

SECTION 6

Foot Care

Background

Foot complications are among the most serious and costly diabetes complication.¹ However, strategies which encompass prevention, patient and staff education, multidisciplinary treatment of foot ulcers and close monitoring can reduce the rate of amputations by 49-85%.¹

The effects of diabetes and complications of diabetes commonly target the feet. Any person with diabetes, of whatever age, requires good foot care whether at home, in hospital or in a nursing home. The feet of a person with diabetes are at risk of damage due to a combination of small and large vessel disease, nerve damage and mechanical instabilities in the foot.

Diabetic foot ulcers usually occur as a result of two or more risk factors occurring together. In particular peripheral neuropathy plays a central role. Statistics show that anywhere from 19.6%² and 50%¹ of people have at risk feet. All health care providers can play a role in helping people assess their own level of risk and to understand their own self care practices.

Poor glycaemic control increases the risk of vascular disease, neuropathy and infection.³ Hyperglycaemia may lower immune response, increase the risk of infection and delay healing.

Neuropathy

Peripheral neuropathy, with or without peripheral vascular disease is a major underlying risk factor in people with diabetes developing a foot ulcer.³ Sensory loss associated with peripheral neuropathy becomes progressively more common with increasing duration of diabetes. Neuropathy leads to an insensitive foot. Neuropathy also sometimes leads to a deformed foot which then causes more pressure on different parts of the foot, resulting in thickened callus or corns and potential ulcers. If a person with neuropathy has a minor trauma such as blisters (from ill fitting shoes or walking barefoot on hot ground) this can be enough to start a chronic ulcer.¹ If the person cannot feel that they have an injury then they will continue to re-injure the area and will not identify the need to seek help.

Signs and symptoms of peripheral neuropathy:⁴

- abnormal, decreased or increased sensitivity
- loss of deep tendon reflexes
- loss of vibratory, cutaneous pressure, temperature, or position sense
- heavy callus formation over pressure points
- trophic ulcers
- foot drop
- changes in shape of foot:
 - muscle atrophy
 - changes in bone and joint.

NHMRC guidelines recommend that 'people with type 2 diabetes who have peripheral neuropathy should be identified because they are at risk of foot ulceration and amputation'.³

Peripheral vascular disease

The presence of peripheral vascular disease (PVD) becomes progressively more common with the duration of diabetes.⁵ PVD is degenerative and hyperglycaemia, smoking, hypertension and hyperlipidaemia are all risk factors.⁶ PVD in conjunction with minor trauma may result in a painful, purely ischaemic foot ulcer.¹ However if the person also has neuropathy then symptoms may be absent. Peripheral vascular disease is associated with a 2 - 4 fold increased risk of amputation.³ People with diabetes should be assessed regularly for peripheral vascular disease.³

Signs and symptoms of peripheral vascular disease

- intermittent claudication (pedal pulses usually absent)
- rest pain
- nocturnal pain
- shiny appearance of skin
- bluish discolouration of skin
- skin cool to touch
- loss of hair on feet and toes
- failure of a wound to respond to appropriate treatment
- delayed venous filling after elevation
- gangrene.

Foot deformity

Foot deformities such as bunions, hammer or claw toes, callus and Charcot foot are major contributors to increasing foot pressures. Callus develops in response to shear stresses and usually occur close to a bony prominence. Callus contributes to increases in foot pressures by acting as a foreign body and predisposes to the formation of ulcers beneath these lesions.³ Limited joint mobility and bony deformities or callus in the presence of neuropathy increases the risk of ulceration.³ Similarly deformity from previous amputation also increases the risk of ulceration (3-fold increase).

NHMRC guidelines suggest that people with diabetes need regular assessment to detect foot deformities.³

Foot risk assessment and management

There are five key elements that underpin foot management.¹

- Regular inspection and examination of the feet by health care providers.
- Identification of the foot at risk.
- Education of the person, family and health care providers.
- Appropriate foot wear.
- Treatment of non-ulcerative pathology.

Regular inspection and examination

It is important to realise that absence of symptoms does not mean that a person's feet are healthy; a person may have neuropathy, PVD, or even an ulcer and not be aware of it.¹ Every person with diabetes should have their feet, shoes and socks examined at least every 6 months.⁷

All health care providers should be involved in ensuring that the person with diabetes has regular inspection and examination of both feet. This involves assessing the person in a standing and sitting / lying position with their shoes on initially and then without their shoes. Shoes and socks should also be inspected. It is through regular checks and reinforcement of appropriate and relevant self care practices that the person with diabetes will have a solid understanding of the importance of foot care. A key aspect of education is to teach those with at risk feet the importance of self care. The responsibility of the individual with diabetes or of their carer cannot be emphasised strongly enough. Daily inspections of at risk feet and footwear should be conducted at home, with particular attention paid to the identification of any problems and early management of these.

Identification of the foot at risk

It is only through a thorough and systematic history and assessment that the health professional can determine the level of risk for the individual. This level of risk then needs to be communicated to the person. An action plan relevant to the level of risk should be put in place. Determining the level of risk will guide subsequent management including the type of referrals, frequency of follow up appointments and types of footwear.

Identifying the foot at risk can be based on the National Association of Diabetes Centres (NADC) 2004 '*Basic Foot Screening Checklist*' (Appendix 1). The checklist is broken up into 7 sections which will be discussed in more detail below.⁶

Note:

The NHMRC guidelines 'Diabetes foot problems' adopts the following definitions to describe risk categories for diabetes foot problems:

- 'at risk' people – neuropathy or peripheral vascular disease or foot deformity
- 'high risk' people – foot deformity with neuropathy or peripheral vascular disease or previous ulcer or previous amputation.³

Section 1

Ask the person if they have experienced previous foot problems, symptoms of neuropathy or intermittent claudication. Ask about previous foot ulcer or amputation because this will immediately put the person in an at risk category for another ulcer.³

Neuropathic symptoms can include numbness, tingling, creeping ants, shooting pains, burning and deep bone ache. Symptoms may be worse at night, may be present at diagnosis, may worsen with unstable blood glucose and may not accompany reduced sensation.

Intermittent claudication symptoms can include 'angina' of the legs, ischaemic muscle pain with exercise. Pain often develops after walking a certain distance or length of time. Note: less than half of people with diabetes and PVD experience intermittent claudication.³ Presence of palpable pedal pulses is usually a good predictor of adequate peripheral circulation.³

Section 2

Look at both feet to identify active problems including PVD and neuropathy.

Active problem	Signs and symptoms
Infection	<ul style="list-style-type: none"> • look for redness, warmth, discharge, swelling, pain • usually accompanied by elevated blood glucose levels • may spread rapidly - signs visible across the foot or up the leg • signs may be masked by ischaemia or neuropathy
Ulceration	<ul style="list-style-type: none"> • non-healing wounds may occur anywhere on the foot • persistent pressure results in tissue breakdown and may be painless • look particularly at pressure areas e.g. tops of toes, tips of toes, ball of the foot, around the heels • ulcers are often present underneath callus and corns or between the toes
Corns and callus	<ul style="list-style-type: none"> • must be regarded as pre-ulcerative, especially in the neuropathic foot • appear as areas of hard, yellow, thickened skin • occur at pressure points • early treatment and pressure relief prevents ulceration
Skin breaks	<ul style="list-style-type: none"> • possible portal for bacteria and therefore infection • check between toes and around heels • treat skin which is excessively dry or moist
Nail disorders	<ul style="list-style-type: none"> • thickness • discoloration • infection • check general condition • provision for basic nail care may be necessary
Deformity	<ul style="list-style-type: none"> • deformed foot is more susceptible to pressure • corns and calluses are more evident in the irregularly shaped foot • special attention to shoe fit is required

Mechanical factors are those related to structural changes, the shape of the foot and the type of footwear. Small muscle wasting, secondary to neuropathy may develop in the feet leading to an abnormal posture of the foot. It may be difficult to find a comfortable, well-fitting shoe.

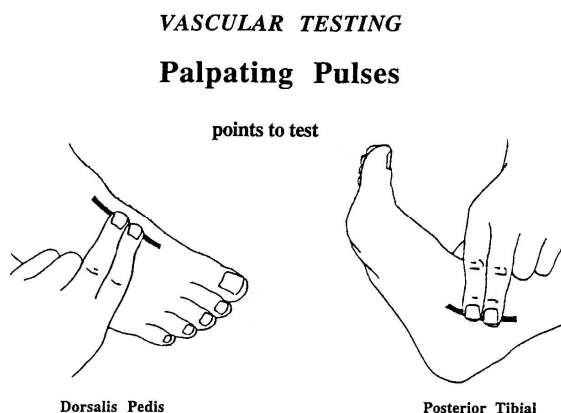
Assessment of mechanical factors includes observation of gait and shoe wear pattern. Gait problems may indicate special footwear is necessary. Conditions include hammer toes, clawfoot, bunions, calluses, partially amputated feet, Charcot feet and other deformities.

Section 3

Check foot pulses

Indicates arterial blood supply to the feet and *healing potential* of wounds

Check for both pulses. See diagram below



Section 4

Test both feet for neuropathy

The NHMRC footcare guidelines recommend that all people with diabetes be routinely assessed with a 10g monofilament to detect loss of protective foot sensation (see Appendix 2 for instructions).³ The 10g monofilament is clinically reliable and best practice. However, if this is not available cottonwool can be used in the same way (note this method is not gold standard). These tests measure nerve supply to the feet and the persons *ability to detect injury* to the feet. They are testing for loss of protective sensation.

There is limited data to support which sites should be tested using the monofilament. The NHMRC guidelines suggest that testing at two sites (over the first and fifth metatarsal heads) is sufficient to identify loss of protective sensation.³

Section 5

Assess footwear

Ensure footwear is of appropriate size, shape and width to accommodate the foot. Avoid vinyl uppers as these can trap moisture. Poorly fitting shoes can cause blisters and corns which may ulcerate, especially in the person with sensory loss.⁶

Section 6

Assess education need

As part of the foot assessment it is important to ascertain what the person understands about the effects of diabetes on foot health. Asking the person do they know why and how diabetes can affect their feet and what the associated self care practices are. Are their feet adequately cared for.

Section 7

Assess self care capacity

The last part of the assessment is an opportunity to assess whether the person is capable of the level of care that is required for their level of foot risk.

Summary of assessment of feet

The summary of assessment provided by the National Association of Diabetes Centres will help approach the assessment in a logical and systematic way.⁶

Task	History	Examination
Detect peripheral neuropathy	Ask about symptoms of peripheral neuropathy	10 gram monofilament
Detect peripheral vascular disease	Ask about symptoms of peripheral vascular disease	Check dorsalis pedis and posterior tibial pulses
Previous foot ulcer	Ask about previous foot ulcers	Look for signs of scarring, contractures of muscles
Major foot abnormality	Ask about previous injury	Examine foot for significant callus, foot deformities
Detect active foot problems		Examine for foot ulcers, infection, corns, maceration, fissuring, anhydrosis, nail problems

At the end of the assessment it is important to document whether or not the foot is at risk. Using the NADC Action Plan in Appendix 3 can be a useful tool for documenting your findings and plan. The person is deemed to be at risk if they have any history of ulceration or amputation, neuropathy, PVD, foot deformity or any other abnormality that was identified during the assessment.

If the foot is deemed to be 'at risk' then further referrals will need to be arranged. The type and urgency of the referral will depend on the problem identified for example;

Refer to the podiatrist for further assessment if the person has:

- reduced circulation – poor colour, cooler to touch, reduced or absent pulses (if foot is cold, pallor and pulses are absent consult a general practitioner or medical officer)
- nerve damage – numb feet, reduced sensation
- abnormal nails – thickened, ingrown
- abnormal foot structure, bunions, hammer toes
- evidence of trauma – calluses, past ulcers.

Further referral to a vascular surgeon may also be necessary for circulatory problems.

Ulceration or significant infection requires URGENT referral to a multidisciplinary team (see section Multidisciplinary foot care team and /or high risk foot clinics).

Education

Education is best presented in several sessions using a mixture of methods. The person with diabetes needs to learn how to recognise potential foot problems and be aware of the steps they need to take when a problem occurs. Education should be structured in such a way that it is appropriate for their individual level of risk. For example we don't need to tell all people with diabetes that they can never walk barefoot. This advice needs to be reserved for the person who really is at risk ie those with a neuropathic foot. If we tell people to do something when they don't need to, they may be less likely to take it seriously when it really is important for them to never walk barefoot. Furthermore it is unfair to expect people to have an increased burden of self care tasks that are not relevant to their needs.

General foot care principles

Foot care involves daily washing, drying and regular inspecting of the feet (daily for those deemed at risk). People who are unable to do so should be helped to find the best way to perform this. Health care providers and carers can supervise this practice initially and regularly check that the person performs foot care daily. The person may need help to organise a low, safe seat, plastic bowl, mirror and a mild soap.

Health care providers should assist as appropriate for those who are not able to manage themselves.

Daily treatment (self care or nursing care)

- **Dry skin**- Massage a water-based moisturiser such as Sorbolene cream into all areas of the feet. Wipe off stickiness.
- **Moist skin** - Commonly found inter-digitally, especially when toe joints are stiffened. Refresh toe creases with methylated spirits or Povidone-iodine solution on a cotton bud. It may be necessary to use a tinea solution.
- **Minor skin damage** - Treated by using the recommended first aid routine below.

First aid for minor skin injuries (small cuts, abrasions etc)

1. Gently wash and dry the foot.
2. Apply antiseptic – eg Povidone-iodine or chlorhexidine solution.
3. Apply a clean non-stick dressing and secure with tape-bandage.
4. Protect with additional padding or bandage if needed.
5. After the daily shower re-dress the foot until healed.

Notify the doctor if there is any deterioration, signs of infection or delay in healing within 24 hours or immediately if any pus.

Trimming toe nails

Toe nails which are 'normal' in size and shape (absence of thick-gryophotic, crumbly-mycotic, ingrown +/- infection) may be cut by any competent person.⁸

Wash the feet, ensure a seat in a good light and provide a pair of clean, stainless steel nail clippers. Each person must have their own clippers or clippers need to be cleaned and sterilised between cuttings.

Trim nails following the natural curve of the toe, being sure not to cut too short. Never cut down the sides of the nail. If there are sharp edges, file with nail file or emery board.

The 'at risk' foot: recommended care:¹

- daily inspection of feet, including areas between the toes (if not possible then arrangements will need to be made for someone else to be able to do it)
- regular washing of feet with careful drying, especially between the toes (water temperature always below 37 degrees)
- do not use a heater or a hot water to warm up feet
- avoid walking barefoot when walking indoors or outdoors
- avoid wearing shoes without socks
- daily inspection and palpitation of the inside of the shoes
- do not wear tight shoes or shoes with rough edges and uneven seams
- do not use moisturising creams between the toes
- change socks daily
- wear stockings inside out or seamless
- do not wear tight or knee high socks
- care in cutting nails (see diagram)
- always have corns and calluses removed by a podiatrist
- notify healthcare provider at once if blister, cut, scratch or sore has developed (action plan)
- ensure regular examinations by podiatrist and other health professionals.

Providing individualised education using an Action Plan

Someone with diabetes and normal sensation, circulation and structure needs the same foot care and footwear as someone without diabetes.⁵ However all people with diabetes need to be well informed about the potential for future problems and the importance of early diagnosis ie the need for 6 monthly foot checks by their GP, diabetes educator or podiatrist.

For those people who have one or more risk factors it is recommended that they have an up to date action plan developed as part of the education process. The action plan can be used as a tool to link their risk status with self care practices (see Table 1).

EG – Scenario: 55 year old man with neuropathy but who has good blood supply and no visual impairment or musculoskeletal problems. See table below.

Potential problems	Cause	Action
Cut or abrasion	skin break	<p>Make sure shoes are worn at all times to protect your feet from damage.</p> <p>Check the inside of your shoe for rough areas or objects before you put them on.</p> <p>Make sure shoes fit well.</p> <p>Keep feet away from excess heat eg heaters, hot water bottles, wheat bags, check temperature with hand before putting feet in bath.</p> <p>If damage occurs:</p> <p>Simple first aid: wash and dry the area and apply mild antiseptic (eg betadine): cover with a sterile dressing.</p> <p>If not healing in 24 hours , worsens, becomes inflamed or discharges – see doctor straight away.</p>
Pressure areas eg redness, blisters	excess pressure	<p>Check feet daily to see if there area any signs of pressure or other damage.</p> <p>Break shoes in slowly.</p> <p>See podiatrist for footwear advice.</p>
Nails Moist areas between the toes		<p>Cut nails following curve of toe, not too short, and file edges.</p> <p>Moisturise the feet but not between the toes.</p> <p>See doctor if signs of tinea infection.</p>
Inflammation eg Redness, warmth or swelling	infection	See doctor straight away.

Appropriate footwear

Inappropriate foot wear is a major cause of ulceration.^{1 3} People who do not have altered sensation or deformities can select off-the-shelf footwear. For people with neuropathy and/or PVD extra care is needed when selecting shoes. Shoes should not be too tight or too loose eg allow 1-2cm longer than the foot.¹ Shoes should be selected at the end of the day to allow for any swelling and any new shoe needs to be broken in very slowly eg half an hour only on the first day and then increase time over next few days, checking for signs of pressure.

If there are signs of abnormal loading of the foot eg callus, corns, ulceration then the person will probably need special foot wear including insoles and orthoses. Consult a podiatrist.



Treatment of non-ulcerative pathology

In an at risk person it is imperative that callus, nail and skin pathology are treated regularly by a podiatrist. Deformities should be managed using orthoses and sometimes surgery.¹

Tinea is a fungal infection which often targets the feet;⁹

- symptoms: itching and stinging, reddening, scaly rash, cracking, splitting and peeling, blisters
- treatment: antifungal creams, seek medical or podiatry advice if person has at risk feet
- reducing the risk: dry feet thoroughly particularly between the toes, expose the feet to as much as air as possible, wear cotton socks, wear thongs to swimming pools and communal showers, clean socks each day, expose shoes in sunshine.

Callus and corns are signs of pressure and the mainstay of treatment is to reduce the pressure to prevent recurrence.

Corns and calluses should never be cut or removed with commercial remedies which may ulcerate the skin. Refer to podiatrist.

Foot ulcer management

People presenting with foot ulcers must be managed in relation to the extent of ulceration and results of investigations. Foot ulcers present a special problem and require intensive medical, nursing and podiatry assessment and management. Pressure is often the key issue in ulcer development, and ulcers will not heal unless pressure on the area is reduced or eliminated. If the ulcer is on a weight bearing or a frictional area of the foot, podiatry advice should be sought, as wound management alone is unlikely to allow the area to heal or remain healed.² Ulcer care stresses the need for adequate circulation, early antibiotics if clinically indicated, and removal of debris and pressure.

Principles of ulcer treatment¹

1. Relief of pressure and protection of the ulcer eg mechanical off loading.
2. Restoration of skin perfusion eg surgery, cardiovascular risk factor reduction.
3. Treatment of infection eg debridement and antibiotics.
4. Metabolic control and treatment of co morbidity eg BGLs less than 8.0mmol/L, treat oedema and malnutrition.
5. Local wound care eg wound debridement and control of exudate.
6. Education of patient and relatives eg self care, how to recognise and report (worsening) signs and symptoms of infection such as fever, changes in wound or hyperglycaemia.
7. Determining the cause and preventing recurrence.

Foot care in specialist areas

Foot care in the operating theatre

Protect bony protuberances such as ankle bones, heels and 'bunions' with cushioning materials if the operation requires a body position which will cause prolonged pressure to the 'at risk' areas. Use lambskin boots, protectors, foam, air pillows, etc. Inform the theatre nurse of the need for pressure relieving devices during the operation and prior to theatre.

Keep feet warm. A cold foot will automatically close down peripheral circulation. An ischaemic area, under pressure, may precipitate skin breakdown and subsequent ulcer. Use cotton or wool socks and sockettes to increase warmth.

Foot care in intensive care / high dependency / recovery

The focus of attention will be on 'vital signs' but there are numerous examples of people with diabetes who recover from a heart attack or stroke, only to spend months immobilised with a non-healing foot ulcer. Sensible foot care will avert this risk.

Use cushioning materials, attend pressure areas two hourly with immobilised, paralysed or unconscious patients, keep the feet warm with socks, wash and thoroughly dry interdigital areas and treat macerated skin.

Lengthy bed rest often associated with hospital admissions requires careful assessment and daily observation of feet. Avoid pressure being exerted on toes and heels.

Multidisciplinary foot care team and high risk foot clinics

It has been shown that the number of amputations can be decreased by the use of a multidisciplinary foot care team.³ The full team can be built up slowly by introducing the various disciplines at difference times. This team needs to work across primary and secondary health services.¹ The team commonly includes a physician, podiatrist, specialist nurse, orthotists and surgeon.³ If this expertise can not be found locally a virtual clinic can be set up using technology such as digital photos, telephone and videoconferencing. Strong local networks are also important so that staff can keep up to date and resources can be used appropriately.

Summary

It must be stressed that optimal care of the feet of a person with diabetes involves a multidisciplinary team approach. Communication within the team is vital.

Education of the person in the care of their own feet is of prime importance. Assistance from family or friends is essential where the person has difficulty seeing or reaching the feet. The older person may require assistance.

Encourage the person to carry out **self care** as stated in the foot care section on the previous page.

Regular checks are recommended by GP or diabetes educator and / or podiatrist depending on the person's risk factors. Other health professionals should also be trained in foot risk assessment such as Aboriginal health workers, community nurses, and nurses working in general practice.

The need for keeping blood glucose as close to normal as possible needs to be reinforced to the person.

Smoking, high alcohol intake, excess weight should be reduced as part of **prevention**.

Basic Foot Screening Checklist

1. Ask the patient	neuropathic symptoms	Y	N
	intermittent claudication	Y	N
	previous foot ulcer	Y	N
	amputation	Y	N
specify SITE _____			
DATE _____ / _____ / _____			

2. Look at both feet	infection	Y	N
	ulceration	Y	N
	calluses or corns	Y	N
	skin breaks	Y	N
	nail disorders	Y	N
	foot deformity	Y	N

		LEFT		RIGHT	
		Y	N	Y	N
3. Check foot pulses	Dorsalis pedis	Y	N	Y	N
	Posterior tibial	Y	N	Y	N

		LEFT		RIGHT	
		Y	N	Y	N
4. Test for neuropathy	Monofilament <i>detected at sites marked - o</i>	Y	N	Y	N



5. Assess footwear	<i>style</i>	Good	Poor
	<i>condition</i>	Good	Poor
	<i>fit</i>	Good	Poor

6. Assess education need	Does the patient understand the effects of diabetes on foot health?	Y	N
	Can the patient identify appropriate foot care practices?	Y	N
	Are the patient's feet adequately cared for?	Y	N

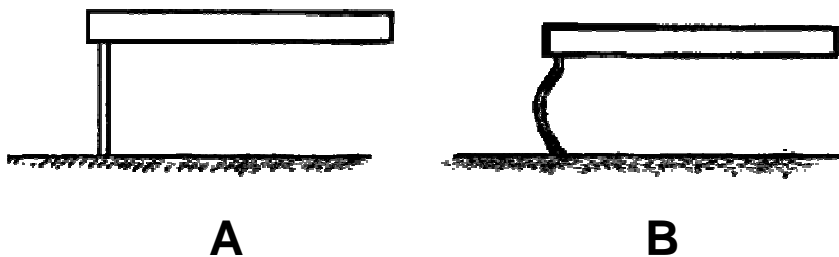
7. Assess self care capacity	Does the patient have impaired vision?	Y	N
	Can the patient reach own feet for safe self care?	Y	N
	Are there other factors influencing ability to safely care for own feet?	Y	N

All people with diabetes need to have their feet screened with these 7 simple steps every 12 months or more often if problems are identified

Testing for neuropathy with a monofilament

Method:

- Test first at a site with normal sensation - away from feet (eg. hands)
- Apply the monofilament perpendicular to the skin's surface INSERT (diagram A)
- The approach, skin contact and departure of the monofilament should be approximately 1 ½ seconds duration
- Apply sufficient force to cause the monofilament to bend INSERT (diagram B)
- Do not allow the monofilament to slide across the skin or make repetitive contact at the test site
- Ensure person has their eyes closed while you do the test
- Avoid testing areas where there is callus, scar, neucrotic tissue or ulcer
- Press the filament to the skin and ask the person whether he/she feels pressure (yes/no) and then ask where they can feel the pressure (left foot / right foot).¹
- Protective sensation is present at each site if the person correctly answers 2 out of 3 checks¹
- If the person gives 2 out of 3 incorrect answers their protective sensation is absent and they are considered to be at risk of ulceration¹



Action Plan following Basic Foot Screening

DATE OF REFERRAL ____/____/____

PATIENT NAME _____

SERVICE PROVIDER _____

Is the foot high risk ?

Yes No (re-check in 12 months)

If yes, why ?

- history of previous foot ulceration or amputation
- peripheral neuropathy
- peripheral vascular disease
- foot deformity
- other _____

Action*

Record details of personnel referred to. Where resources are unavailable, indicate and describe alternative care provision

1. Ulceration or significant infection

- referred to multidisciplinary team : _____

2. 'High risk' foot

- referred to podiatrist and/or multidisciplinary team : _____
- referred for medical assessment at least every 6 months and foot examination every 3 months : _____

3. Active foot problem

- referred to podiatrist _____

4. Symptomatic peripheral vascular disease

- referred to vascular surgeon : _____
- involving endocrinologist / physician : _____

5. Symptomatic peripheral neuropathy

- referred to endocrinologist : _____

6. Foot deformity or abnormality

- referred to podiatrist : _____

7. Inadequate knowledge or foot care practices

- referred to : _____
- or education provided Yes

****The patient's General Practitioner or Local Medical Officer will usually be responsible for coordinating the patient's care and should be informed of referrals, interventions and progress.***

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