Psychology Research on Education and Social Sciences, 4(1), 7-19, March 2023
e-ISSN: 2717-7602
dergipark.org.tr/press

Young Wise Publishing
youngwisepub.com
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Research Article

The risk stratification of the diabetic foot and foot neuropathy in patients in the greater Durban area

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Article Info

Received: 17 February 2023
Accepted: 28 March 2023
Online: 30 March 2023

Keywords:
Diabetes
Diabetes Foot Screening and Risk Stratification
Diabetic foot ulcers (DFUs)
Foot neuropathy
Lower extremity amputations (LEAs)

Abstract

With the rapid growth of diabetes, there are increased complications, particularly in patients' lower limbs. Diabetic foot ulcers affect 10-20% of the diabetic population. Early detection and management of risk factors can significantly reduce the development of diabetic foot ulcers and prevent foot amputation. A risk stratification tool can detect these risk factors and avoid amputation. This study aimed to identify and categorise diabetic patients into risk categories based on their diabetic foot status. The study was conducted in the greater Durban area in the KwaZulu-Natal province. The authors used a cross-sectional observational study design. The study population consisted of 155 diabetic patients. The Diabetes Foot Screening and Risk Stratification Form were used as data collection instruments. The study found that several patients who presented with diabetes were potential candidates for diabetic foot ulcers, and these patients needed immediate attention and care. Furthermore, it was identified that more males presented with diabetes and foot complications in the Durban area than females. From the results, it was concluded that diabetic patients should become conscious of foot care. Foot care education is recommended, and patients should be made aware of foot care, self-examination, and the need for medical attention.

To cite this article

Venketsamy, L.A., & Hu, Z. (2023). The risk stratification of the diabetic foot and foot neuropathy in patients in the greater Durban area. *Psychology Research on Education and Social Sciences, 4*(1), 7-19.

Introduction

The prevalence of diabetes is increasing worldwide [World Health Organisation (WHO), 2019]. Purbhoo and Swart (2015) found that many patients consulting at podiatry clinics in Johannesburg had diabetes. The number of patients presenting with diabetic foot ulcers (DFUs) and lower extremity amputations (LEAs) globally has significantly increased (Mehta *et al*., 2009). There is a 15% greater chance of foot ulcerations and amputations within the diabetic population if early treatment is not received (Shearman, 2015). Many individuals who develop diabetic peripheral neuropathy (DPN) often experience a loss of sensation in their feet. These include the sensation of light touch, pressure, pain, and temperature. Foot pathologies are often linked to an increased risk of an individual developing a DFU and undergoing LEA (Shearman, 2015; Atsona & Larbie, 2019). Due to a lack of sensation, diabetic patients are at a greater risk of injuring their feet without knowing (Vinik *et al*., 2018).

Diabetes is the fourth major cause of death in KwaZulu Natal. Between 2006-2015, an estimated increase of 305% of diabetic patients visited clinics in Durban (Department of Health-KZN, 2018). Of the 11 districts, Durban has the highest percentage (36.68%) of registered diabetic patients (Sahadew & Singaram, 2019), thus causing financial burdens to the health sector (Vileikyte, 2001). Early detection of diabetic foot pathologies can significantly reduce the risk of

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DFU and LEA, thus reducing the social and economic strain on patients and the healthcare sector (Monteiro-Soares *et al*., 2012; Shearman, 2015). Therefore, Ntuli *et al*. (2018) recommended podiatric treatment as part of the primary healthcare system, where diabetic patients receive appropriate medical treatment and accurate assessment of the patient's feet (Fernandez-Torres *et al*., 2020).

The diabetic foot ulcer risk stratification tool is an example of an assessment tool that can be used to screen patients. This tool allows for identifying and predicting patients who are likely to develop pathologies that can lead to LEAs. It will enable health practitioners to categorise and prioritise patients to prevent DFUs and LEAs (Gordon & Bitton, 2013). Risk stratifications can and should involve regimes and algorithms, although the data and results are highly dependent on the examination by the healthcare practitioner (Monteiro-Soares *et al.*, 2012). This study aimed to identify and categorise diabetic patients into risk categories based on their diabetic foot status. The patients presented themselves at the podiatry clinics in the greater Durban area.

The Diabetic Foot Risk Stratification

Diabetic foot risk stratification identifies clinical features of individuals with diabetes predictive of the relative risk of foot ulceration (Crawford *et al*., 2007). Akinbode and Yewande (2017) stated that 80% of diabetic-related amputations are preventable with early detection and intervention; Ntuli *et al*. (2018) agree that early intervention is a significant preventative measure. Due to limited data on diabetic foot risk stratification in South Africa, this study seeks to identify, document, and describe diabetic foot risk stratification of patients in the greater Durban area.

Diabetic Foot Complications

Diabetes mellitus is a rapidly growing disease affecting the public and private health sectors (Shearman, 2015). In South Africa, according to van Wyk and Mostert (2018), almost 10% of the population has diabetes, with type 2 diabetes being the more prevalent. In Durban, an average of six lower limb amputations are performed daily (Mbatha, 2017); almost. In 2018, it was reported that estimated f 2500 amputations per annum were performed in the public health sector due to diabetes (KZN Department of Health, 2018). Mehta *et al.* (2009) state that chronic and uncontrolled diabetes often leads to the feet developing macro and microvascular disease, peripheral neuropathy and structural changes. They further state that diabetic foot diseases occur when an individual has diabetic peripheral neuropathy (DPN) and PAD factors.

Diabetic Peripheral Neuropathy (DPN)

DPN is a symmetrical, length-dependent, sensorimotor polyneuropathy that is due to prolonged elevated blood glucose levels. Depending on the onset of diabetes, blood glucose control, and age, DPN can be prevalent in up to 50% of these individuals (Yates, 2012). Up to 30% of people with diabetes can experience symptoms of neuropathy. Individuals with DPN can develop atrophy in the small muscle of the foot; this can cause abnormal plantar pressure due to an increase in bony prominences and a loss of supportive surface (Frowen *et al.*, 2012).

Diabetic Foot Ulcers

Diabetic foot disease, including DPN and PAD, can affect one-third of the global diabetic population, increasing this figure (Levy & Gilbrand, 2019). This can lead to an increase in DFUs, resulting in amputation. DFUs can be classified as neuropathic, ischemic, or neuro-ischemic, which can be found with or without infection. These incidences of uncontrolled diabetes significantly increase the risk of infection, which could result in amputation (Shearman, 2015).

Peripheral Arterial Diseases

Arterial diseases are considered the most dangerous form of circulatory pathologies, as arterial diseases can significantly decrease one's quality of life and result in the loss of limbs (Frowen *et al.,* 2012). The diabetic foot can be affected by PAD with or without a history of trauma and infection (Frowen *et al*., 2012). Sherman (2015) noted that the risk of developing PAD is up to four times higher in the diabetic population and 8% of people with type two diabetes have

PAD. Within the diabetic population, the risk of lower limb amputations can be estimated between 10 and 16 folds compared to the non-diabetic population (Sherman, 2015).

Distal PAD can commonly affect the hands and feet, although it is more prevalent in the feet. Often in the diabetic population, bilateral, multi-segmented and distal ischemia is caused by arteriosclerosis affecting vessels below the knee (Frowen *et al.*, 2012). Around 50% of people who develop PAD are asymptomatic and approximately 33% have atypical symptoms. PAD may cause wounds on the limb that are often difficult to heal and are prone to infection (IDF, 2019).

DFU Risk Factors

The development of DFU is multifactorial and is highly influenced by blood glucose levels. The combination of DPN and PAD increases the risk of DFU. Structural foot pathology, ill-fitting footwear, poor foot hygiene, and trauma have been linked to the development of DFU (Levy & Gilbrand, 2019).

Age and Gender

Diabetes Mellitus (DM) was once considered a condition that mainly affected the elderly population; now, it has become more prevalent in the 'under-age' group (those of a younger age group). The IDF (2019) research estimated that 19.3% of people between 69 and 99 years have diabetes. According to Ramkisson *et al*. (2016), it is estimated that there are 7% of people aged between 20-79 have Type 2 diabetes. Gender differences play a vital role in living effectively with diabetes. Males living with diabetes display a better-coping mechanism than females; however, separate studies by Purbhoo & Swart (2015) and Mokena *et al*. (2017) identified that more females participated in podiatry studies in South Africa.

Problem of Study

Diabetes is a rapidly growing global epidemic. South Africa has the most significant number of people living with diabetes in Africa. With the rapid growth of diabetes, there is an increase in related complications, particularly in the lower limb. Research has found that complications of diabetes that affect the feet are peripheral neuropathy, peripheral arterial disease, structural foot deformities, diabetic foot ulcers and lower-extremity amputations. Diabetic foot ulcers are known to affect 10-20% of the diabetic population. Global statistics indicate that lower limb amputation is performed; 85% of the cases are due to diabetes. Podiatrists play a crucial role in the management of diabetic foot care. Early detections and management of risk factors can significantly reduce the development of diabetic foot ulcers and prevent foot amputation. Research has shown that diabetes is rapidly increasing among the Indian population in the greater Durban area. Studies by Sahadew and Singaram (2019) and the Department of Health in KwaZulu Natal found that almost 305% of diabetic patients visited clinics in Durban. For this reason, the researcher focused on the diabetic patients in the greater Durban area to minimise and support patients through podiatry care and treatment.

A scarcity of data and published literature within the South African context regarding the risk factors of the diabetic population in developing foot or lower limb-related complications such as DFU and LEA provided the rationale for this type of study to be conducted. Anecdotal observation by the researcher identified that most patients consulting for podiatric treatment in the Durban area were diabetic, with little to no knowledge of their risk category and presenting diabetic lower limb complications at the first consultation. This study aimed to identify and categorise diabetic patients into risk categories based on their diabetic foot status. The study was conducted in the greater Durban area in the KwaZulu-Natal province.

Method

Study Design

A cross-sectional observational study design was used in this research. The research setting was the researcher's practice in the greater Durban area in KZN province in South Africa. The three practices used to collect data are Chatsworth, Amanzimtoti and Umkomaas.

Sample

The study population included a total of 155 patients. Due to the COVID-19 pandemic, many patients did not present themselves at the clinic. Patients over 18 years and who had diabetes were included in the study. This study examined two independent variables: gender and age of diabetic patients with NIDD or IDD. The findings in the study revealed that more males (52%) participated in comparison to females (48%). It was found that 47.7% of the participants were older than 65% and 0.6% below 20 years of age.

Data Collection

The data was collected over four months, from January 2020 to April 2020. Data were collected by conducting individual face-to-face interviews using the risk stratification tool designed by the SDFAG. The researcher took approximately 20 minutes with each participant to complete the instrument. This was done when participants came in for a consult, where the researcher informed them of the study.

Data Analysis

The data were analysed and the frequencies were presented in tables by Statkon. Descriptive statistics and frequencies were used to categorise patients with a low, medium, and high risk of diabetes. The results were introduced in the form of frequency tables. The researcher categorised patients into low, moderate, and high-risk categories and identified the prevalence of these categories within different age groups and gender.

Ethical Consideration

Permission to conduct this study was approved by the Departmental Research Committee of Podiatry, the Higher Degree Committee of the Faculty of Health Science, and ethical clearance from the Health Sciences Research Ethics committee – reference Rec-192-2019. Signed informed consent was obtained from each patient before the interview.

Results

Clinical Data

Clinical data is collected during ongoing patient care or as part of a formal clinical trial program to inform guidelines and practices (Lu & Su, 2010; Masic et al., 2008For this study, clinical data was collected from all diabetic patients. The clinical data gathered included the patient's diabetes type, pharmacological treatment, duration of diabetes, HbA1c profile of patients, and random blood glucose readings.

According to the data, 98.1% of participating patients were diagnosed with NIDD (Type 2) diabetes. A high percentage, 70.6%, were using oral anti-glycaemic agents (OHA) as part of their treatment compared to 7.2% who were using insulin. Regarding the duration of their diabetes, 76.2% of these patients were diagnosed for 15 years or less. To understand the HbA1c profile of the patients, the researcher found that most patients, 75.5% (n=117), did not know their latest HbA1c result, nor had they gone for testing at the time of the data collection.

Diabetic Foot Screening Examination

Neurological assessment was conducted using a 10g monofilament to detect the loss of protective sensation and neuropathic pain symptoms. It was found that 13.5% were identified as having loss of protective sensation and 36.1% experienced some form of painful neuropathy. During the vascular assessment, using a handheld Doppler to assess the pedal pulses and questions relating to the possibility of intermittent claudication, rest/night pains and previous vascular surgeries performed, the finding showed 8.4% experienced rest/night pain and 9.7% intermittent claudication.

Risk Factors

Table 1 presents the risk factors predisposing patients to develop a DFU and/or LEA

Table 1. Risk factors for the development of DFU's and LEA's

	Frequency		**Percent**		**Total**	
	Yes	No	Yes	No		
Did the patient have a previous amputation?	4	151	2.6%	97.4%	155	100%
Did the patient have a previous ulcer?	18	137	11.6%	88.4%	155	100%

Does the patient have significant structural foot deformities?	8	147	5.2%	94.8%	155	100%
Does the patient have significant callous/pre-ulcerative lesions?	11	144	7.1%	92.9%	155	100%
Does the patient have end-stage renal failure	1	154	0.6%	99.4%	155	100%
Does the patient fall under the Maori ethnicity	0	155	0.0%	100.0%	155	100%
Is the patient capable or has help to self-manage foot care	141	14	91.0%	9.0%	155	100%

When the researcher categorised the risk factors into low, moderate or high-risk, the finding highlighted 62.6% as low, moderate (21.9%), high (8.4%) and 7.1% of patients with active foot disease

Correlations between risk profile vs. the duration of diabetes

The *p*-value (<0.05) in Table 2 indicates a statistically significant relationship between risk profile and duration of diabetes. There appears to be a higher percentage of moderate and high-risk patients in those who were diagnosed for 10 years or longer. The results indicate that the risk of developing DFUs and LEAs increases, the longer the duration of diabetes.

Table 2. Correlations between risk profile vs the duration of diabetes

			Risk categories			**Total**
			Low-risk foot	Moderate risk foot	High-risk foot / Active foot disease	
Duration of diabetes	10 years or less	Count	40	7	2	49
		% within rA5	81.6%	14.3%	4.1%	100.0%
	+ 10 years	Count	29	17	10	56
		% within rA5	51.8%	30.4%	17.9%	100.0%
Total		Count	69	24	12	105
		% within rA5	65.7%	22.9%	11.4%	100.0%

Table 3. Chi-Square tests between risk profile vs the duration of diabetes

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.835a	2	0.004
Likelihood Ratio	11.413	2	0.003
Linear-by-Linear Association	10.332	1	0.001
No. of Valid Cases	105		

a. 0 cells (0%) have an expected count of less than 5. The minimum expected count is 5,60.

Correlations between risk profiles vs. age groups

The *p*-value (>0.05) in Tables 4 and 5 indicates a statistically insignificant relationship between risk profile and age. The results have demonstrated that the risk of developing DFUs and LEAs remains equally probable in any age category.

Table 4. Correlations between risk profiles vs age groups

			Risk categories			Total
			Low-risk foot	Moderate risk foot	High-risk foot / Active foot disease	
Age (in complete years)	65 years or younger	Count	56	13	12	81
		% within rA1	69.1%	16.0%	14.8%	100.0%
	+ 65 years	Count	41	21	12	74
		% within rA1	55.4%	28.4%	16.2%	100.0%
Total		Count	97	34	24	155
		% within rA1	62.6%	21.9%	15.5%	100.0%

Table 5. Chi-Square tests between risk profiles and age

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.894[a]	2	0.143
Likelihood Ratio	3.913	2	0.141
Linear-by-Linear Association	1.574	1	0.210
N of Valid Cases	155		

a. 0 cells (0%) have an expected count of less than 5. The minimum expected count is 11,46.

Correlations between risk profile vs. sex

The *p*-value (>0.05) in Tables 6 and 7 indicates a statistically insignificant relationship between risk profile and gender. The results suggested that the risk of developing DFUs and LEAs remains equally probable in any gender.

Table 6. Correlations between risk profiles vs sex

			Risk categories			Total
			Low-risk foot	Moderate risk foot	High-risk foot/ Active foot disease	
Sex	Male	Count	49	16	16	81
		% within A2	60.5%	19.8%	19.8%	100.0%
	Female	Count	48	18	8	74
		% within A2	64.9%	24.3%	10.8%	100.0%
Total		Count	97	34	24	155
		% within A2	62.6%	21.9%	15.5%	100.0%

Table 7. Chi-Square tests between risk profiles and sex

	Value	**df**	**Asymptotic Sig. (2-sided)**
Pearson Chi-Square	7.267[a]	3	0.064
Likelihood Ratio	8.436	3	0.038
Linear-by-Linear Association	2.724	1	0.099
N of Valid Cases	155		

a. 0 cells (0%) have an expected count of less than 5. The minimum expected count is 5,25.

Discussion

Patient Demographic Data

According to Cardiovascular Diabetes Education (n.d.), 90% of diabetic patients are diagnosed with type 2 diabetes. In the South African population, the incidence of type 2 diabetes varies between 3% and 28.7%, with the highest prevalence found amongst the Durban Indian community (Groenewald *et al.,* 2014). For example, some ethnic groups, for example, the Indian community, are more likely to develop diabetes, and the current study found that 100% (n=155) were of Indian descent. Simmons (2019) found that males are more likely to develop type 2 diabetes than females; the findings in this study revealed that marginally more males (52%) than females 48% presented with diabetes.

The IDF (2019) highlights that 12.5% of the adult population (20-79 years) are living with diabetes and a national survey across India indicated a higher prevalence of diabetes amongst the ageing population; 23.8% aged between 45-59 years old and 36.8% aged over 60 years (Statista Research Department, 2020). This trend can be seen in the current study; 94.2% of diabetic participants were over 41 years old. Huizen (2019) indicated that people over 45 years have a greater chance of developing type 2 diabetes.

The current study indicated that 70.6% of the patients used oral hypoglycaemic agents (OHA) as part of their diabetic treatment. Metformin is used as the drug of choice upon diagnosis (CDE Guideline, 2018). Furthermore, 20.3% of patients undergo OHA's and insulin; the CDE guidelines (2018) suggest that type 2 diabetic patients should be placed on insulin therapy if oral treatment fails. These statistics correlate with the higher prevalence of type 2 diabetes.

Foma *et al.* (2013) indicated that many complications caused by uncontrolled diabetes could be prevented via dietary modifications; these authors mention that a tiny population knew that diabetes could be controlled with dietary changes and exercise. The lack of awareness concurs with the current study which found that 2% of the population indicated changes in diet to control their diabetes.

According to Gurung *et al.* (2018), patients who lacked information and were non-compliant with their diabetic treatment had a higher chance of developing diabetes-related complications. The current study showed that 32.3% of

the patients could not provide any information on how long they have been living with diabetes, and for those who did respond, the majority (76.2%) have had diabetes for 15 years or less. Gurung *et al.* (2018) further stated that patients diagnosed with diabetes for five or more years were at risk of developing diabetic-related complications.

The CDE Clinical Guidelines (2018) indicated that the targeted HbA1c for adults should be 7%. The current study results indicated that the lowest HbA1c reported was 5.2%, and the highest HbA1c said was 13%. Studies have shown that people with an increased HbA1c baseline have a greater risk of developing diabetic-related complications such as DFU and LEA (Cefalu *et al.,* 2013). According to the Journal of Endocrinology Metabolism and Diabetes in South Africa (JEMDSA) (2017) guidelines, diabetic patients are advised to aim and maintain an HbA1c <= 7%. In the current study, 47.4% of patients whose HbA1c was recorded could achieve an HbA1c <=7%.

Risk Factors Leading to DFU and LEA

The development of DFU and LEA is multifactorial and varies from diabetic peripheral neuropathy, peripheral vascular diseases, foot structure, glycaemic control, general foot care and many other factors.

Peripheral Neuropathy

As the global prevalence of diabetes increases, so do complications such as DPN. DPN must be detected in its early stages. It can cause sensory abnormalities in the early stages, such as pain, numbness, loss of sensation, and hardening of the limbs (Chou *et al.*, 2019). Alexiadou and Doupis (2012) stated that neuropathy is the common factor presenting in 90% of all diabetic foot ulcers and that DPN and PAD are associated with LEA, while neuropathy alone was not independently associated with LEA.

McAra (2011) identified that 78% of patients who presented with neuropathic symptoms assumed that their protective sensations were intact. However, 53% of McAra's (2011) study population was diagnosed with a lack of protective sensation, and these patients were not aware of the presence of the pathology. The current study indicated that only 13.5% of patients were diagnosed with loss of protective sensation.

A study performed in South Africa indicated that the most common form of DPN was symptoms of burning, numbness and pins and needles. Bogoshi *et al.* (2014) indicated that 67.7% of patients complained of moderate pain and 11.7% reported extreme pain or discomfort. Furthermore, DPN pain caused nearly half the patients in the study to suffer from anxiety and depression. The current research shows that only 36.1% of patients experienced neuropathic pain.

The monofilament is a quick and cheap way to detect the early onset of DPN, which can then be used to reduce limb amputation by 85% and DFU by 60% through education and therapeutic footwear (Babitha & Subathra, 2020). In this study, 12 points were tested using the monofilament; patients who could perceive 11 points or less were diagnosed with having loss of protective sensation. In the current study, 13.5% of patients were diagnosed with having loss of protective sensation. 65.2% of the patients had perceived all 6 points on the left foot and 63.2% on the right foot. The study found that 18.1% could not detect a single application on the left foot and 17.4% on the right foot. This study found that both feet are equally affected by the loss of protective sensation. The findings of this study contradict McAra's (2011) on patients' awareness of the loss of protective sensation in the diabetic foot; she found that 78% of the study population assumed that their protective sensation was intact. However, only 25% were correct in this assumption, indicating more patients with a loss of protective sensation.

Patients' lack of awareness and education regarding the loss of protective pedal sensation recommends the need for effective diabetes education programs to prevent DFU and LEA (Burke *et al.,* 2014). Early education and awareness of diabetes are crucial in managing an unnoticed injury to the feet (Yates, 2012; Frowen *et al*., 2012).

The findings in this study showed a significantly lower prevalence of DPN than in other studies. This could be because 76.2% of the patients have been living with diabetes for less than 15 years and almost half (47.4%) of patients have an HbA1c result <=7%.

Vascular Pathologies

According to Hawkins and Jaff (2013), the longer the duration of diabetes, the greater the risk of developing PAD (Hawkins & Jaff, 2013). According to the IDF (2019), 50% of people who develop PAD are asymptomatic and approximately 33% have atypical symptoms.

The American Endovascular and Amputation Prevention (2020) states that pain in the back of the leg during walking is the most common sign of vascular pathologies. This pain is known as intermittent claudication and is caused by a lack of blood supply to the muscle due to plaque build within the arteries. In this study, 9.7% of patients were diagnosed with intermittent claudication.

According to the American Diabetes Association (2003), more severe forms of PAD include rest pain, tissue loss or gangrene. The current study indicated–that rest/night pain symptoms were the second-highest reported vascular pathology, affecting 8.4% of patients. Forlee (2010) states that many patients may not experience rest/night pain even with extensive tissue loss due to the presence of DPN. Rest pain is often seen in critical limb ischemia (CLI) because of reduced blood supply to the surrounding tissue. This, in turn, dramatically increases the risk of DFU and LEA (Jorneskog, 2012). In 90% of LEA in diabetic patients, CLI is the main causative factor.

The Vascular Centre (2019) in Cape Town states that all diabetic patients are at risk of an LEA and 70%-80% of all non-traumatic amputations occur in patients living with uncontrolled diabetes. This study identified that 0.6% of the participants had a lower limb amputation. Unfortunately, once a patient living with diabetes has had an LEA, the chances of having another amputation on the other limb are as high as 68% (Vascular Centre, 2019).

The severity and duration of diabetes are significant predictors of both the extent and incidence of vascular pathologies such as PAD. This study found a low prevalence of vascular pathologies. This is because two-thirds of the patients were living with diabetes for 15 years or less, and almost half of them had reasonable glycaemic control.

Significant Structural Foot Deformities and Calluses/Pre-Ulcerative Lesions

The development of motor neuropathy can cause muscular weakness resulting in an abnormal balance between the flexor and extensors of the foot. Common structural foot deformities such as hammertoes, claw toes, pes cavoid and prominent metatarsal heads are caused by such muscular weaknesses. 5.2% of the patients in the current study presented with a structural foot deformity.

Calluses are thick, hardened layers of skin that develop when the skin tries to protect itself against friction and excessive pressure. When these thickened layers of skin are stepped on repetitively, they increase the risk of developing a DFU (Frowen *et al.,* 2012). Foot deformities such as prominent metatarsal heads are considered the leading factor of DFU (Ledoux *et al*., 2013). The study found 7.1 % of these patients had significant callus growth or a pre-ulcerative lesion. The findings correlate with Thompson *et al.* (2021), who found that almost 25% of patients also presented with callus formation.

Furthermore, Tang *et al.* (2015) also found that 53% of patients presented with callosities in the heel region. In terms of prevention strategies, the authors recommend that insoles and shoes be widely prescribed to protect the feet and redistribute the plantar pressure to prevent the development of DFU. According to Arosi *et al. (*2016), callus formation is linked to motor neuropathy causing foot deformities leading to abnormal plantar pressure and callus development.

Diabetic Foot Ulcers

Diabetic foot ulcers are common, stressful, expensive and life-threatening pathologies associated with significant impairment of the quality of life (Boulton & Whitehouse, 2020). DFU often occurs in combination with neurological and vascular pathologies and structural deformities of the foot (Mehta *et al.,* 2009). This combination of pathologies often leads to tissue destruction and hence the development of the DFU. Around 10% of the diabetic population experience these pathologies, often leading to a DFU. Allen-Taylor *et al.* (2002) noted that 20% of all patients living with a DFU have impaired blood supply to the lower limbs, and these patients are prone to delayed wound healing and an increased risk of infection and LEA. Thirty percent of DFUs have a combination of neurological and vascular pathologies, whereas 50% of DFUs are neuropathic. As indicated previously, the current study results show a lower

prevalence of vascular and neurological complications and, as such, could account for the lower prevalence (7.1%) of active foot ulcers in this population. In an unpublished dissertation by Mokoena *et al.* (2017), 12.53% of diabetic patients at a public hospital presented with diabetic foot ulcers. The prevalence of DFU in Ghana has been identified as 11% at tertiary institutions and in Ethiopia, the prevalence of DFU has been identified as 11.6% (Abdissa *et al.,* 2020).

However, because the current study collected data from private practices, the results are significantly lower than those obtained from the two tertiary academic public hospitals. The disparity could be one of the differences in socioeconomic status between Africa and South Africa. Purbhoo and Swart (2015) found that many health problems, including foot problems, are caused by various historical, cultural, and socioeconomic factors influencing lifestyles. Due to the high poverty rate and financial constraints, most patients (80%) must visit provincial healthcare facilities (Webb et al., 2019). In South Africa, most diabetes care occurs at PHC facilities, where screening for diabetic complications is often low. This statement correlates with the findings by Tumbo and Kadima (2013) in the Northwest Province in South Africa. Webb *et al.* (2019) state that clinics require access to equipment, resources, and a functional health system to screen effectively. They found that no clinics had monofilaments available in the Tshwane District in Pretoria and were poorly resourced to screen diabetic patients.

Risk Stratification

The data gathered indicated that 62.6% of patients were placed into low-risk categories for developing DFU and LEA. Although the prevalence of uncontrolled diabetes is higher, most patients were not at risk for developing DFU and LEA. This could be because 76.2% of patients who participated in the study lived with diabetes for less than 15 years. This finding correlates with Ahmadi *et al.* (2018) as they described the duration of diabetes being a causative risk factor for microvascular diseases, neuropathy and DFU.

The most significant number of patients were found in the low-risk category, 69.1% were under 65, and 55.4% were over 65. The results indicate that the risk of developing DFUs and LEAs remains equally probable in any age category. Other risk factors such as foot hygiene, duration of diabetes, neuropathy, vascular disease, structural foot deformities and glycaemic control are more significant contributing factors to developing DFU and LEA (Shearman, 2015; Levy & Gilbrand, 2019).

The results from this study indicated that the risk of developing DFUs and LEAs remains equally probable between the genders. Although studies by Dinh and Veves (2008) note that females are less likely to develop DFU when compared to males due to them presenting with minor server neuropathic pathologies, an increase in joint mobility and a decrease in plantar foot pressure. However, if PAD, PDN or other risk factors develop, females will be at an equal risk of DFU and LEA (Dinh & Veves, 2008).

Conclusion and Recommendations

Based on the results of the study, the following are recommended to minimise DFU and LEA among diabetic patients: ongoing foot screening for the risk of DFU and LEA should become an essential service at all podiatry practices; foot care and education become an integral part of the well-being of diabetic patients; patients should be provided with knowledge of self-examination, appropriate footwear and immediate medical attention should they experience foot pain and discomfort. It is also recommended that areas should be identified as diabetic hotspots and podiatry services made available.

Since diabetes is rapidly growing with devastating complications, the role of podiatrists is crucial in diagnosing and treating pathologies affecting the lower limb.

Although various studies indicate the prevalence of diabetic complications affecting the lower limb, many participants in this study were placed into a low-risk category. The current study shows a significantly lower prevalence of DPN and vascular pathology than other studies. This could be because 76.2% of the patients lived with diabetes for less than 15 years and almost half (47.4%) had an HbA1c result <=7%.

Acknowledgment

Thanks

The first author would like to acknowledge the University of Johannesburg for allowing this study to be conducted under the supervision of Ms M Purbhoo. He would also like to thank his supervisors Ms Purbhoo and Mr Ntuli for their guidance during this study.

Conflict of Interest

The authors declare that there is no known conflict of interest or competing financial interest or personal relationships that could have influenced this paper.

Author's Contribution Statement

The authors declare that they have both conceptualised and written this paper together. This paper emanated from the first author's master's study.

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