of the screening tool.

In the following questions, the researcher sought to establish if the respondents were aware of the risk factor for developing diabetic foot.

The results are displayed in the table below:

Table 4.5: Diabetic foot risk factors

Characteristics		True	False	Don't know	Total
4.4.4	A history of the previous ulcer is a high-risk diabetic foot only if both feet were affected	36 (34.3%)	57 (54.3%)	12 (11.4%)	105 (100.00%)
4.4.5	Previous amputation of only one toe is not a high-risk diabetic foot	11 (10.5%)	82 (78.1%)	12 (11.4%)	105 (100.00%)
4.4.7	The absence of foot pulses is a high risk only if both dorsalis pedis and posterior tibialis pulses are affected	47 (44.7%)	49 (46.7%)	9 (8.6%)	105 (100.00%)
4.4.8	Calluses, blisters, fissures, and ulcers are high-risk diabetic foot but not the ingrowing toenail	33 (31.4%)	68 (64.8%)	4 (3.8%)	105 (100.00%)
4.4.15	Smoking cessation is not important to prevent diabetic foot	16 (15.2%)	87 (82.9%)	2 (1.9%)	105 (100.00%)
4.4.16	High blood sugar and cholesterol is high risk diabetic foot	97 (92.4%)	6 (5.7%)	2 (1.9%)	105 (100.00%)
4.4.17	Weight loss can reduce the incidence of diabetic foot	84 (80.0%)	16 (15.2%)	5 (4.9%)	105 (100.00%)
4.4.18	Poor blood supply to the legs can increase diabetic foot risk	105 (100.00%)	0 (0.00%)	0 (0.00%)	105 (100.00%)

Table 4.5 above shows that in total, 20% of nurses are not aware of diabetic foot risk factors, whereas 75% are aware of diabetic foot risk factors. A minute of 5% does not know about diabetic foot risk factors. The absence of pulse, a history of the previous ulcer, and in growing

toenail were the most unaware risks. An overwhelming majority agreed to high blood sugar/cholesterol, obesity, and poor blood supply to legs being high risks for diabetic feet. Fifteen percent (15%) still do not consider smoking cessation as being necessary for preventing diabetes-related foot problems.

The result illustrates that in total 75% of nursing staff in Sol Plaatje Sub-district are aware of diabetic foot risk.

4.4.4 Charcot foot is a foot deformity caused by significant nerve damage

The researcher sought to assess whether the nursing staff at Sol Plaatje were aware of neuropathy's severe diabetic foot impact.

The results indicate that a majority (64/105) (61%) of the interviewees agree that significant nerve damage can cause Charcot foot whilst (4/105) (4%) disagree. A substantial number of interviewees do not know the correlation between neuropathy and serious foot problem.

Figure 4.7: illustrates these findings.

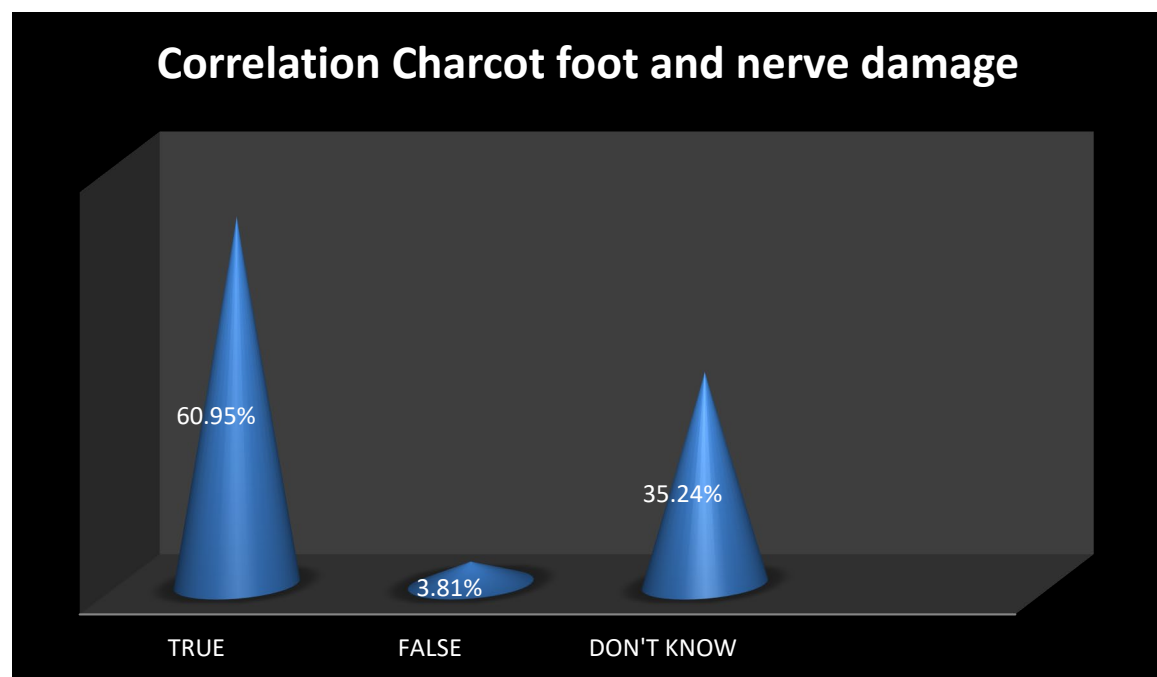


Figure 4.7: Correlation between Charcot foot and neuropathy

The results indicate that the majority of nursing staff do not know the correlation between nerve damage and bone deformity, which is of concern as one may find it non-relevant to assess foot neurology

The researcher sought to establish the knowledge of nurses at Sol Plaatje Sub-district on specialist referrals through the following questions.

The results are shown in the table below.

Table 4.6: Nurses knowledge of specialist referral

Category		True	False	Don't know	Total
4.4.9	Foot deformity alone is not enough risk for specialist referral	22 (20.95%)	76 (72.38%)	7 (6.67%)	105 (100.00%)
4.4.10	Specialist referral can be delayed if there is only foot deformity but pulses are present	48 (45.71%)	49 (46.67%)	8 (7.62%)	105 (100.00%)
4.4.11	Specialist referral can be delayed if there is only an active ulcer, but pulses are present	35 (33.33%)	64 (60.95%)	6 (5.71%)	105 (100.00%)
4.4.12	Absence of pulse needs urgent referral but not an active ulcer or bony deformity	50 (47.62%)	47 (44.76%)	8 (7.62%)	105 (100.00%)
4.4.27	A negative result for the “60-second Foot Screening Tool” do not require referral to the specialist	36 (34.29%)	39 (37.14%)	30 (28.57%)	105 (100.00%)

Table 4.6 above indicates that 37% of nurses were wrong on not referring when there is an indication for referral, whilst 52% correctly refer when there is a risk. 11% do not know when to refer. The majority, 48%, disagree with an active ulcer or bone deformity needing urgent referral, which is of concern as those high-risk patients will not be referred timeously.

These results indicate that approximately 48% of diabetic foot risk patients are not referred to the specialist for appropriate care and management. This may explain the increasing amount of diabetic foot complications, including lower limb amputation.

4.4.5 Part of the foot exam consists of checking 4th and 5th web spaces and nails

The results indicate that a minority (22/105) (20.95%) of the respondents highlight that they did not know the relevance of checking web spaces and nails in the foot exam whilst a minute figure (12/105) (11.43%) felt that it is not essential to check at all. Still, the majority (71/105) (67.62%) accepted the notion that checking web spaces and nails are part of the foot exam.

Figure 4.8 illustrates these findings.

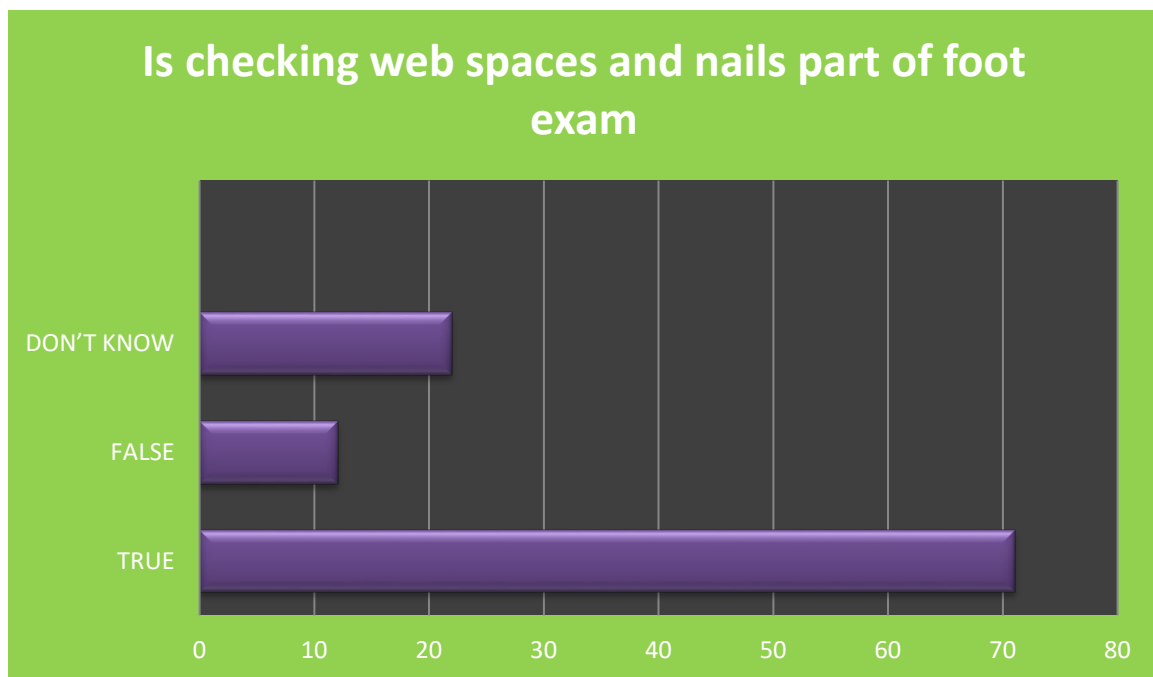


Figure 4.8: Checking of web spaces and nails in the foot exam

The majority of the respondents indicated that checking of 4th and 5th web spaces and nails is part of the foot exam.

4.4.6 10g monofilament is used to check for nerve damage in the foot

The researcher sought to check whether the nurses (respondents) in Sol Plaatje Sub-district are aware of the tool used to assess the loss of sensitivity in screening peripheral neuropathy

as recommended in the SEMDSA guidelines.¹ The figure below indicates that the majority are not aware of it.

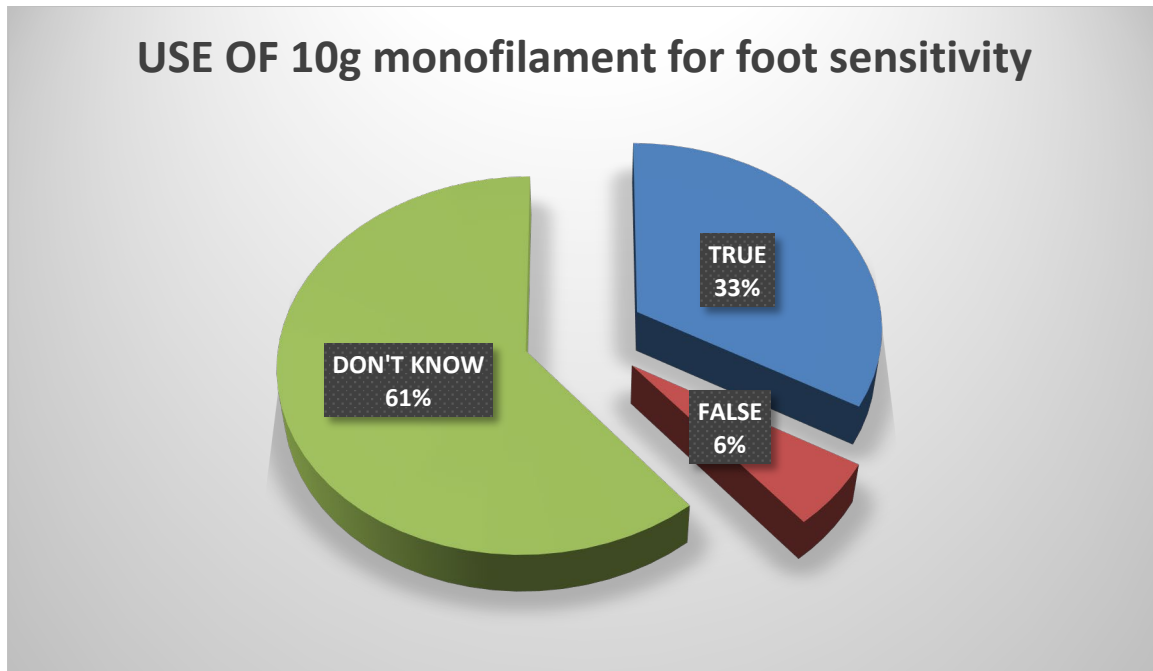


Figure 4.9: Checking of foot sensitivity with 10g monofilament

The results show that very few respondents are aware of this useful tool and how it can help determine a foot's neurological problem. This contrasts the results in Table 4.4, where the majority indicated that they were aware of the diabetic foot guideline.

In the following questions, the researcher sought to assess nurses' knowledge (respondents) on diabetic foot education.

The results are shown in the table below

Table 4.7: Nurses knowledge of diabetic foot education

Category		True	False	Don't know	Total
4.4.19	Diabetic patients should be encouraged to sit with their legs crossed	7 (6.67%)	87 (82.86%)	11 (10.48%)	105 (100.00%)
4.4.20	Diabetic patients should not dry between their toes unless they have an obvious ulcer	10 (9.52%)	93 (88.57%)	2 (1.90%)	105 (100.00%)
4.4.21	Diabetic patients should trim their toenails only if it is painful	8 (7.62%)	93 (88.57%)	4 (3.81%)	105 (100.00%)
4.4.22	Diabetic patients should no inspect their shoes prior to wearing them if their sugar is well controlled	8 (7.62%)	96 (91.43%)	1 (0.95%)	105 (100.00%)
4.4.23	Diabetic patients should not bother to wash their feet everyday if it is not dirty	3 (2.86%)	99 (94.29%)	3 (2.86%)	105 (100.00%)
4.4.24	Diabetic patients should always check the water temperature before washing feet	98 (93.33%)	4 (3.81%)	3 (2.86%)	105 (100.00%)
4.4.25	Diabetic patients are allowed to walk barefoot only on clean surfaces	15 (14.29%)	85 (80.95%)	5 (4.76%)	105 (100.00%)
4.4.26	Diabetic foot patients already referred and waiting for a specialist appointment do not need any education on what changes to observe while awaiting	4 (3.81%)	99 (94.29%)	2 (1.90%)	105 (100.00%)
4.4.29	Diabetic patients need education only if they have foot problems	7 (6.67%)	95 (90.48%)	3 (2.86%)	105 (100.00%)
4.4.30	Diabetic patients should not wear tight shoes but very ample non-fitting shoes	61 (58.10%)	40 (38.10%)	4 (3.81%)	105 (100.00%)

Table 4.7 above indicates that an overwhelming majority of 84% of nurses are aware of diabetic foot education whilst a minority 12%, disagree. A minute of 4% is not aware of diabetic foot education. The majority, 58%, agree to diabetic patients wearing very ample, unfitting shoes; this is of concern as both tight and unfitting shoes pose a problem to the feet.

These results indicate that there is a need for diabetic foot education for nurses in Sol Plaatje Sub-district.

4.4.7 A patient with negative results for the “60-Second Foot Screening Tool” needs to be examined yearly

The researcher sought to establish whether the respondents (nurses) at Sol Plaatje Sub-district were aware of SEMDSA recommendations on foot examination interval in diabetic patients.²⁶

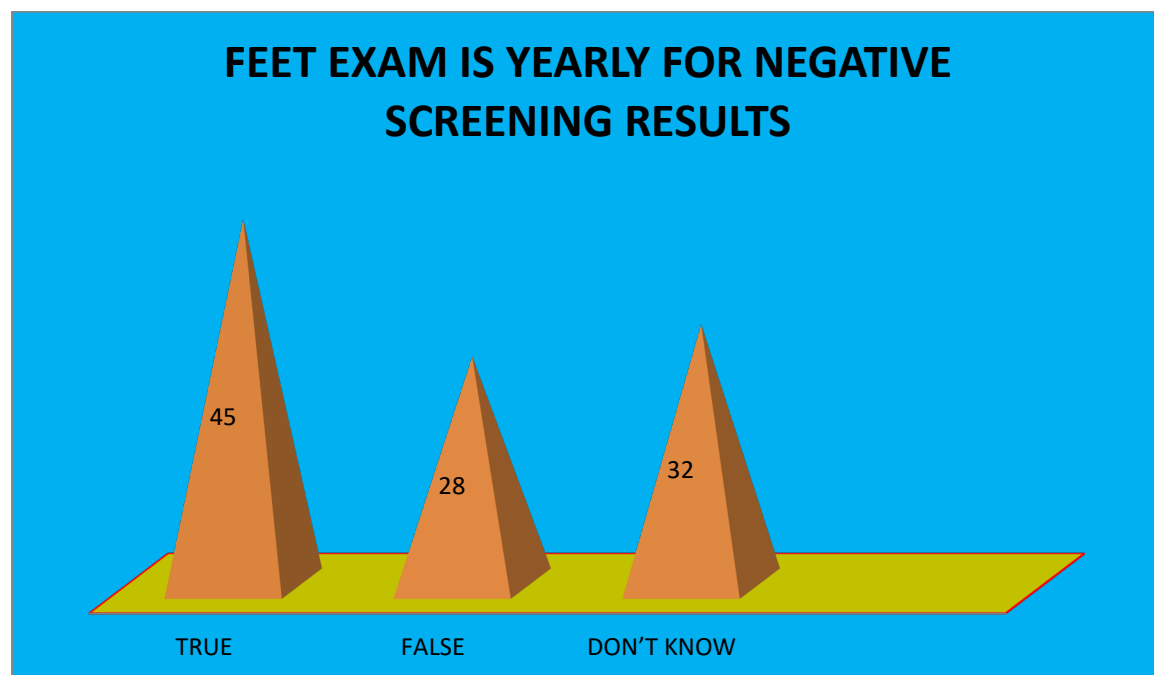


Figure 4.10: Feet examination is yearly on diabetics with a negative screening test

Figure 4.10 illustrates that the minority 26.67% (28/105) do not agree with the foot examination interval in diabetic patients without foot problems whilst an underwhelming

majority 42.86% (45/105) agree to the interval. 30.48% (32/105) highlighted that they were not aware of the interval.

There is a need to increase awareness among nursing staff at Sol Plaatje Sub-district on foot examination interval.

4.5 ATTITUDE

Attitude can be defined as a settled way or a tendency of responding positively or negatively regarding a particular idea, object, person, or situation.⁸⁸ It guides an individual choice of action and response to challenges, incentives, and rewards (together called stimuli); Attitude can be formed from a person's past or present environment or condition.

The following table outlines questions about the attitudes of nurses in the Sol Plaatje Sub-district regarding diabetic foot.

Table 4.8: Nurses attitude on diabetic foot care

Category		Strongly agree	Agree	Neither Agree Nor disagree	Disagree	Strongly disagree	Total
4.5.1	I think Diabetes control is more important than preventing foot problem	44 (42.3%)	17 (16.4%)	11 (10.6%)	18 (17.3%)	14 (13.5%)	104 (100.0%)
4.5.2	Diabetic education is an important part of my job	85 (80.9%)	18 (17.1%)	1 (1.0%)	0 (0.00%)	1 (1.0%)	105 (100.0%)
4.5.3	It is not worth educating a patient who has already developed an ulcer	1 (1.0%)	1 (1.0%)	4 (3.8%)	34 (32.7%)	64 (61.5%)	104 (100.0%)
4.5.4	I don't think patients with diabetic foot problem are my concern	3 (2.9%)	5 (4.7%)	1 (1.0%)	20 (19.0%)	76 (72.4%)	105 (100.0%)
4.5.5	Diabetic education is a waste of time as patients are not receptive to healthcare providers' education	1 (1.0%)	2 (1.9%)	2 (1.9%)	29 (27.6%)	71 (67.6%)	105 (100.0%)
4.5.6	I do not educate diabetic patients on foot problem because it is time consuming	1 (1.0%)	4 (3.8%)	0 (0.0%)	21 (20.0%)	79 (75.2%)	105 (100.0%)
4.5.7	I do not have sufficient time to advise each patient individually on how to look after their feet	4 (3.8%)	19 (18.3%)	8 (7.7%)	31 (29.8%)	42 (40.4%)	104 (100.0%)

4.5.8	It is not necessary to assess diabetic foot regularly	2 (1.9%)	3 (2.9%)	1 (1.0%)	30 (28.5%)	69 (65.7%)	105 (100.0%)
4.5.9	Diabetic patients should have their foot examination recorded in their files at each visit to the primary healthcare facility	52 (49.5%)	37 (35.2%)	5 (4.8%)	4 (3.8%)	7 (6.7%)	105 (100.0%)
4.5.10	I do not like to examine patient's feet as it stinks	0 (0.0%)	4 (3.9%)	5 (4.9%)	30 (29.4%)	63 (61.8%)	102 (100.0%)
4.5.11	I think foot care awareness is important in self-care	75 (72.8%)	19 (18.5%)	0 (0.0%)	3 (2.9%)	6 (5.8%)	103 (100.0%)

In statement 4.5.1, the minority 32/104 (30.77%) disagree that preventing foot problems is less important than sugar control, while most 61/104 (58.66%) agree to sugar control as more important. The remaining 11/104 (10.58%) remained neutral on the subject.

The results clearly show that nursing workers at Sol Plaatje Sub-district think controlling sugar is more important than preventing its complications.

Thus, it is necessary to ensure that these workers also emphasise prevention rather than only controlling the disease.

In statement 4.5.2, an overwhelming majority of 103/105 (98.09%) agreed that education is an indispensable part of their duties whilst only 1/105 (0.95%) had a contrary view on this. Also, one remained neutral on the subject.

These results show that health workers generally have an essential part in educating and counselling patients on different diabetes aspects, notably preventing complications.

Regarding statement 4.5.3, the majority 98/104 (94.23%) agree that it is worth educating a patient with already a lower limb ulcer whilst a minute figure 2/104 (1.92%) disagree with that. The minority 4/104 (3.85%) remained neutral.

The respondents agree that education is important even when there are already complications.

Concerning statement 4.5.4, the nurses being at the centre of their patients' everyday lives, the researcher sought, against this background, to gather their attitude towards their clients' care and concern.

A mighty six respondents (76 + 20) view their patients' foot status as a matter of concern for them, and they have to offer necessary advice. Eight (3 + 5) oppose that view, stating that patients with foot problems should care for themselves, and one was neutral on the subject.

In statement 4.5.5, like in 4.4.29 tab 4.8, where 90% conceded that patients should be educated even in the absence of foot problem, the results here show that 95.24% (100/105) agree that diabetic education is not a waste of time even if patients were not receptive to healthcare worker's advice. Only 3/105 were against this, and a remaining figure 2/105 were not sure whether to educate patients not adhering to the counselling.

In statement 4.5.6, the responses gathered indicate that the majority of 100 (21 + 79) of respondents agree that time constraint should not be an obstacle to educating patients, whilst the minority five (1 + 4) said it is time-consuming to educate diabetic patients.

About statement 4.5.7, the responses gathered indicate that 23 (4 + 19) of nurses agree that they do not have sufficient time to advise patient individually, while only one (0.95%) had disagreed that diabetic foot education is an integral part of their job (refer to 4.5.2); 73 (31 + 42) respondents disagree that they do not have time to advise their patient on taking care of their feet and the remaining 8 were neutral on the matter.

Thus, these workers must make time in their busy schedules to include counselling and advice to patients on diabetic foot care.

In statement 4.5.8, the researcher sought to assess the guideline's attitude, which says foot examination must be an integral component of diabetes management to identify persons at

risk for ulcer and LEA.²⁶ The majority 99 (30 + 69) agree that it is necessary to assess diabetic patient's feet regularly whilst the minority five (2 + 3) disagree with that, and one (0.95%) respondent was neutral to the subject.

The results reflect that healthcare providers (nurses) endeavour to assess their patients' feet whenever the opportunity arises.

Concerning statement 4.5.9, the researcher sought to check the nurse's adherence to the guideline, stating that foot examination should be recorded in the patient file at each visit.²⁶ The majority of 89 (52 + 37) respondents consider that the foot examination findings be recorded in the file at each visit whilst a minority 11 (4 + 7) disagree. Five respondents were neutral on the matter.

The results show that healthcare workers (nurses) should be encouraged to recording diabetic foot examination findings in the file.

About statement 4.5.10, the majority 93 (30 + 63) agree to examine the patient's feet even when it stinks, whereas four disagree; Five were neutral.

The results show that patients with poor hygienic feet are an obstacle to some healthcare providers (nurses) for examining them, which is of concern as these patients will not benefit from healthcare services and may find themselves with many complications.

With statement 4.5.11, the researcher sought to establish whether the respondents do consider making their patients aware of caring for their feet as per SEMDSA guidelines.¹

The majority 94 (75 + 19) agree that patient foot care awareness is essential for self-care whilst nine (3 + 6) disagree.

The results show that it is necessary to ensure that healthcare workers make time to counsel their diabetic patients on a foot problem.

The overall results show that healthcare workers displayed a positive attitude, yet of concern was the lack of awareness about diabetic foot prevention and lack of time to provide advice on foot care. This would sound an alarm and go against the SEMDSA guideline on diabetic foot prevention¹, emphasizing preventing foot problems.

4.6 PRACTICES

Practice can be defined as a method, procedure, process, or rule used in a particular field or profession.⁸⁶ Therefore, it is crucial to ascertain the practices of healthcare workers (nurses) in diabetic foot care. One of the limitations was to assess nurses only and no other categories.

The table below comprises questions where the researcher sought to establish nurses' practices in Sol Plaatje Sub-district regarding diabetic foot care.

The results are shown in the table below.

Table 4.9: Nurses practices on diabetic foot

Category		Yes	No	Total
4.6.1	Have you ever read the diabetes management guidelines for primary healthcare providers?	60 (57.7%)	44 (42.3%)	104 (100.0%)
4.6.2	Have you ever attended a class on how to care for diabetic patient's feet problem?	31 (29.8%)	73 (70.2%)	104 (100.0%)
4.6.3	I do record in the file the foot examination of diabetic patients attending my facility	48 (46.1%)	56 (53.9%)	104 (100.0%)
4.6.4	I do ask patient about their foot problem at each visit	64 (62.1%)	39 (37.9%)	103 (100.0%)
4.6.5	I do practice a 60-second screening Tool assessment for all my diabetic patients	18 (17.6%)	84 (82.4%)	102 (100.0%)
4.6.6	I do check patient's feet for loss of sensation	67 (64.4%)	37 (35.6%)	104 (100.0%)

4.6.7	I do check diabetic patient's feet for any deformity, calluses, infection or ulcer at each visit	60 (57.7%)	44 (42.3%)	104 (100.0%)
4.6.8	I do check diabetic patient's foot wear at each visit	57 (54.8%)	47 (45.2%)	104 (100.0%)
4.6.9	I always discuss diet with my diabetic patients	93 (89.4%)	11 (10.6%)	104 (100.0%)
4.6.10	I educate and encourage diabetic patients on smoking cessation	94 (90.4%)	10 (9.6%)	104 (100.0%)
4.6.11	Do you think you need training in diabetic foot care?	89 (85.6%)	15 (14.4%)	104 (100.0%)
4.6.12	I do not have wound care experience	42 (40.4%)	62 (59.6%)	104 (100.0%)

With statement 4.6.1, 60/104 revealed that they had read the diabetes management guideline, 44/104 said that they have never read such guidelines.

The results show that there is a need to encourage healthcare workers to familiarise themselves with the guidelines.

With statement 4.6.2, the researcher sought to establish whether the healthcare workers (nurses) had a formal experience and had been refreshed on foot care.

The majority 73/104 never attended any class on caring for diabetic foot problems, and a minority 31/104 said they had participated in such course.

The results show that there is a need for refresher courses on diabetic foot prevention and management.

Using statement 4.6.3, the researcher sought to establish, against the background that any diabetic foot examination must be recorded in the file at each visit, nurses' practice regarding their patient's feet history and examination record keeping.

The majority 56/100 do not record their patient's feet examination, in contrast with 85% who agreed that feet examination findings should be recorded in the file (refer 4.5.9 in table 4.9)

The results show a need to consistently encourage healthcare workers (nurses) to record their diabetic patients' foot examinations.

Concerning statement 4.6.4, when asked about whether they ask patients about their feet problem at each visit, 64/103 revealed that they do make enquiries regarding their patient's feet problem, with 39/103 saying they did not make any enquiries.

The results show concern about recording and enquiring, and healthcare workers should be encouraged to inquire about their diabetic patients' feet status.

With statement 4.6.5, the researcher sought to establish whether the healthcare workers practice foot risk assessment on their diabetic patients.

The majority 84/102 said they do not practice a 60-second screening tool, with 18/102 saying they did ask.

The results agree with the 87% who were not aware or did not know about the 60-Second Screening test (refer 4.4.3).

There is a need to increase awareness of diabetic foot risk assessment on healthcare workers.

With statement 4.6.6, the researcher sought to establish the practice of nurses on assessing for foot neuropathy.

Sixty seven of the 104 of respondents said they did check, with 37/104 admitting they did not.

The results contrast with 61% who did not know that "10g monofilament" was used to check for nerve damage (refer 4.4.14). The results may suggest that healthcare workers are using alternative methods such as cotton wool or tuning fork.

About statement 4.6.7, 60/104 said they checked the patient's feet for a problem, whilst 44 said they did not.

There is a small discrepancy of results between question 4.6.6 with 64%, and 4.6.7 with 58% on which we did not have a valid explanation.

From statement 4.6.8, the results show that 57/104 checked their patient's footwear at each visit, with 47/104 saying they did not check.

With statement 4.6.9, the researcher sought to establish whether the nurses practiced diabetic education.

The majority 93/104 said that they do discuss diet with their diabetic patients whilst 11/104 did not.

The results show that not all nursing workers are discussing diet with their patients.

Statement 4.6.10 sought to establish whether healthcare workers practice general prevention strategies as outlined in the SEMDSA guideline.¹

The majority 94/104 respondents said they have educated and encouraged their patients to quit smoking, whilst 10/104 said they did not educate.

The results show that there are still healthcare workers who do not encourage their patients on smoking cessation, which might stem from the fact that they could also be smokers and do not want to project it to themselves.

There is a need to encourage healthcare workers to advocate smoking cessation on their diabetic patients to prevent neurovascular complications as per guideline.¹

With statement 4.6.11, the researcher sought to establish whether the healthcare workers needed to acquire more diabetic foot training.

The results show that 85% (89/104) of respondents need training in diabetic foot care.

There is a need to organise refresher courses and workshops on diabetic foot care.

Statement 4.6.12 sought to establish whether the healthcare workers were experienced in wound care.

The majority, 60% (62/104), said they did not have wound care experience while the minority said they did have wound care experience.

The results show that, as in 4.6.11, the healthcare workers (nurses) need further training in wound care.

The researcher received some comment from the participants who welcomed the survey and expressed satisfaction on the study wishing to get more training on diabetic foot care to improve their knowledge; they also felt that guidelines need to be made readily available at the local clinics.

4.7 Summary

This chapter covered data presentation and analysis. The next chapter will look at the discussion of the results presented.

CHAPTER 5: DISCUSSION

5.1 Introduction

This study aimed to assess the knowledge, attitude, and practice (KAP study) of nursing staff regarding diabetic foot care. The study was performed in the Northern Cape, Sol Plaatje sub-district, primary health centre. The study assessed whether they were aware of national guidelines on diabetic foot care and the 60-Second Screening Tool for diabetic foot risk assessment. Appropriately, this project conceived that an evaluation of knowledge helps design and develop an education program to prevent diabetes-related foot problems. The research participants were of diverse socio-demographic characteristics. The socio-demographic included were gender, age, professional qualification, years of experience.

The major themes identified in the study were: Knowledge, Attitude, and Practices on diabetic foot care. The study revealed that Sol Plaatje sub-district primary health care centres have been implementing measures to limit diabetes-related foot problems and complications. However, the measures include making available guidelines on diabetic foot prevention and management to a limited extent, running education awareness programmes on diabetes and related problems prevention, management, and knowledge management.

Most healthcare workers (nurses) do not know about the guidelines even though it exists; a proper root cause analysis is needed to ensure that prevention and management of diabetes-related problems and complications, notably foot problems and amputations remain effective.

5.2 Knowledge of primary health care nurses on diabetic foot care

Knowledge assessment is important in determining if the healthcare providers have the necessary information required to assist patients in preventing or managing diabetes-related foot problems and complications. As primary contact with the patient and spending more time with the patients, nurses play an essential role in patients education.^{87,88} They can

adequately improve diabetic patients' quality of life by implementing educational programs destined to help patients develop self-care attitudes towards foot care. In the same optic, nurses can identify risk patients in the community, delay or prevent the appearance of diabetes-related feet problems.⁸⁹

The study found that nurses have varying levels of knowledge about diabetic foot care and guidelines.

The study found that 34% of nursing staff in the Sol Plaatje sub-district are not aware of diabetic foot prevention and management guidelines despite knowing the importance of diabetes-related foot problems. The results contrast with the study done by Lilly-West R et al.⁹⁰ in Nigeria, where only 24% of nurses were aware of the guidelines. Similar studies done in Turkey on the evaluation of nurses' knowledge levels of diabetic foot care management highlighted that nurses did not provide patients with sufficient education on the subject or examine the foot despite nurses' high knowledge level.⁶⁵ A study by Schoen D.E, Et al.⁸⁹ on two hundred and forty-six professionals from fifteen rural and remote towns in two health regions of Western Australia found that the use of guidelines in clinical settings was low at 19% among health care providers. A study by Okoroma J et al.⁵⁹ in KwaZulu-Natal (KZN) demonstrated poor compliance with current diabetic guidelines. A survey by Arruda LSNS et al.⁶¹ on 90 nurses from the family health strategy in Brazil found that nurses presented unsatisfactory knowledge at 45,6%, and 79% did not use the protocol to assess diabetic foot.

Lack of knowledge of the guidelines significantly compromises patients care.

It was also of great concern that most nurses did not know the importance and indication of the screening test (60-second diabetic foot screening tool) to prevent diabetic foot problems. Forty-four percent were unaware of the screening tool for high-risk diabetic foot, whilst 43% did not know its indication. This is in line with the study done in Jeddah city, Saudi Arabia, by Abdullah W.H et al.³⁰, which showed a poor level at 30% of nurses' practice regarding screening diabetic foot complications. The study done in Guyana highlighted that the 60-Second Diabetic Screening Tool facilitates early detection and appropriate diabetic foot ulcer treatment. Its implementation had the potential to decrease diabetes-related disability and mortality.⁷³ Having many patients in our city with diabetes and some with diabetes-related

feet problems and amputation, primary health care, especially screening, is pivotal in managing such patients, improving foot care, and preventing foot complications.

The respondents (54%) highlighted that previous history of foot ulcer was a high risk of developing diabetic foot, which is similar to a study done in rural and remote health regions of Western Australia where they found that the healthcare professionals' baseline diabetic foot knowledge was adequate to identify the high-risk category correctly but, stratification of the intermediate-risk category was poor.⁴⁶ Patient education could be improved by encouraging diabetic patients to avoid foot problems by increasing nurses' awareness of the association between previous foot problems and diabetic foot in diabetic patients.

When asked about the impact of the previous toe amputation on diabetic foot, 78% of the respondents explained that previous amputation of only one part of the lower extremity would negatively affect the patient and would be a high risk developing diabetic foot. This is in line with a study done in Jeddah city, Saudi Arabia, by Abdullah W.H et al., where 75.5% of nurses had adequate knowledge regarding diabetic foot complications.³⁰ Every diabetic patient with a history of the previous LEA should be aware of the risk associated with the previous amputation during individual patient care and group discussion and through media and pamphlets.

When asked about Charcot foot cause, 64 (61%) of the respondents explained correctly that it was caused by a significant diabetic neuropathy^{91,92}, which contrasts with the study done in rural Australia by Schoen D.E where the knowledge regarding foot deformities was low.⁶⁹ However, more than 35% were not aware of the causality mode. Therefore, there is a need for further education and training in Charcot's foot for local health care providers, which may compromise individual patient care in preventing foot problems.

It was also of concern that 15% of the nursing workers did not know the importance of smoking cessation in preventing diabetes-related foot problems. A study by Madmoli M et al.⁹³ found increased limb amputation, surgery rate, and 4.3% more hospital referral to prevent foot ulcer infection among smokers than non-smokers. Northern Cape Province has one of the highest smoking prevalence rates in the country at 31% and only 2nd to the Western Cape with over 32%.⁸⁶ A study by Thresia C.U et al.⁹⁴ in Kerala, India, found that 25% of patients were not asked by healthcare providers about their smoking status at the time of

consultation and stated that even when complications occurred, healthcare professionals rarely followed-up on current tobacco use or offered specific cessation messages to patients. A randomized control trial in a primary care setting by Canga N et al.⁹⁵ in Navarre, Spain, concluded that structured smoking intervention managed by a single nurse was effective in changing the smoking behaviour of diabetic patients. Even though the number of diabetic patients smoking in the district is unknown, it is of paramount importance to emphasize the risk associated with smoking to the health care workers to educate and inform patients on smoking cessation.

The survey highlighted that 15% of the respondents did not know that weight loss may reduce the incidence of the diabetic foot, considering that South Africa has the highest level of obesity in sub-Saharan Africa^{96,97}, with 58-65% among diabetic people compared with 9.1% in people from Tanzania, and 7.7% in those from Sudan.⁹⁷ The government has set out targets to reduce obesity prevalence by 10% in 2020.⁵⁰ However, surprisingly a study done in Tehran, Iran by Madmoli M, et al.⁹³ found no significant relationship between Body Mass Index with diabetic foot and limb amputation.

This study also highlighted that 22% of healthcare providers (nursing staff) in the sub-district were not aware of the diabetic foot risk, which is corroborated by the study done in rural and remote health regions of Western Australia by Schoen D.E et al.⁶³ where the findings of the survey had cast doubt on the ability of general healthcare professionals to differentiate risk appropriately, specifically for those at intermediate risk, without clinical decision support tools. Contrasting results were found in a study done in Faisalabad, Pakistan, by Nisa ZU et al.⁹⁸, where 50% of nurses did not know that an ulcer associated with limb ischemia increased the risk of LEA and was a high-risk diabetic foot. The study in Jeddah, Saudi Arabia, by Abdullah M et al.³⁰ found excellent knowledge among nurses on diabetic foot risk factors.

There is a need for health authorities to increase awareness of healthcare workers on diabetes-related foot problems and risks to improve patients' care and prevent foot problems and amputation.

This study indicated that only 52% of respondents were referring timeously diabetic foot patients for specialist care. Spanos et al.⁹⁹ pointed out an increased probability of major amputation with each extra day to assessment. Yan et al.¹⁰⁰ reported an increased probability

for those waiting for more than 30 days compared to those waiting for less than 7 days. It was also noted that 48% of the respondents were not aware that any foot deformity or ulcer constituted a high-risk diabetic foot and warranted a specialist referral for appropriate care and management, contrasting this with a study done on how to do a 3-minute diabetic foot exam by Miller JD et al.¹⁰¹ and a survey by Mishra SC et al.⁶⁹, India, which recommend urgent referral to specialised diabetic foot centre or general surgery for care and rehabilitation. A study by Kaya Z et al.³² found that 96.8% of nurses were aware of foot deformity being a reason for referral for appropriate care, which differ from the 52% in this study.

This is of concern as many patients found themselves in an advanced stage of complications leading to lower extremity amputations, non-healing ulcers, and all-cause mortality.¹⁰² As per Donohoe E et al.¹⁰³, the provision of integrated care arrangements for the diabetic foot positively impacts primary care staff's knowledge and patients' attitudes, resulting in an increased number of appropriate referrals to specialist services. Therefore, there is a need for health authorities to raise awareness of the staff regarding diabetes-related feet complications and facilitate referral channels to higher institutions for specialised care.

It was also of great concern that the majority 61% of the interviewees were not aware of the 10g monofilament as a tool used to assess feet neurology as outlined in the guidelines.¹ This contrasts with the nurses' average of 74.9 points on the use of 10 g monofilament in a study on nurses' knowledge about caring for diabetic foot done by Arruda LSNS et al.⁶¹, Brazil. A study by Schoen DE et al.⁴⁶ on improving rural and remote practitioners' knowledge of the diabetic foot found that 10 g monofilaments were not readily available in rural and remote health services. However, Bus et al., 2020.¹⁰⁴ reported that the International Working Group's recently updated guideline on the diabetic foot has incorporated the Ipswich touch test (IpTT) to identify loss of protective sensation by the non-specialist practitioner or when equipment is not available.

This contrasts with the majority outlining that they were aware of the guidelines but demonstrates poor compliance. Thus, the question is how familiar the respondents are with the said guideline's content and whether the district is making available tools for feet assessment in compliance with the guideline. It would be appropriate for the health authorities to do a root cause analysis of this problem.

The study highlighted that 84% of the respondents were aware of diabetic foot education. This is similar to the study done in Pakistan by Nisa ZU et al.⁹⁸, where 88% of nurses responded that it was their responsibility to educate diabetic foot patients. The study by Asha A et al.¹⁰⁵ outlined that patients at increased risk of a major complication never received diabetes education, and more efforts to raise healthcare providers' awareness to improve diabetes management through education are urgently needed and will provide a valuable basis to plan for future diabetes care planning strategies.

However, emphasis should be put on footwear as many respondents indicated that only tight shoes were a problem for diabetic patients but not big unfitting shoes.

There is a need for the authority to increase awareness of the healthcare workers on footwear through seminars and workshops.

The results of this study showed that health care providers (nurses) possessed a higher level of knowledge on diabetic foot education and could assist their clients accordingly. Knowledge of diabetic foot risk factors, cause, and specialist referral needs to be improved to facilitate diabetic patients' behaviour change. Also, knowledge about diabetic foot examination, especially regarding instrument or tool used to assess the foot's neurological state, needs improvement. There is a need for further health promotion against diabetes-related foot problems and a pressing need for guidelines dissemination and implementation review in South African public health hospitals if evidence-based guidelines have to guide patient care.⁵⁹ Furthermore, the findings accentuate the need to increase healthcare workers' awareness of diabetic foot problems through seminars, workshops, tutorials, and other educative programs.

5.3 Attitude of primary health care nurses on diabetic foot care

Attitudes are essential in how healthcare workers perform their duties in handling diabetic patients with or without foot problems. The results gathered indicated that 81% of the respondents strongly agreed to diabetic foot education as an essential and integral element of their jobs. It is not a waste of time because it is worth educating patients on diabetes-related foot problems. The results are not parallel to studies done by Kaya Z et al.³², who found that 80.9% of nurses did not educate diabetic foot risk patients.

The majority, 91% of the respondents, highlighted that it was their concern to care about diabetic patients with foot problems, which is higher than the results obtained in Nigeria by Lilly-West R et al.⁹⁰, where only 56% of the nurses assessed the feet of their diabetic patients. Similar results were obtained in a study done by Nisa ZU et al.⁹⁸, where 88% of nurses agreed that it was their responsibility to care about diabetic foot patients.

Despite the concern from healthcare providers (nurses) to care for diabetic foot patients, 59% of the respondents said that diabetic foot prevention is not as important as sugar control, which is similar to the results obtained by Abdullah M et al.³⁰ where only 30.8% had screened patients for diabetic foot complications. This is of concern as not emphasising glycaemic control on foot problem prevention can be detrimental to the patient and be a source of poor glycaemic control. There is a need for the authority to increase awareness of the healthcare workers on diabetic foot prevention through workshops, refresher courses.

An overwhelming majority of those surveyed highlighted that providing diabetic foot education was not a waste of time, even if the patient would not be receptive to the health care provider's advice. Similar studies done in Pakistan on KAP among 250 nurses towards diabetic foot highlighted that the majority, 182 (73%) of the interviewees, said it was not time-consuming to carry out Diabetic foot care.⁹⁸ A study by Ren M et al.¹⁰⁶ highlighted that intensive nursing education helps prevent diabetic foot ulceration and decrease amputation among patients at high risk for the diabetic foot.

Seventy-five percent of those interviewed stressed that the patient's diabetic foot examination should be recorded in their files at each visit, which is not similar to the results shown in Tab 4.6.3, where 54% of the nurses did not record the findings of diabetic foot exam.

Ninety-one percent of the respondents also stressed the need to examine diabetic patient's feet regularly regardless of the inconvenience of the foot's condition, which is in contrast to the results obtained in Dar es Salaam where only 27% of the interviewees reported having their feet examined by a health care provider at least once since their initial diagnosis.¹⁰⁷

5.4 Practices of primary healthcare nurses on diabetic foot care

SEMDSA guidelines on diabetic foot prevention and management recommend diabetic patients to receive education on good foot care behaviours and ulcer prevention. Healthcare professionals should integrally identify diabetic foot risk patients by frequently examining their bare feet and screening for peripheral neuropathy using the 10g monofilament or tuning fork.¹

This study found that 58% of the respondents have cognisance of the diabetic foot care guideline. In contrast with the majority, 61% are not aware of peripheral neuropathy's screening tool, which implies that many read documents. Still, they do not perceive all the facts and relevant information. These results are similar to several studies where the results have shown that most people with diabetes do not receive guideline-recommended foot care, including regular foot examinations.⁶³

Given this discrepancy between reading and knowing, it becomes imperative to summarise or highlight the essential points needed to be captured by the healthcare workers for practice purposes. Hence, the need to promote and make the 60-Second Screening Tool available for a rapid glance at all the district facilities.

When asked about diabetic foot class attendance, 70% of the nursing staff highlighted that they never attended such class, which is similar to studies done in Brazil on nurses' knowledge about caring for the diabetic foot by Aruna LSNS et al.⁶¹, where 62% of the interviewees indicated that they had not participated in courses or training on diabetic foot care. Nurses who have already attended diabetic classes are likely to offer education on foot care than those who have never attended any such class. This is similar to the study done in Jeddah city,

Saudi Arabia, by Abdullah W.H et al.³⁰, where 60% of those who attended diabetic foot course had at least sound knowledge compared to 36% for those who never participated in a class.

The research also revealed that only 46% of the nursing staff stated that they record the findings of their patient's foot examination, whereas the majority, 54%, do not record at all. For those who record, the question to ask will be how constant they are in their recording. The results findings are similar to the study done in a random survey of 18 community health care centres in the Western Cape in 2008 by Steyn K et al.⁵⁸, which found that only 11.3% of diabetic patients had their foot examination recorded. A study by Okoroma J, et al.⁵⁹ in a regional hospital at KwaZulu-Natal found that only 6% of patients had their feet examination recorded in the file.

More than a third of the respondents highlighted that they do not regularly ask their patients about their feet status, which is similar to the study conducted by Basu et al.⁶³ in the United Kingdom, where 33% of the interviewees did not recall receiving information about foot care. The results are in contrast with the study done in Pakistan by Nisa ZU et al.⁹⁸, where only 10% highlighted that it was not necessary to assess feet status regularly, and a study done in turkey where 77.5% of nurses did not perform a physical examination of their diabetic foot patients.³² A study by Okoroma J et al.⁵⁹ in KZN found that comprehensive foot examination was carried out in only 6% of patients, whilst a study by Abdullah M et al.³⁰ illustrated that majority of the nurses performed feet inspection of diabetic patients.

This study showed that 82% of the healthcare providers (nursing staff) do not practice a 60-second screening Tool assessment, which correlates with the results shown in figure 4.5, where the majority were not aware of the test. These results are comparable to the studies done in Saudi Arabia by Abdullah W.H et al.³⁰ where the general practice regarding screening was poor at 30.8%. Also, Kaya Z et al.³² found that 77.5% of the nurses did not perform a diabetic foot examination for diabetic patients.

The SEMDSA guidelines recommend all type 2 diabetic patients to receive education on foot care practices and ulcer' prevention. However, this study found that 86% of the respondents do not have training in diabetic foot care, which can compromise diabetic patient's education, as also noted in a study by Kaya Z et al.³²

These results are comparable to those found in studies conducted in three teaching hospitals, Sri Lanka by Kumarasinghe S.A et al.³⁹, where 91% of nurses reported a lack of formal wound care training. Also, studies by Kaya Z et al.³² and Lilly-West B.R, et al.⁹⁰ reported that only 34% of the nurses were trained in diabetic foot care, among which 29% received training related to the diabetic foot within the curriculum of nursing education.

Lack of knowledge on diabetic foot care assessment tools can explain the increase in foot complications as most clinicians do not screen or offer brief foot care advice missing; therefore, the opportunities to identify on time some foot problems, this calls for further studies which focus on understanding the way clinicians assess feet neurology in-order to implement practical and useful feet assessment and care programs.

5.5 Limitations of the study

This study only focused on healthcare providers (nursing staff) working in Sol Plaatje Sub-District, Kimberley, Northern Cape. It cannot be generalised to all nursing staff in the country without assumptions as it is not a national representative sample. There may be under, or over-emphasis of nurses' knowledge, attitude, and practices, which may end up skewing the results as the non-validated questionnaire might not have been exhaustive on diabetic foot risks. Some respondents did not complete all sections of the questionnaire because of partial knowledge and other reasons. The pandemic of SARS- COVID 19 made it difficult to attend to all targeted populations as many institutions were not operating as they would during ordinary times. The anonymous identification system made it challenging to follow up with respondents and trace questionnaires. The KAP study being a self-reported method and the use of non-homogenous group of participants are possible limitations that might impact the study findings.

5.6 Conclusion

This study aimed to assess the knowledge, attitude, and practice (KAP study) of nursing staff, regarding diabetic foot care in the Northern Cape, Sol Plaatje Sub-district primary health centres. To assess whether they are aware of the existence of national guidelines on diabetic foot care and the 60-Second Screening Tool for diabetic foot risk assessment.

How knowledgeable is the Northern Cape primary healthcare providers on diabetic foot care? The study found a discrepancy in the knowledge of the guidelines and the 60-Second Screening tool. Most nursing staff in the Sol Plaatje sub-district were not aware of the diabetic foot risk assessment screening tool despite being aware of the guideline. However, the guidelines' knowledge raised some interpretation questions, as many were not cognisant of the information or recommendations prescribed by the said guidelines. Neither the guidelines nor the brief Screening tool has been made available at primary healthcare centres, which negatively affects the providers in discharging their responsibilities of caring and educating diabetic foot patients. It was noted with concern that they were not aware of the tool used to assess foot neurology, whereas such knowledge is critical in identifying and preventing foot problems. The nurses were also unaware of an active plantar foot ulcer and bony deformity needing an urgent specialist referral for appropriate care.

On the other hand, many different initiatives could have been put into place by Sol Plaatje Municipality's health authority, including knowledge management and organisational learning. Those findings imply that Sol Plaatje employed less knowledge management initiatives and could not achieve its full potential in assisting diabetic patients on foot care to prevent diabetes-related feet problems.

What are the attitudes of health care providers (nurses) on diabetic foot care? The study found that the respondents agree that diabetic education is an essential component of their job, and it is necessary to provide regular foot assessment. They also agree that foot examination should be recorded at each visit in the patient's file while also highlighting that foot care awareness constitutes an important self-care element. However, the big concern was on the respondents highlighting that sugar control was more important than preventing foot problems. This attitude may compromise many patients as healthcare providers will be

more focused on checking the sugar level while forgetting or omitting to assess all possible complications that might have arose and prevent the impending or imminent ones. These findings imply a lot needs to be done at the policy level to change care providers' attitudes on diabetic foot care.

What are the practices used by health care providers (nurses) on diabetic foot care? This study found that forty-four clinicians have never read about the diabetic foot guideline, which implies their practice is not evidence-based or in line with the guidelines. Most of the nursing staff never attended a class on how to care for diabetic foot problems, do not record their patient's feet examination, and do not practice a 60-Second Screening Tool, resulting in poor foot care and diabetic foot prevention problems. The study also found that most nurses need training in diabetic foot care, which is critical in providing good education and counselling on diabetic foot care to their patients.

This study, therefore, concludes that South Africa has existing diabetic foot care guidelines which are not promoted, implemented, or made available in the Sol Plaatje Sub-district as the awareness of the guidelines may result from the nursing school but not from different facilities: As a result, 36 nursing providers are not aware of its availability, and 44 had never read about it making them not able to assist patients with education, awareness prevention, and foot care measures ultimately. The 60-Second Screening tool is not promoted and not available in different facilities, which makes it difficult for every diabetic patient to benefit from a comprehensive assessment of disease in a brief time: As a result, 60 nurses either do not know or are not aware that it is a screening tool for the high-risk diabetic foot.

This study concludes that most clinicians display a negative attitude toward preventing diabetes-related feet problems and putting much emphasis on blood sugar control, which is of concern as many patients may have their diabetes controlled but with complications that could have been prevented.

It can also be concluded that the practices of caring for diabetic foot are not adequately followed, with most of the nursing staff not adhering to routine recommendations such as screening for peripheral neuropathy using the 10g monofilament to assess LOPS or recording in the file the foot examination of their patients.

5.7 Recommendations

- 1) Training and development of healthcare providers – There is a need of developing an educational training program structured for nurses dealing with diabetic foot disorders and to make available the guidelines on diabetic foot care readily and brief screening tool assessment for high-risk diabetic foot patients (the 60- Second Screening Tool) to enhance the knowledge of the nursing staff as noted by the forty-two nurses who are either not aware or do not know of the existence of the Society for endocrinology, metabolism, and diabetes of South African guidelines of May 2017. There is a need to train healthcare workers (nurses) on diabetic foot problem assessment, care, prevention, and management through refresher courses, academic presentations, conferences, seminars, and workshops to increase their patients' awareness of feet self-care.
- 2) Leaflet distribution to diabetic patients – The research proposes the production and printing of diabetic foot care leaflets to hand out to diabetic patients attending the clinic at each visit to increase their feet problem awareness and the importance of self-care.
- 3) Diabetic education classes – the author proposes the establishment of a diabetes provincial coordinator to spearhead policy implementation and organise diabetic education classes in general or interest clubs as practiced in the Free State, and encourages healthcare providers to include information gathering and recording of feet examination as one component of the physical examination for diabetic patient visiting clinics. Also to allocate sufficient time to HCWs to provide advice on diabetic foot care.
- 4) Referral system – The author proposes creating a district team specialist composed of professional nurses, Dietitians, physiotherapist, occupational therapist, family physician, and surgeon specialist to assist the clinics and the district hospitals within the province on supervising preventing and managing appropriately diabetes-related foot complications.

- 5) The study focused on nursing staff only. It would be useful to assess other categories of care providers such as doctors and the KAP of diabetic patients themselves in our district. This would help develop interventional and preventive measures from the healthcare providers' views and the patients' perspective.
- 6) Application of the primary health guidelines on diabetic foot management and prevention should be emphasised and monitored to enhance nurse's attitude on prevention. The adverse effects of diabetes-related feet complications cannot be overlooked or undermined; thus, there is a need for on-going and further study on knowledge, attitudes, and practices of PHC workers issues on diabetic foot care both locally and globally.
- 7) By doing this research, we aim to improve the awareness of nurses on national guidelines and screening tools, identify areas where more training is needed to enhance the quality of care in the management of the diabetic patient with and without complications with the hope of preventing lower extremity amputations (LEAs) in the Sub-district in the future.

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CHAPTER 6: APPENDICES

Appendix A – Questionnaire

Appendix B – Participant Information Sheet

Appendix C – Letter of Approval: Health Sciences Research Ethics Committee

Appendix D – Letter of Approval: Northern Cape Department of Health

Appendix E – “TurnItIn” report

APPENDIX A: QUESTIONNAIRE

TITLE:

“KNOWLEDGE, ATTITUDE AND PRACTICE ON DIABETIC FOOT CARE
AMONG NURSING STAFF AT PRIMARY HEALTH CARE FACILITIES IN
SOL PLAATJE SUB-DISTRICT, KIMBERLEY”

Date

...../...../.....(dd/mm/yy)

**Please complete in the available spaces or mark the appropriate option with an X
By filling in this questionnaire, you give consent for the analysis.**

Section A: Demographic variables

1) What is your Gender?

Male	Female

2) What is your Age? (In years at last birthday)

.....years

3) What is your Professional qualification?

Professional Nurse	Enrolled Nurse	Auxiliary Nurse

4) How many Years of experience do you have since your degree?

--

Section B: Research questionnaire

A. KNOWLEDGE ON DIABETIC FOOT CARE

Please indicate with "X or \sqrt " if the following statements are True or False

		True	False	Don't know
1	South Africa has a diabetic foot guideline for primary healthcare professionals			
2	Diabetic foot is associated with neurological and vascular damages			
3	A 60-second test is a screening Tool for low risk diabetic foot			
4	A history of previous ulcer is a high risk diabetic foot only if both feet were affected			
5	Previous amputation of only one toe is not a high risk diabetic foot			
6	Charcot foot is a foot deformity caused by significant nerve damage			
7	Absence of foot pulses is a high risk only if both dorsalis pedis and posterior tibialis pulses are affected			
8	Calluses, blisters, fissures and ulcer are high risk diabetic foot but not the ingrowing toenail			
9	Foot deformity alone is not enough risk for specialist referral			
10	Specialist referral can be delayed if there is only foot deformity but pulses are present			
11	Specialist referral can be delayed if there is only an active ulcer but pulses are present			
12	Absence of pulse needs urgent referral but not an active ulcer or bony deformity			
13	Part of Foot exam consists of checking 4 th and 5 th web spaces and nails			
14	10g monofilament is used to check for nerve damage in the foot			
15	Smoking cessation is not important to prevent diabetic foot			
16	High blood sugar and cholesterol is high risk diabetic foot			
17	Weight loss can reduce the incidence of diabetic foot			
18	Poor blood supply to the legs can increase diabetic foot risk			
19	Diabetic patients should be encouraged to sit with their legs crossed			
20	Diabetic patients should not dry between their toes unless they have obvious ulcer			
21	Diabetic patients should trim their toenails only if it is painful			
22	Diabetic patients should not inspect their shoes prior to wearing them if their sugar is well controlled			

23	Diabetic patients should not bother to wash their feet everyday if it is not dirty			
24	Diabetic patients should always check water temperature before washing feet			
25	Diabetic patients are allowed to walk barefoot only on clean surfaces			
26	Diabetic foot patients already referred and awaiting for specialist appointment do not need any education on what changes to observe while awaiting			
27	A negative results for the "60-Seconds Foot Screening Tool" do not require referral to the specialist			
28	A patient with a negative results for the "60-Second Foot Screening Tool" needs to be examined on a yearly basis			
29	Diabetic patients need education only if they have foot problems			
30	Diabetic patients should not wear tight shoes but very ample non fitting shoes			

B. ATTITUDE ON DIABETIC FOOT CARE

Please tick in the appropriate space provided

		Strongly agree	Agree	Neither Agree Nor disagree	Disagree	Strongly disagree
31	I think Diabetes control is more important than preventing foot problem					
32	Diabetic education is an important part of my job					
33	It is not worth educating a patient who has already developed an ulcer					
34	I don't think patients with diabetic foot problem are my concern					
35	Diabetic education is a waste of time as patients are not receptive to healthcare providers' education					
36	I do not educate diabetic patients on foot problem because it is time consuming					
37	I do not have sufficient time to advise each patient individually on how to look after their feet					
38	It is not necessary to assess diabetic foot regularly					
39	Diabetic patients should have their foot examination recorded in their files at each visit to the primary healthcare facility					
40	I do not like to examine patient's feet as it stinks					
41	I think foot care awareness is important in self-care					

C. PRACTICE ON DIABETIC FOOT CARE

Please tick in the appropriate space provided

		Yes	No
42	Have you ever read the diabetes management guidelines for primary healthcare providers?		
43	Have you ever attended a class on how to care for diabetic patient's feet problem?		
44	I do record in the file the foot examination of diabetic patients attending my facility		
45	I do ask patient about their foot problem at each visit		
46	I do practice a 60-second screening Tool assessment for all my diabetic patients		
47	I do check patient's feet for loss of sensation		
48	I do check diabetic patient's feet for any deformity, calluses, infection or ulcer at each visit		
49	I do check diabetic patient's foot wear at each visit		
50	I always discuss diet with my diabetic patients		
51	I educate and encourage diabetic patients on smoking cessation		
52	Do you think you need training in diabetic foot care?		
53	I do not have wound care experience		

Any additional comments

Thank you for participating in this study. Please place the completed questionnaire in the enclosed envelope and seal it.

APPENDIX B: INFORMATION SHEET

Study title:

“Knowledge, attitude and practice on Diabetic Foot Care among nursing staff at Primary Health Care facilities: case of Sol Plaatje Sub-District, Kimberley, Northern Cape”.

Researcher : Dr LGJ Mafusi; Registrar Department of Family Medicine, UFS
Co researcher : Prof WJ Steinberg, Department of Family Medicine, UFS
: Dr M. Harmse, specialist family physician

Dear participant

My name is Labala Guy-juste Mafusi, a student at Free State University and I am currently studying towards an attainment of a Master's Degree in Family Medicine. As part of my studies, I am conducting a research study on the topic: knowledge, attitude and practice on Diabetic Foot Care among nursing staff at Primary Health Care facilities – a case of Sol Plaatje Sub-District, Kimberley, Northern Cape.

There has been an increase in the prevalence of diabetes with its related complications in South Africa particularly and the world in general. Despite care that many patients are receiving from various institutions, there is a significance increase in diabetic foot complications leading to lower limb amputations thus devastating not only the family but the whole society.

I would like, therefore, to invite you to take part in my research study which is a descriptive cross- sectional study assessing knowledge, attitude and practice on diabetic foot care. The sample includes 144 nurses working in different primary healthcare facilities in Sol Plaatje Sub-District.

The participants are expected to answer the questions that will be presented to them by the researcher in English. The research questionnaire takes about 20 minutes and is divided in 2 parts, where part 1 is on general and demographic information. Part 2 is asking about knowledge, attitude and practice on diabetic foot.

Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or would like more information. Take time to decide whether or not to take part

Participants of this study are primary health care workers (nurses) working in Sol Plaatje sub-district. The decision to involve this study population is that they are the health stuff that is first in contact with most patients in the community prior to referral to higher levels of care.

The following conditions apply:

- Your participation in this project is voluntary and you may refuse to participate or withdraw from the project at any time with no negative consequence.
- Your expressed consent is sought before you engage in the study.
- No participant will be injured or harmed physically or emotionally throughout the research process.
- All participants' names and identity will not be asked and all responses and research findings will be treated professionally without being associated to any specific individual. Individual participant research data (questionnaires) will be anonymous and given a research code, known only to the researcher. The questionnaires will be kept in locked cupboards and information uploaded in the computer will be password protected.
- The research involves you filling up a questionnaire and no further participation after that.
- I cannot promise the study will help you but the information we get from the study will help to understand the level of knowledge, attitude and practice on diabetic foot care in our health facilities and to plan interventions on improving diabetic foot care.
- If you have a concern about any aspect of this study, you should ask to speak to the researcher who will do his best to answer your questions.

- The results of the study may be published in a journal

For any queries and concerns regarding the research study feel free to contact Dr LGJ Mafusi on 0732434238 or 0538022002








Contact details of secretariat and Chair: Ethics Committee of the Faculty of Health Sciences, University of the Free State – for reporting of complaints/ problems: Telephone number +27 (0)51 401 7794/5

If you chose to fill in the questionnaire after reading the information sheet is regarded as giving consent.


Thank you for participating in the study.

LGj Mafusi(justemafusi@gmail.com or 0732434238)

Appendix c: Letter of Approval: Health Sciences Research Ethics Committee

  	
Health Sciences Research Ethics Committee	
23-Mar-2020	
Dear Dr Labala Mafusi	
Ethics Clearance: Knowledge, attitude and practice on Diabetic foot care among nursing staff at primary health care facilities in Sol Plaatje Sub-district, Kimberley Northern Cape, South Africa	
Principal Investigator: Dr Labala Mafusi	
Department: Family Medicine Department (Bloemfontein Campus)	
APPLICATION APPROVED	
Please ensure that you read the whole document	
With reference to your application for ethical clearance with the Faculty of Health Sciences, I am pleased to inform you on behalf of the Health Sciences Research Ethics Committee that you have been granted ethical clearance for your project.	
Your ethical clearance number, to be used in all correspondence is: UFS-HSD2019/1884/2104	
The ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.	
We request that any changes that may take place during the course of your research project be submitted to the HSREC for approval to ensure we are kept up to date with your progress and any ethical implications that may arise. This includes any serious adverse events and/or termination of the study.	
A progress report should be submitted within one year of approval, and annually for long term studies. A final report should be submitted at the completion of the study.	
The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act, No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite); Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.	
For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email EthicsFHS@ufs.ac.za .	
Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.	
Yours Sincerely	
	
Dr. SM Le Grange Chair : Health Sciences Research Ethics Committee	
<hr/> Health Sciences Research Ethics Committee Office of the Dean: Health Sciences T: +27 (0)51 401 7795/7794 E: ethicsfhs@ufs.ac.za FNB 08011892; BIC 236438-011; JORC 0010096; FWA 00027947 Block D, Dearth Division, Room D004 P.O. Box/Postbus 339 (Internal Post Box G40) Bloemfontein 9300 South Africa	
 	

Appendix D: Letter of Approval: Northern Cape Department of Health

	DEPARTMENT OF HEALTH	OFFICE OF THE HOD
	LEFAPHA LA BOPHELO BO BOTLE	Executive Offices
	DEPARTEMENT VAN GESONDHEID	Northern Cape Department of Health
	ISEBE LEZEMPILO	Du Toit Span Road, Belgravia P/Bag X5049, Kimberley, 8300 Tel: 053 830 2134 Fax: 086 485 3243 Email: irelsmith@ncpg.gov.za

Engelies: _____	Date: _____
Diphetisiso: _____	Leshepelo: _____
Isibhozo: _____	Umhlo: _____
Isicelo: _____	Datane: _____

Reference: _____	Mr. B Mashute	26 February 2020
Tshupoko: _____		
Isibhisho: _____		
Vervysing: _____		

NC_2020SOL_001

Dr Labala Mafusi
07 Carters Glen
Kimberley
8301

Project Title: Knowledge, Attitude and Practices on Diabetic Foot Care among Nursing Staff at Primary Healthcare Facilities in Sol Plaatje Sub-District, Kimberley Northern Cape, South Africa.

Dear Dr. Mafusi


The application for gate-keeper's permission to conduct the above-mentioned research study in Sol Plaatje Sub-District, Northern Cape Province was received.

Decision: Approval is granted to conduct this research study in public primary healthcare facilities in Sol Plaatje Sub-District as indicated in your research proposal.

The reference number for this research project is **NC_2020SOL_001**, please use this reference number in all you communication with the Provincial Health Research Coordinator (BMashute@ncpg.gov.za or 053 830 2134)

Please note the following:

1. The researcher is hereby requested to make all necessary arrangement with each facility management prior to visiting each facility, so that the provision of healthcare services is not affected by this research project.



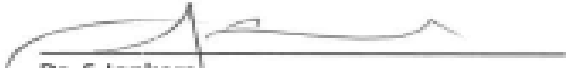
We are committed to achieving our vision through a decentralized, accountable, accessible and constantly improving health care system within available resources. Our caring, multi-skilled, effective personnel will use evidence-based, informative health care and nurturing partnerships for the benefit of our clients and patients.

2. Approval for this research study is granted for a period of one (1) year from the date of approval.

Please note the following conditions:

1. This project must be conducted at no cost to the Northern Cape Department of Health.
2. This approval is limited to the research proposal as submitted in the application.
3. There must be no modification or modification on the research project.
4. The Research Unit may monitor the research progress at anytime
5. At the completion of your study, a copy of your final report must be submitted to the Research and Development Unit
6. The Northern Cape Department of Health Senior Management Committee shall be briefed on the outcome of the study prior publishing

Yours' faithfully



Dr. S Jonkers
Head of Department
Northern Cape Province
Department of Health

Date

Appendix E: TurnItIn report

KNOWLEDGE, ATTITUDE, AND PRACTICES ON DIABETIC FOOT CARE AMONG NURSING STAFF AT PRIMARY HEALTH CARE FACILITIES IN SOL PLAATJE SUB-DISTRICT, KIMBERLEY

ORIGINALITY REPORT

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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