Prevention, screening and referral of people with diabetes-related foot complications in primary care

RACGP QI&CPD Accredited Activity CATEGORY 2

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Learning objectives

After reading this article, the participant should be able to:

1. Outline how to perform foot screening quickly and effectively using validated and accepted screening tools.
2. Describe foot ulcer risk stratification following foot screening.
3. Understand referral pathways and describe when, where and who to refer.
4. Discuss effective and targeted foot health education for people with diabetes.

Key words

- Diabetic foot
- Diabetic peripheral neuropathy
- Peripheral arterial disease
- Screening
- Ulcer risk status

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The prevalence of diabetes and its related complications, such as foot ulcers and amputations, are increasing. Foot complications lead to reduced quality of life and significant health and societal costs, and there is also an associated significant morbidity and mortality risk for those affected. Up to 85% of major amputations can be prevented. Prevention involves regular screening and stratifying for risk of amputation, integrated with comprehensive and structured foot care pathways. This article describes methods for identifying and stratifying the risk of foot ulceration, and outlines management and referral pathways for people with diabetes-related foot conditions. Being diligent and using these simple methods will reduce amputation rates in people with diabetes.

The global prevalence of diabetes has steadily risen over the last few decades to reach approximately 422 million in 2014 (World Health Organization [WHO], 2016), and it is projected to increase to 642 million by 2040 (International Diabetes Federation [IDF], 2015). Currently more than 1.2 million Australians are estimated to be living with diabetes (National Diabetes Strategy Advisory Group, 2015) with some 2–3 million Australians projected to have diabetes by 2025 (Magliano et al, 2009). Approximately 85% have type 2 diabetes. The majority of Australians with diabetes are affected by cardiovascular disease, a comorbidity of diabetes, with foot complications as a result of neuropathy a close second (Lazzarini et al, 2012a). Up to 25% of people with diabetes will develop foot ulcers in their lifetime (Singh et al, 2005), and 85% of amputations are preceded by foot ulcers (Reiber et al, 1999). Annually, 3500 Australians require an amputation related to diabetes (Australian Institute for Health and Welfare [AIHW], 2014), although these figures are likely an underestimate as many cases may be missed due to coding issues (Wraight et al, 2006). Furthermore, risk of ulceration and amputation increases with increasing age and diabetes duration (Tapp et al, 2003). Given the ageing population, these figures are expected to increase further. After a major amputation, 50% of people with diabetes will require their other limb to be amputated within 2 years (Armstrong et al, 1997). The mortality rate 5 years after amputation is up to 55% (Moulik et al, 2003), with higher rates of mortality in those with impaired renal function (Ghanassia et al, 2008). The hospital costs associated with managing foot complications related to diabetes are high, with direct costs averaging AUS$31 435 per amputation (€18 547 Euro rate in 2003; Ray et al, 2005).

The negative effect of diabetes on quality of life is high; people with diabetes who have foot ulcers have significantly lower quality of life and higher rates of depression compared to the general population and to those who do not have foot complications (Ribu et al, 2007).

Since 1989, one aim of the WHO has been to reduce amputations by 50% (The Saint Vincent Declaration, 1997). Unfortunately, despite increasing knowledge, research and guidelines relating to this issue, data suggest

there has been a 30% increase in diabetes-related amputations in Australia over the past decade, with 8% of diabetes-related deaths being attributable to foot disease (Payne, 2000; AIHW, 2008). Guidelines have been developed to assess, prevent and manage diabetes-related foot complications nationally and internationally (Baker Institute and the International Diabetes Institute, 2011; International Working Group on the Diabetic Foot [IWGDF], 2015). The IDF advised that a 49–85% risk reduction for amputation can be achieved by implementing these guidelines (e.g. foot screening, improving multidisciplinary management, close monitoring, improved education of both clients and health practitioners, and appropriate organisational structure [Krishnan et al, 2008; IWGDF, 2015]). Australia has resources available for preventative foot care within the community for people with diabetes, with care being provided in the acute, sub-acute, community and private health sectors by healthcare providers, including podiatrists, diabetes educators, GPs, community nurses and medical and surgical specialists. In Victoria, there are also a number of specific programs funded by Hospital Admission Risk Prevention (HARP), which is a program targeting people with chronic disease to prevent re-hospitalisation. These programs increase specialist access in the community such as endocrinologists and hospital diabetes foot services. Despite this, the levels of amputations have not reduced (Bergin et al, 2012). GPs can provide a systematic approach to care to prevent diabetes-related amputations by following The Royal Australian College of General Practitioners (RACGP) and Diabetes Australia (2014) guidelines for people with type 2 diabetes. This includes regular screening for risk factors of amputation and timely referral to appropriate providers or services to address identified issues.

Evidence-based practice for the prevention and management of diabetes-related foot complications

Over the last 25 years, much research has been done to identify who is most at risk of amputation. The IWGDF, a peak body of international experts from different disciplines, is focussed on preventing amputations in people with diabetes. The IWGDF has developed systematic reviews in the areas of prevention of amputation, peripheral arterial disease (PAD), footwear and offloading, infection and wound healing. In addition, they have developed guideline documents based on their systematic reviews combined with international expert opinion on the same areas (which can be viewed at www.iwgdf.org/guidelines-2/systematic-reviews). *Table 1* describes practice recommendations for the prevention of amputations in diabetes developed for the Australian context, using

Page points

1. The International Diabetes Federation advises that a 49–85% risk reduction for amputation can be achieved by foot screening, improving multidisciplinary management, close monitoring, improved education of both clients and health practitioners, and appropriate organisational structure.
2. Australia has resources available for preventative foot care within the community for people with diabetes. Despite this, levels of amputations have not reduced.

Table 1. Key evidence-based, recommended practices for prevention of diabetes-related amputations.

	Recommended practices
1	Screen all people with diabetes for foot complications using a standard assessment form to assess for the following: ● Presence of neuropathy. ● Presence of peripheral arterial disease. ● Presence of joint or nail deformity or skin issue. ● Ability to self care. ● Past history of foot ulceration. ● Past history of lower-extremity amputation.
2	To generate a risk of amputation for each person with diabetes who is screened.
3	To educate a person with diabetes on their risk level for amputation.
4	Refer people with diabetes for management of identified risk factors.
5	Base frequency of screening on risk of foot complications: ● Low risk: screen annually. ● Increased risk: screen every 3–6 months. ● High risk: screen every visit.

Page points

1. The presence of neuropathy is the single most common risk factor for foot ulcer development.
2. If there is a current ulcer or previous lower extremity amputation or foot ulceration, the person is classified at high-risk of amputation for the rest of their lives.
3. Until adequately assessed, all Aboriginal and Torres Strait Islander people with diabetes are considered to be at high-risk of developing foot complications and, therefore, will require foot checks at every clinical encounter and active follow-up.

best available evidence (Baker Institute and the International Diabetes Institute, 2011).

Risk factors for amputation

There are four dominant pathways for foot ulcer development (Lavery et al, 2008a):

1. Loss of protective sensation, deformity, callus and elevated peak plantar pressure.
2. PAD.
3. Penetrating trauma.
4. Ill-fitting shoes.

The presence of neuropathy is the single most common risk factor for foot ulcer development (Reiber et al, 1999). Approximately 50% of people with diabetes will develop peripheral neuropathy (Dyck et al, 1993). Interrupting one key component of the foot ulceration causal pathway may avoid significant morbidity down the pathway to amputation (Lavery et al, 2008b). By undertaking foot assessments to identify risks for amputation, early intervention can be implemented and reduce the escalation of foot problems to requiring amputation (Canavan et al, 2008).

Approximately 50% of people with diabetes in Australia have foot assessments (Tapp et al, 2004), despite this being a key component of preventing amputation. Foot assessments are necessary to identify risk factors, and only then can actions be implemented to address them. *Table 2* outlines the risk factors and the assessments that can identify risk factor presence. If there is a current ulcer or previous lower extremity amputation or foot ulceration, the person is classified at high-risk of amputation for the rest of their lives.

Any healthcare providers, with some training, can undertake foot assessments. In Australia podiatrists, GPs, credentialled diabetes educators and practice and community nurses generally undertake these assessments.

Stratification of risk for amputation in people with diabetes

Once the risk level for amputation has been identified in a person with diabetes, a management plan can be tailored to their risk level as shown in *Table 3*. Assessment alone will not reduce amputations (Mayfield et al, 2000); therefore, integrating management with risk assessment is essential. Early and timely intervention in people with diabetes with foot risk factors can prevent many amputations (Krishnan et al, 2008).

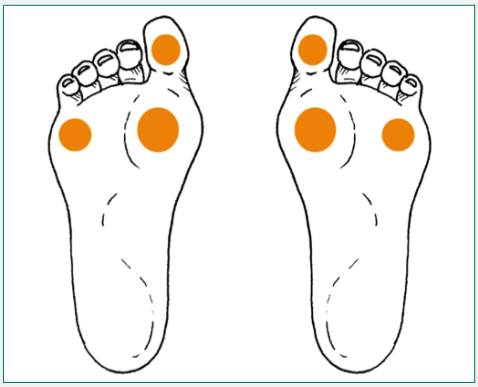
The average prevalence of ulceration in community settings is approximately 1.7% (Abbott et al, 2002); however, indigenous populations are considered at higher risk of developing foot complications and have increased rates of amputation when compared to non-indigenous populations (Norman et al, 2010). Until adequately assessed, all Aboriginal and Torres Strait Islander people with diabetes are considered to be at high-risk of developing foot complications and, therefore, will require foot checks at every clinical encounter and active follow-up (Baker Institute and the International Diabetes Institute, 2011). It is estimated that approximately 20% of people with diabetes are at increased risk of developing a foot ulcer (Tapp et al, 2003), although in some groups this may be an underestimation of the real frequency (Bergin et al, 2009).

Ulceration management

Full description of the management of foot ulcers in people with diabetes requires considerable resources and expertise, and is beyond the scope of this article. The authors refer readers to the IWGDF consensus documents and guidelines (2015) and NHMRC best practice guidelines (Baker Institute and the International Diabetes Institute, 2011). A standardised, consistent patient and wound assessment to guide management is essential, and the involvement of multiple clinicians with expertise in this area is required (Apelqvist et al, 2008). Assessment of people with diabetes who have a foot ulcer should include the following:

- Systemic medical issues to be identified and addressed, particularly glycaemic management.
- Psychosocial factors must be identified and addressed, as they significantly impact on the outcome of clinical management (Prince, 2008).
- Ulcer aetiology must be identified, as management is specific to each one. There are three main types of ulceration associated with

Table 2. Amputation risk factors and the corresponding screening tests.

Amputation risk factor	Screening tests required
Loss of protective sensation (LOPS) Inability to sense the pressure applied with 10 g Semmes–Weinstein monofilament.	• 10 g monofilament testing at three sites, shown in *Figure 1*, is valid and reliable. Absent sensation at any one of the three sites indicates loss of protective sensation (Bakker et al, 2012). • When recommended equipment is not available, a validated, simple screening test called the Ipswich Touch Test can be used (Rayman et al, 2011). This involves lightly resting an index finger on the tips of the first, third, and fifth toes of the person with diabetes for 1–2 seconds while their eyes are closed. A similar technique to the 10 g monofilament is used, where the individual is instructed to respond when they have sensation.  *Figure 1. Sites to be tested with monofilaments. The monofilament should be applied to each site shown in orange until it bends into a "C-shape" for 1 second (Apelqvist et al, 2008).*
Peripheral arterial disease (PAD) Obstructive atherosclerotic vascular disease with clinical symptoms, signs or abnormalities on non-invasive vascular assessment, indicating disturbed or impaired circulation in one or more extremity.	• Complete a vascular assessment. • Classic symptoms, such as intermittent claudication (pain or cramping of the calves or thighs) and night or rest pain, are present in only about a quarter of people with diabetes who have PAD (Stoffers et al, 1996; Hooi et al, 2001). • Diabetes may reduce the symptoms of PAD (American Diabetes Association, 2003); however, fatigue during walking distances, particularly up hills, may help indicate PAD (Frykberg et al, 2006). • Visual examination of skin, hair and nail growth can provide further information (Frykberg et al, 2006). • Palpate pulses at each visit. Should pulses be impalpable, PAD may be present. Undertaking an ankle-brachial index (ABI) may provide further information (Frykberg et al, 2006). • In the presence of known arterial disease risk factors, an ABI should be performed. ABI <0.9 warrants further investigations. • Independent risk factors for PAD include hypercholesteraemia, smoking and hypertension (Dormandy et al, 2000). Please note, in some people with diabetes, an ABI may result in a high false reading due to potential vessel calcification (Brooks et al, 2001). If the ABI is falsely elevated, a toe pressure is recommended to determine the arterial flow to the feet (Baker Institute and the International Diabetes Institute, 2011). For further details refer to the National Health and Medical Research Council national evidence-based guideline (Baker Institute and the International Diabetes Institute, 2011).
Foot and skin structure deformities Structural abnormalities of the foot include hammer toes, mallet toes, claw-toes, hallux valgus, prominent metatarsal heads, residuals of neuro-osteoarthropathy, amputations or other foot surgeries.	• Visual inspection of the feet for any rigid and flexible foot deformities is important, particularly if there is increased pressure on the tissues (e.g. claw toes, hallux valgus or charcot deformity [Lavery et al, 1998]). • Feet should be assessed for the presence of corns and callus, blisters, ulceration, tinea pedis, toenail pathologies, past amputations or ulcerations (Apelqvist et al, 2008).
Other	The following factors are also an important part of the assessment of the person with diabetes (Frykberg et al, 2006): • Medical and surgical history. • Duration and control of diabetes. • Previous ulcers and infection. • Assessment of appropriate footwear. ◦ Ill-fitting footwear is the most frequent precipitating factor for foot ulcer formation (Pecoraro et al, 1990). • Ability to self-care. • Skin integrity. • Nail structure. • Skin infections, such as tinea and onychomycosis. • Smoking. • Vision and mobility. • Foot care knowledge and self care practices. • Social and cultural issues. • Aboriginal and Torres Strait Islander origin*.

*Until adequately assessed, all Aboriginal and Torres Strait Islander people with diabetes are considered to be at high risk of developing foot complications and, therefore, will require foot checks at every clinical encounter and active follow-up (Baker Institute and the International Diabetes Institute, 2011).

Table 3. The amputation risk classification system, management for each amputation risk level and recommended healthcare professionals to be included in the care team (Apelqvist et al, 2008; Bakker et al, 2012).

Amputation risk level	Number of amputation risk factors as described in *Table 2*	Management	Recommended healthcare providers involved in care team
Low risk	No risk factors present	• Annual foot assessment to assess whether risk factors have developed. • Foot care advice. • Ensure ongoing good glycaemic management. • Self-inspection of feet daily. Individuals should report any changes to the feet as they are detected.	GP and diabetes educator. Podiatrist can be called upon if foot screening is requested.
Increased risk	One risk factor present	• As per "no risk factors present for amputation", and address the identified risk factor (e.g. if painful neuropathy or peripheral arterial disease present, referral to appropriate specialist is required). • Foot care education. • May require referral to a podiatrist, especially for arthritic problems or presence of callus or nail issues. • Formal foot assessment to be undertaken every 3–6 months.	GP, podiatrist and diabetes educator.
High risk*	Two or more risk factors present OR past history of foot ulcer/amputation	• Requires regular podiatry care and a formal foot assessment to be undertaken every 3 months. • Ensure that current risk factors are addressed with early, aggressive management of any skin breakdown. • Foot care education.	Endocrinologist, surgeon (general and/or vascular and/or orthopaedic), podiatrist and diabetes nurse educator.
Current foot ulcer	n/a	If an ulcer has been present for 4 weeks or longer without improvement, refer to a multidisciplinary foot ulcer clinic (Baker Institute and the International Diabetes Institute, 2011).	Multidisciplinary team – usually as part of a tertiary hospital outpatient clinic. Contact the local Australian Podiatry Association in your state for details.

*Until adequately assessed, all Aboriginal and Torres Strait Islander people with diabetes are considered to be at high risk of developing foot complications and, therefore, will require foot checks at every clinical encounter and active follow-up (Baker Institute and the International Diabetes Institute, 2011).

diabetes – neuropathic, ischaemic or neuro-ischaemic (Apelqvist et al, 2008). The presence of PAD is of particular concern, as this (with infection) is the leading cause of amputation (Lavery et al, 2008a). To ensure healing and prevention of ulcer recurrence, addressing these factors is essential.

- Wound assessment and documentation of site, size and depth is important to evaluate progress of management. Wound classification according to accepted classification systems, such as the University of Texas Wound Classification System (Armstrong, 1996), can be helpful to provide indication of prognosis and whether more aggressive intervention is required.
- The leading cause of hospitalisation in people with diabetes is infection, so the presence of infection must be assessed at every visit. Foot ulcer infection concomitant with PAD is the leading cause of amputation in people with diabetes (Lavery et al, 2008a). Infection should be treated promptly and actively, and risk for osteomyelitis must be determined (Lipsky et al, 2006; Apelqvist et al, 2008).

Once these factors are addressed, and assessment identifies that the wound is likely to heal, moist wound healing principles are to be used. This includes regular and frequent debridement of callus and the wound bed – debridement is only to be undertaken in wounds in which there is adequate arterial flow to allow healing (Sibbald et al, 2003).

The key to treatment for the majority of diabetes-related foot ulcers is pressure redistribution (Wu and Armstrong, 2006), and, therefore, referral to appropriate specialists with expertise in this area is strongly recommended (Apelqvist et al, 2008). Unfortunately, this is an area that has limited research, and few clinicians implementing effective strategies, so working with an expert team is strongly advised (Baker Institute and the

International Diabetes Institute, 2011; Bus, 2012; van Houtum, 2012).

It is important to note that some diabetes-related foot ulcers may not be able to heal, and expert multidisciplinary teams are best placed to appropriately assess healing capacity (Jeffcoate, 2012).

Australian strategies to prevent amputations in people with diabetes

To prevent or slow the progression of chronic disease complications, the Australian Government funds five healthcare provider visits annually through its Medicare Benefits Scheme (MBS), which can include podiatry as well as a number of other allied health provider appointments (Australian Government Department of Health, 2014). Unfortunately, there is a lack of co-ordinated approach within the health system to prevent diabetes-related complications. Recommendations have been made by the Australian National Diabetes Strategy Advisory Group (2015) to develop nationally agreed clinical guidelines, local care pathways and complication prevention programs to address this. A specific diabetes-related amputation prevention strategy was developed by key stakeholders (Bergin et al, 2012); however, there has still been no national action. Queensland has developed and implemented a multi-faceted evidence-based approach over most of the state to improve diabetes foot-related complication management in ambulatory services and reduce foot-related hospitalisation and amputations among people with diabetes (Lazzarini et al, 2012b). The approach includes the following:

1. Multidisciplinary diabetes foot teams.
2. Clinical pathways.
3. Clinician training programs.
4. Telehealth programs.
5. Clinical performance indicators.

After 5 years of the program, there has been a significant reduction in the incidence of hospital admissions and lower extremity amputations in people with diabetes (Lazzarini et al, 2015).

A new organisation, called Diabetic Foot Australia (DFA; https://diabeticfootaustralia.org/about-dfa [accessed 06.06.16]), was established in late 2015 as a national body for people with diabetes who have foot disease, to help reduce the incidence and impact of foot disease on the lives of Australians living with diabetes. DFA involves key stakeholders across the disciplines, including people with diabetes, researchers, healthcare professionals and industry. The primary objectives of DFA are as follows:

- Optimise national evidence-based clinical practice to prevent, assess and manage diabetes-related foot ulcers.
- Stimulate national clinical research in diabetes-related foot ulcers.
- Reduce Australia's national diabetes amputation rate.
- Empower Australia to become a leading nation in the management of people with diabetes who have foot ulcers.

It is early days; however, it is anticipated that a co-ordinated approach to increase efforts at prevention and improved management of people with diabetes will be pursued, and once implemented, should lead to positive results.

Conclusion

Not everyone with diabetes is at high-risk of amputation. It is important to identify those who are at increased risk of complications in an effort to prevent foot problems from developing. The number of amputations can be reduced by identifying people with diabetes at high-risk of lower-extremity amputation and addressing the risk factors appropriately. To achieve this requires a community approach and increasing levels of foot screening to include all people with diabetes to identify risk of amputation, followed by any identified problems being addressed quickly and aggressively by those healthcare professionals who have the skills and expertise to do this. Australia has the services available to reduce amputations in people with diabetes, but it is increasingly apparent that the lack of co-ordination of care of people with diabetes is leading to avoidable amputations, and the systematic implementation of evidence-based measures nationally needs to occur. GPs can contribute to prevention of amputations right now by ensuring they undertake the foot screening as recommended by the national guidelines, and address identified risk factors promptly. ■

"GPs can contribute to prevention of amputations right now by ensuring they undertake the foot screening as recommended by the national guidelines, and address identified risk factors promptly."

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Online CPD activity

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Participants should read the preceding article before answering the multiple choice questions below. There may be MORE THAN ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

1. What is the percentage of people with diabetes who may develop a foot ulcer in their lifetime?
Select ONE option only.

A. 1%
B. 5%
C. 25%
D. 50%
E. 75%

2. What is the most common single risk factor for foot ulcer formation?
Select ONE option only.

A. Poor glycaemic control
B. Presence of peripheral neuropathy
C. Presence of peripheral arterial disease
D. Being overweight
E. Presence of a foot deformity

3. What percentage of people with diabetes will develop neuropathy?
Select ONE option only.

A. 1%
B. 5%
C. 25%
D. 50%
E. 75%

4. What procedure(s) should be included during a foot screening in people with diabetes?
Select ONE option only.

A. Pulse palpation
B. Evaluation of shoe size and fit
C. Use of a 10 g monofilament to evaluate sensation
D. Visual examination for callus and other lesions
E. Allocation of a risk status for lower-extremity amputation
F. Referral to a podiatrist if problems identified
G. All of the above

5. If an individual has had a foot ulcer in the past, what is their level of risk that they will develop a second foot ulcer or require a lower extremity amputation in the future?
Select ONE option only.

A. None
B. Low
C. Increased
D. High

6. Which of the following situations automatically stratifies a person with diabetes as having "high-risk" feet?
Select ONE option only.

A. Absence of one dorsalis pedis pulse but no foot deformity
B. Being registered blind
C. Inability to reach one's own feet
D. Normal foot pulses but inability to feel a 10 g monofilament
E. Presence of callus and a history of previous foot ulceration

7. If a foot ulcer is identified in a person with diabetes during a foot screening, what is the current recommended action?
Select THREE options.

A. Ascertain cause, and if possible remove causative factor (e.g. ill-fitting footwear)
B. Apply dressing, prescribe antibiotics and review in a week
C. Where possible, refer to a specialist multidisciplinary foot team
D. If pulses are not palpable, refer to vascular surgery

8. In an individual who has one risk factor for a lower-limb amputation, what is the recommended frequency of formal foot assessment?
Select ONE option only.

A. Every 12 months
B. Every 2 years
C. Every 3–6 months
D. Only when patient complains of foot symptoms

9. Which of the following foot ulcer presentations suggest an individual should be referred to a multidisciplinary team?
Select ONE option only.

A. Ulcers not improving after 4 weeks despite appropriate treatment
B. Absent foot pulses
C. Deep ulcers
D. Suspected Charcot's neuroarthropathy
E. Ascending cellulitis
F. All of the above

10. Which of the following are recommended practice for prevention of diabetes-related amputations?
Select THREE options.

A. Regular foot assessment based on patient-reported symptoms
B. Determine the amputation risk for every patient who is screened
C. Educate the patient on their level of risk for amputation
D. Assess for patient's ability to self care
E. All of the above