

The spectrum of missed lower limb clinical findings at a diabetes clinic in KwaZulu-Natal: red flags for costly complications

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Including a podiatrist in a multidisciplinary team (MDT) has been shown to reduce the incidence of diabetes-related lower limb amputations by at least 56% to as much as 85%. This reflects podiatry's role in foot screening and assessment, diagnosis, foot treatment, patient education and timely referral in diabetes care. There is no podiatry post at Edendale Hospital, a state health regional hospital in KwaZulu-Natal. What a podiatrist could contribute to the clinical examination, education and treatment of patients living with diabetes (PLWD) attending the Edendale Hospital diabetes clinic was, therefore, unknown. During the last quarter of 2018 and the first quarter of 2019, as part of a research project into peripheral vascular disease, a podiatrist carried out screening, comprehensive foot assessments and observation on 301 outpatients attending the diabetes clinic at Edendale Hospital. Dermatological, musculoskeletal, cardiovascular and neurological presentations found in the patients' feet and lower limbs were documented. The podiatrist's assessments and observations were compared with the attending medical doctor's clinical notes. More than two-thirds of patients (68.1%, $n = 205$) had an undocumented clinical presentation of lower limb pathologies requiring treatment, in-depth patient education, further investigation and preventive treatment to avoid further costly and debilitating complications. The results of this study support the dire need for podiatry services at a regional hospital level to provide timeous foot care and trained observation skills for PLWD.

Keywords: Podiatry, diabetes mellitus, amputations, multidisciplinary team, regional hospital

Introduction

In the multidisciplinary team (MDT) approach to the managed care of patients living with diabetes (PLWD), the podiatrist enables identification of clinical signs and symptoms that raise red flags for potential complications, not only in the lower limb but systemically. Podiatry involvement in diabetes care has been reported to reduce diabetes-related amputations by 56% and up to 85%.¹

In South Africa, podiatry posts are missing from regional and district state health structures.² Unsurprisingly, podiatry in South Africa is a scarce skill, with most practitioners active in the private sector as state health posts are not available. In KwaZulu-Natal, it has been shown that diabetes-related lower limb amputations are increasing.³ Furthermore, it is unknown what pathologies are clinically present in the lower limbs of patients attending state health outpatient clinics but are missed due to work pressure and lack of a podiatry presence. Early identification of pathology related to the lower limbs will enable the clinician to enact timeous patient management decisions.

This study aimed to determine the relationship between the clinical notes of doctors and nurses who assess patients attending a state health diabetes outpatient clinic with the observations and clinical lower limb assessment notes of a podiatrist taken on the same day.

Methods

Podiatric assessments and observations on 301 volunteer patients attending a weekly diabetes clinic at Edendale hospital,

KwaZulu-Natal, were collected from October 2018 to March 2019 (see [Table 1](#)). At the same time, clinical notes were collected for the same patients as completed by the attending doctors on the same day. Written data from both sets of notes were categorised into dermal (skin and nails), cardiovascular, musculoskeletal and neural.

A spreadsheet (MS Excel; Microsoft Corp, Redmond, WA, USA) was used to identify the presentations that should have been in the clinical notes but were omitted or missing from the attending clinician's patient notes.

Ethics

Ethical approval to collect and utilise data was granted by the Department of Health, management of Edendale Hospital and the Biomedical Research Ethics Committee of the University of KwaZulu-Natal, BREC reference BE264/17.

Results

The results are shown below in chart form ([Tables 2–5](#)), together with 'red flags' (potential complications) and management as suggested by the podiatrist. It should be noted that, in all instances, the podiatrist brought each missed item back to the attention of the attending doctor or arranged a referral.

[Table 2](#) shows that 20.9% of the patients ($n = 63$) presented with dermal findings that were not noted in the medical clinician's notes. Of these, 26.9% ($n = 17$) presented with active foot problems in the form of Diabetic Foot Ulcers (DFU) that placed these patients at very high risk of amputation, particularly as

Table 1: Medical and sociodemographic profile of the patient sample

Variables (n = 301)	Characteristics	Frequency	Percentage (%)
Number of years since diagnosis of diabetes	1–5	86	28.6
	6–10	64	21.3
	11–15	62	20.6
	16–20	28	9.3
	21–25	16	5.3
	26–30	11	3.7
	31–35	8	2.7
	Missing entries	26	8.6
Type of diabetes mellitus	Type I	39	13.0
	Type II	251	83.4
	Missing entries	11	3.7
Family history	No	87	28.9
	Yes	150	49.8
	Missing entries	64	21.3
Gender	Male	78	25.9
	Female	219	72.8
	Missing entries	4	1.3
Ages (grouped)	10–19	8	2.7
	20–29	10	3.3
	30–39	27	9.0
	40–49	46	15.3
	50–59	84	27.9
	60–69	86	28.6
	70–79	31	10.3
	80–89	7	2.3
	90–99	2	0.7
Employed	No	95	31.6
	Yes	44	14.6
	Pensioner	72	23.9
	Scholar	8	2.7
	Prisoner	1	0.3
	Missing entries	81	26.9
Racial composition	Black African	291	96.7
	White African	1	0.3
	Indian heritage	4	1.3
	Mixed heritage	4	1.3
	Missing entries	1	0.3
Body mass index	Underweight	4	1.3
	Normal weight	30	10.0
	Overweight	58	19.3
	Class I obese	75	24.9
	Class II obese	104	34.6
	Missing entries	30	10.0
Hypertensive	No	56	18.6
	Yes	233	77.4
	Missing entries	12	4.0
Hyperlipidaemic	No	33	11.0
	Yes	255	84.7
	Missing entries	13	4.3
eGFR (grouped)	< 60	88	29.2
	≥ 60	179	59.5
	Missing entries	34	11.3

Table 2: Dermal findings by podiatrist, missing from diabetes clinic notes

Dermal observations by podiatrist	n	“Red flag” relative importance	Suggested management, missing
Ulcer, untreated under 5th MTPJ (patient unaware)	1	High-risk amputation	Debridement by podiatrist, reduction, dressing, offloading device or intervention, education of patient and medical personnel, footwear assessment
Ulcer untreated under 1st MTPJ (patient unaware)	3	High-risk amputation	Debridement by podiatrist, reduction, dressing, offloading device or intervention, education of patient and medical personnel, footwear assessment
Ulcer: dry gangrene (unprotected)	1	High-risk amputation	Offloading device or intervention, dressing, education of patient and medical personnel, footwear assessment, protective device, vascular investigation
Ulcers, plantar, patient unaware	4	High-risk amputation	Debridement by podiatrist, reduction, dressing, offloading, education, footwear assessment
Ulcer open (patient aware) but no dressing used, no offloading	3	Infection, amputation	Debridement by podiatrist, reduction, dressing, offloading device or intervention, education of patient and medical personnel, footwear assessment
Ulcer under foot, unaware, no dressing used, no offloading	3	Infection, amputation	Debridement by podiatrist, reduction, dressing, offloading device or intervention, education of patient and medical personnel, footwear assessment
Ulcer, medial heel, no ulcer dressing or pressure relief	1	High-risk amputation	Debridement by podiatrist, reduction, dressing, offloading device or intervention, Wound care education, follow up. The patient should be offloading on crutches or moon boot
Ulcer, new, amputee, dressed by Eshane Clinic but no offloading	1	Impeded healing, amputation	Debridement and vascular assessment by podiatrist, reduction, offloading device or intervention, education of patient and medical personnel, footwear assessment
Incurvated nails Hx DVT	4	If not corrected, nail will encircle the nail tuft, resulting in ischaemic tip, gangrene; ulcer risk	Regular preventative treatment by podiatrist to re-shape nail margins; nail plate ‘Keriflex’ type nail prosthetic to be made by podiatrist to guide straight nail growth. Total nail removal contraindicated
Non-healed amputation site (> 1 year duration)	2	Receded blood flow	Vascular workup, patient wound care education, follow-up. Patient should be offloading, e.g. on crutches
Hippocratic nails Hx smoking	1	Sign of potential pulmonary pathology	Screening chest radiograph
Indurated skin at ankle	1	Lipodermatosclerosis	Compression therapy arterial status permitting, fibrinolytic medication cardiac status permitting, potent anti-inflammatory topicals and steroids such as clobetasol propionate
Pre-tibial necrobiosis lipoidica diabeticorum	3	High risk of broken skin, Ulcer risk	Topical retinoids, topical steroids, PUVA light therapy, patient education on protecting the skin
Severe anhidrosis despite use of basic emollients	5	Dry, broken skin increases risk of infection; investigate neural involvement (sympathetic nervous system), ulcer risk	Next level keratinolytic balms (podiatrist to advise compounding pharmacist in hospital), education, e.g. advise no foot soaking, Rx neural supportive medication/supplementation, Ddx dry scaly tinea, obtain skin specimen for pathology test
Hyperhidrotic feet (untreated)	1	Risk factor for fungal infection or pitting keratolysis, community infective risk	Prescription-strength antiperspirant preparation, education re dietary restrictions (e.g. avoid chillies), podiatry treatment and patient education
Severe callus, corns or grossly thickened nails	14	Ulcer risk, (11 times more likely to ulcerate in diabetes)	Debridement, reduction, padding, offloading device or intervention, education of patient and medical personnel, footwear assessment, education
Skin and nail pathology (severe)	15	Ulcer risk (11 times more likely to ulcerate in diabetes)	Reduction, prevention of ulceration on IPJs, MPJs, plantar surface, patient education, footwear assessment and education
Total patients with dermal findings needing podiatric care/management/referral	63		

Notes: Hx (history), Dx (diagnosis), Ddx (differential diagnosis), Tx (treatment), DVT (deep vein thrombosis), PUVA (psoralen and ultraviolet A), Rx (prescription), IPJ (interphalangeal joint), MPJ (metatarsophalangeal joint).

patient management appeared missing (as detailed in the last column). Three amputees were not using crutches, and two had untreated wounds. The remaining patients ($n = 44$) had severe dermal presentations requiring treatment and management.

Table 3 shows that 22.9% of the patients ($n = 69$) presented with cardiovascular findings that were not noted in the medical clinician’s notes. Of these, 62.3% ($n = 43$) had cardiovascular

presentations captured by the standard Doppler examination and Ankle Brachial Pressure Index (ABPI) carried out by the podiatrist. These are examination modalities that are not used by the doctors on duty and were therefore missed.

Table 4 indicates that 19.6% of the patients ($n = 59$) presented with musculoskeletal findings that were not noted in the medical clinician’s notes. Of these, 98.3% ($n = 58$) had

Table 3: Cardiovascular findings by podiatrist, missing from diabetes clinic notes

Cardiovascular observations by podiatrist	n	"Red flag" relative importance	Suggested management, missing
Abnormal pulsatile waveforms on Doppler	1	Thrombus formation	ECG, bloods and medication review
Arrhythmia or abnormal pulsatile waveforms	11	Thrombus formation	ECG, medication review
BPM < 40	2	Cardiac arrest	Evaluate if candidate for pacemaker, revise meds, admit to high care
Fem pop artery biphasic continuous (hot, painful knee but cold monophasic foot)	2	Fem pop thrombus/blockage	Refer for angiogram lower limb; re-vascularise
Medial arterial calcification ABPI reading > 1.4, Doppler waveform biphasic continuous	4	Strong predictor for future cardiovascular event	Refer for X-ray confirmation, supplementation vit K2, revise anticoagulant therapy, low-dose vit D, phosphate binders
Medial arterial calcification, severe	4	Strong predictor for future cardiovascular event	Refer for X-ray confirmation, supplementation vit K2, revise anticoagulant therapy? Low-dose vit D, phosphate binders?
Monophasic pedal pulses yet compression hose was dispensed for varicose leg pain at Embalenhle Clinic	1	Compression in presence of ischaemia can cause gangrene; ulcer risk	(Re-)education of clinic staff that only once Doppler ultrasound indicates good arterial supply can compression hose be dispensed. Refer to vascular for full Doppler exam
Pain in arms when lifting the arms	2	Rotator cuff disease or peripheral vascular disease; tendonitis, bursitis; nerve impingement	Investigation – orthopaedics, vascular, neurology
Pain in chest when lifting arms above shoulders	1	Thoracic outlet syndrome?	Investigation – cardiology
Pain on leg elevation	3	Peripheral arterial disease; nerve impingement	Investigation – vascular, neurology
Painful oedema of the feet	8	Indicator for cardiac failure; lymphoedema; renal disease; ulcer risk	Investigate low protein levels; medications (side effect?); venous insufficiency
Pedal pulses monophasic or biphasic continuous	10	High risk of non-healing pedal tissue, ulcer risk	Refer for angiogram lower limb; re-vascularise
Post-stroke	3	High fall risk	Refer to podiatrist re footwear, occupational therapy for devices
Weak bpm (Hx stroke)	1	Potential cardiac failure	Refer to cardiology, suitable patient for pacemaker?
Tachycardia (> 100 bpm resting)	7	If prolonged, syncope, cardiac failure, thrombus formation	Medication review (HBP), check electrolytes, cardiovascular workup?
Unilateral calf pain	5	Potential thrombus	Refer for angiogram lower limb; re-vascularise
Unilateral knee pain, hot to touch (leg wrapped with tight hose at the knee)	4	Potential thrombus	Refer for angiogram lower limb; re-vascularise
Total patients with cardiovascular findings needing podiatric care/management/referral	69		

Notes: Hx (history), Dx (diagnosis), DDx (differential diagnosis), Tx (treatment).

presentations representing ulcer risk to be prevented by appropriate podiatry workup, treatment and management.

Table 5 lists the neurology findings in 4.7% of the patients ($n = 14$) that were not noted in the medical clinician's notes. Of these, 85.7% ($n = 12$) had presentations that represented ulcer risk to be addressed by podiatric treatment and management in conjunction with MDT disciplines.

In summary, Tables 2–5 show that 205 patients (68% of the total sample $n = 310$) were found by the podiatrist's observations to present with undocumented findings that needed management, podiatric care and/or onward specific referral in order to prevent complications.

Discussion

The prevalence of DM is increasing globally, more so in low- to middle-income countries (LMICs). Clinicians working in diabetes clinics in these LMICs must often see large numbers of PLWD. The addition of podiatry services to the MDT in these clinics

will help improve overall diabetes care offered to PLWD in LMICs.

Key findings from Statistics South Africa demonstrate an evidence-based pattern in the increased number of deaths arising from diabetes-related complications. Despite the slight decline in 2016 in overall deaths, diabetes mellitus was the second leading natural cause of death after tuberculosis, ahead of other forms of cardiovascular disease and human immunodeficiency virus disease. The leading cause of death in South African females is attributed to diabetes mellitus.⁴

The high numbers of diabetes-related amputations in KwaZulu Natal^{3,5} are linked to diabetic foot disease, which, in turn, is related to the rate and risk of ulceration.

Working back from when diabetes is first diagnosed, it is now clear that in-depth detection of risk factors for lower limb complications ought to play a crucial role in any medical intervention, whether at primary, secondary or tertiary level, not only

Table 4: Musculoskeletal findings by podiatrist, missing from diabetes clinic notes

Musculoskeletal observations by podiatrist	n	“Red flag” relative importance	Suggested management, missing
Gait imbalance with leg pain	2	Unable to ambulate or exercise, fall risk, ulcer risk	Investigate musculoskeletal, biomechanics, gait function, vascular workup
Gait imbalance due to lumbar and unilateral leg pain	1	Fall risk, ulcer risk	Workup by podiatrist, imaging, in-shoe prescription insole
Mallet toes	1	Ulcer risk	Workup by podiatrist, conservative treatment with custom toe props to be fabricated in clinic from two-part silicone
Metatarsus adductus (uncorrected)	3	Callus formation due to shoe misfit, ulcer risk	Workup by podiatrist, templates by podiatrist for custom prescription shoe insert with components to be built in to support lateral borders of foot and prevent ulceration
Pain under the 1st MTPJ, Hx stumbled and fell	1	Ddx: plantar plate injury, sesamoiditis, bursitis, ischaemia, ulcer risk	Imaging investigation, workup by podiatrist, offloading in-shoe device made by podiatrist
Severe plantar fasciitis with suspected calcaneal spur	1	Inability to exercise, decreased blood supply, musculoskeletal compensatory fatigue, pain syndrome, inability to work	Refer for X-ray confirmation, send for in-shoe correction to be made by podiatrist, followed by physiotherapy once patient is pain-free
Shoes: high heels, biphasic pulses	2	Callus formation, decreased blood supply, ulcer risk	Workup by podiatrist, patient education, follow-up
Short first metatarsal (bilateral) with hallux rigidus, painful/symptomatic	38	Callus formation, musculoskeletal deformation (toes); ulcer risk	Workup by podiatrist, templates by podiatrist for custom prescription shoe insert with components built in to re-establish metatarsal parabolic action; patient education
Unilateral ankle pain	8	Unable to exercise, impacts vascular, impacts quality of life, ulcer risk	Imaging investigation, workup by podiatrist, offloading in-shoe device made by podiatrist
Unilateral knee imbalance	1	Unable to exercise, impacts vascular, impacts quality of life, ulcer risk	Imaging investigation, workup by podiatrist, offloading in-shoe device made by podiatrist
Unilateral short first metatarsal and back pain	1	Unable to exercise, impacts vascular, impacts quality of life, ulcer risk	In-shoe device for correction of gait imbalance
Total patients with musculoskeletal findings needing podiatric care/management/referral	59		

Notes: Hx (history), Dx (diagnosis), Ddx (differential diagnosis), MTPJ (metatarsophalangeal joint).

Table 5: Neural findings by podiatrist, missing from diabetes clinic notes

Neural observations by podiatrist	n	“Red flag” relative importance	Suggested management, missing
Gait anomaly Hx TB spine	1	Fall risk, ulcer risk	Supply crutches/walking aids, physiotherapy, podiatry in-shoe orthotics
Gait imbalance post-stroke (has no crutches or walking aid)	1	Fall risk, ulcer risk	Supply crutches/walking aids, physiotherapy, podiatry in-shoe orthotics, patient education
Hand paraesthesia as well as lower limb paraesthesia	1	Fall risk	Assess vit B12 levels, Rx medication for neuropathic pain, physiotherapy, occupational therapy
Ineffective pain medications given for neuropathic pain	1	Patient risks toxicity by self-medication dose increase	Pt had been given Tramadol, suggest rather carbamazepine or newer duloxetine
Pain in feet Hx meningitis with temporary paralysis	1	Fall risk due to painful gait, ulcer risk, loss of quality of life	Assess vit B12 levels, Rx medication for neuropathic pain, physiotherapy, podiatry
Retracted extensor tendons in presence of sensory neuropathy	3	High ulcer risk under MTPJs, Ddx rhabdomyopathy	Neural support, e.g. vit B12, physiotherapy. Ulcer prevention for metatarsophalangeal joints, podiatry workup and podiatry orthotics
Shoe coring exposed (patient neuropathic and unaware)	1	Exposed holes can damage skin, ulcer risk	Patient education, clinic personnel education, podiatry offloading intervention
Shoes too small – patient unaware	3	Neuropathy causes patient to wear tighter shoes to increase diminishing sensation; ulcer risk	Patient education, clinic personnel education, podiatry foot protection intervention
Feet as cold as ice, not wearing socks	2	High ulcer risk, or burn risk	Refer for duplex Doppler, review medications, patient education, clinic personnel education
Total patients with neural findings needing podiatric care/management/referral	14		

Notes: Hx (history), Dx (diagnosis), Ddx (differential diagnosis), Tx (treatment), DVT (deep vein thrombosis), PUVA (psoralen and ultraviolet A), Rx (prescription), IPJ (interphalangeal joint), MTPJ (metatarsophalangeal joint).

for the prevention of complications but also to reduce the earlier mortality associated with lower limb complications.

Accurate, thorough testing and documentation are vital for the identification of risk. For example, as completed by the doctors on duty, some clinical records in this study indicated that pedal pulses were 'weak' or 'strong', based on manual palpation. Doppler ultrasonography of the same patients on the same day and within minutes of each examination showed that these recorded outcomes of manual palpation of pedal pulses showed little relationship to the actual Doppler ultrasonography. For example, a recorded 'strong' (palpated) pulse was frequently a stenotic 'bounding' pulse as indicated by the doppler waveforms. The 2017 SEMDSA guidelines⁶ state that:

'At diagnosis and annually thereafter, a trained healthcare worker (podiatrist, nurse, doctor, community health worker) must examine patient's feet without socks or bandages to determine risk status: Inspect for foot deformities, skin and nail abnormalities; Inspect footwear; Test sensation (monofilament, 128 Hz tuning fork or "touch the toe" and "Palpate dorsalis pedis and posterior tibial pulses".'

It may be suggested that these guidelines are inadequate in scope, as it has been shown that palpation is an unreliable method to inform on arterial flow or waveforms that require intervention in PLWD.⁷⁻¹⁶

It was noted that there was a low number of amputees ($n = 3$) attending the diabetes clinic, given the known high numbers of amputations in KZN. Amputees are high-risk patients and should be attending monthly as per the SEMDSA guidelines.⁶ We were unable to determine why there was such poor attendance by amputees. We postulate that they might be following up at the surgical outpatient department post-amputation or be lost to follow-up or might be deceased.

Masoetsa's unpublished 2005 dissertation on 'Positioning of podiatric medicine within the South African healthcare system' notes the long history of attempts to reinstate podiatry in the public health sector, military and correctional services, due to the error of omission of the discipline of podiatry in the post-1994 White Paper on national health.²

At present, there is only one podiatrist, based at Grey's Hospital, who serves the podiatric needs of the entire uMgungundlovu district, a district that contains more than 10 district hospitals, 78 provincial clinics and at least 3 community health centres.¹⁷ Each of the regional and district hospitals needs a podiatry post, as the evidence presented in this paper indicates podiatry's role in the prevention of diabetes complications.

Diabetes-related lower limb amputations (LLA) adversely affect the individual PLWD and the healthcare fiscus. Early intervention remains the most effective option for PLWD to prevent this negative impact. Engagement of podiatry is a viable option as it is lower in cost than the estimated costs of diabetes-related LLA.¹⁷

The burden of non-communicable disease is increasing, underpinning the urgent need for evidence-based decisions and planning to provide appropriate public health education, preventive services and interventions. This is most true regarding the provisioning of podiatric medical personnel throughout all three

levels of health care and, particularly, the need for urgent establishment of podiatry posts at regional and district level and of multidisciplinary teams for diabetes care that include podiatry.

The low numbers of podiatrists in KwaZulu-Natal, while statistically vast, can be remedied. In the short term, collaboration between the HPCSA, private podiatry regulatory boards, existing practitioners, the DoH and tertiary institutions is required to strategize by correcting the distribution of podiatrists and the appropriate management of PLWD.

It is recommended that an assessment of current tertiary medical and other healthcare institutions and their current syllabi be undertaken to introduce podiatry's scope of practice and application in the inter-professional education models. Further, the call for more podiatry training must be urgently considered to address the vast shortage of practitioners.

Disclosure statement – No potential conflict of interest was reported by the authors.

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Received: 27-10-2021 Accepted: 19-05-2022